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IND: Kutch Wind Project

Prepared by ARCADIS India Pvt. Ltd., Uttar Pradesh, India

ARCADIS Design & Consultancy for natural and built assets

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

250 MW Wind Power Project in Kutch district, Gujarat

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Final Report
Prepared For:
Ostro Kutch Wind Private Limited

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Background	M/s Ostro Kutch Wind Private Limited (hereafter known as OKWPL) - a Special Purpose Vehicle (SPV) of Ostro Energy intends to develop 250 MW wind power project in Kutch district of Gujarat. OSTRO will sign a lump sum turnkey contract with Vestas for development of this proposed project. Vestas will be responsible for construction of WTG and pooling substation and laying of transmission line. Post construction, Vestas will be responsible for long term operation and maintenance of the site as well. OKWPL has completed various key activities with respect to the project viz. approval for grid connectivity for power evacuation, wind monitoring, wind resource assessment, micro-siting, land survey and application submission for land procurement etc. ARCADIS India was appointed by OKWPL as an independent environment consultant to undertake Environmental and Social Impact Assessment (ESIA) study. The ESIA was conducted to assess any potential impacts (both negative and positive) that may arise from the construction, operation and decommissioning of the proposed wind power project. .
Project Overview	The project will comprise of 125 WTG's, each with 2 MW capacity and is spread across 30 villages viz. Sedata, Jadura, Reha Nana, Vadva, Harudi, Sakrai Timbo, Vavdi, Gandher, Chubdak, Reha Mota, Bandhara Nana, Sanosara, Vadajar, Bandhara Mota, Naranpar Ravli, Nagiyari, Samatra, Kurbai, Vadasar, Godpar, Meghpar, Godpar Sarli, Kanpar, Ludva, Virani, Nabhoi Moti, Filon, Deshalpar, Bharasar and Ajapar village falling in Bhuj taluka of Kutch district in Gujarat. The proposed site is accessible through State Highway SH-42 and SH-46, which further connects the wide project site through various villages Samatra, Jamura and Kukma village (adjoining the project site area). Reportedly, all land identified for the project is government land. The plant is proposed to be connected via a 220kV A/C Surajpur - Bachau transmission line (approx. 62 km in length) to the pooling substation (PSS) of 33/220 KVA capacity identified to be located in Surajpur village, which in turn would be connected to the 220/400 KV grid substation(GSS) located in Bachao village. To avoid potential impacts related to noise, shadow and ecology, Ostro reportedly adopts below practices while selecting a WTG location. • Every WTG location is sited approx 300 m away from nearby village settlements/ houses in order to avoid possible noise and shadow flicker impacts. The 300m distance from houses/villages fulfils the setback distance of WTG as recommended by IFC in its guidelines for Wind Energy Sector. Also, locations are sighted in a way that they are away from the nearest public roads, EHV lines, railway tracks by 'falling distance', which is (Hub Height + Blade length + 5m). • It is also evaluated whether any proposed locations fall in any ecologically sensitive areas such as forest, bird sanctuaries etc and such locations are cancelled for further consideration, thereby avoiding potential ecological impact. • All such locations which doesn't meet the above points are informed to WRA and Contracts team.

	• WRA then finds alternate locations, which is again verified on ground by site teams.
Applicable IFC's Performance Standards	The IFC's performance standards that are applicable for this project are PS1: Social and Environmental Assessment and Management Systems, PS2: Labour and Working Conditions, PS3: Resource Efficiency & Pollution Prevention, PS 4: Community Health, Safety and Security, PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources and PS 8: Cultural Heritage. The other performance standards PS5: Land Acquisition and Involuntary Resettlement: The project involves only revenue land for all proposed WTGs. The government lands to be transferred for the project are primarily open scrublands and are without habitation. This was confirmed based on site observations and consultations. The project hence does not involve any involuntary resettlement, PS 5 is not applicable for this project. PS7: Project is not located in scheduled area. No land has been procured from the ST community. No impact on Indigenous people anticipated. Hence PS-7 is not applicable.
PS1: Assessment and Management of Environmental and Social Risks and Impacts	There is a potential of environmental and social impacts due to project activities during construction and operations phase. Limited impacts such as generation of noise and dust during construction activities, domestic wastes from labour camp, and generation of hazardous wastes from the construction site. OKWPL needs to formulate and implement an Environmental and Social Management System to manage the risks associated with its operations. This ESIA report includes the environment and social risks arising from the project activities along with recommended mitigation measures. OKWPL should also appoint qualified E&S personnel with appropriate responsibility to implement/ oversee/ monitor the following: *Construction Phase* a) Performance of contractors on labour and health & safety aspects *Operation Phase* a) Periodic monitoring of social and environmental performance b) Internal and third party audit c) Management review *Both for Construction and Operation Phase* a) The implementation of the ESMP b) Community engagement and grievance redressal system/mechanism c) Regular training of employees and contractors d) Emergency preparedness and response e) Periodic reporting of E&S performance to the management
PS2: Labour and Working Conditions	During construction, around 600-700 workers along with additional 10-12 security personnel would be employed for a duration of 10-12 months. The contractor's workforce will comprise both skilled and unskilled labours, which may be sourced from the nearby village settlements depending on their skills and capabilities. There is also a possibility that migrant labours, will be employed at site.

	During the operations phase, approx. 15-20 nos. of technical personnel in addition to4-5 security guards will be deployed at site. **Hence PS 2 is applicable**
PS3: Resource Efficiency & Pollution Prevention	The construction works for the development of project will result in generation of wastes like wastewater, and construction debris. The operation phase will result in noise emissions and generation of minor quantities of waste such as used oil and used oily cotton rags. **During Construction** Temporary impacts on ambient air quality and noise levels may be expected during construction. Solid waste viz. packing material, metal, debris, cement bags, drums/cardboards etc. will be generated, which will have an impact if not managed properly. No material impact on surface or groundwater resources is expected on account of the project as the water procured for the project will be sourced through authorised sources. **During Operation** Noise emission from operation of WTG is envisaged considering the aerodynamic noise emanated from the wind turbines. Spent oil from transformers / WTG during maintenance needs to be managed as per Hazardous Waste (Management, Handling and Trans-Boundary Movement) Rules 2016 **Hence PS 3 is applicable**
PS4: Community Health, Safety and Security	**During Construction** The project will involve movement of vehicles on the approach road passing close to few villages, entering the site through the State Highway SH-42 and SH46. The project envisages influx of labours from different nearby villages and migrant labours, who will be accommodated in the labour camp. Health and safety need to be taken care of by the project developer, which should ensure that safety measures are put in place both during the construction and the operation phase of the project. **During Operation** Blade throw, Shadow flicker, Noise emission during wind turbine operation and Electro Magnetic field from transmission line may impact community health and security. It should be noted that the grid connection lines are similar to other power lines and generate low levels of EMF, comparable to those generated by household appliances. Thus, it can be concluded that the electromagnetic fields produced by the generation and export of electricity from a wind farm do not pose a threat to public health **Hence PS4 is applicable**
PS5: Land Acquisition and Involuntary Resettlement	Reportedly, government land will be procured for all 125WTG's and for pooling substation. The land requirement for each wind turbine generator (WTG) is approximately 1 hectare. Similarly, private land required for the construction of the transmission line (either pole/ tower site and/ or for the line right-of-way (RoW) will be leased from individual land owners based on negotiations via vendors appointed by OKWPL. As per the available current information no private land will be acquired for construction of WTG's. No involuntary resettlement is envisaged for the proposed project, hence PS5 is not applicable.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	No National park and wildlife sanctuary is located within 10km radius of the project area. However, twenty-one (21) demarcated patches of reserve forest exists within 10 km radius of the project area. The project is located on undulating open scrubland. The surrounding vegetation observed around the WTG's is sparse. A roost of Indian Flying Fox (also known as

	Fruit bat) was spotted and also has been reported in the project site by local villagers. The study area has a rich avifaunal diversity as per the site visit observations. During primary survey 80 bird species were recorded, out of which 31 birds fly or are able to fly more than 40m from the ground. Birds that fly above 40m from the ground can be considered vulnerable to get hit by the wind turbines because of flying within the "Probable Collision Risk Zone" of a WTG. In addition to this, out of the total 80 species observed, twenty-two bird species are migratory. A total of eight Schedule-I species (viz. Long-Legged Buzzard, Montagu's Harrier, Black Kite, Pallid Harrier/Pale Harrier, Indian Shikra, Oriental Honey Buzzard, Indian Peafowl, Eurasian Spoonbills) and five Near Threatened species of birds were observed within the study area. Further, during the course of this study, an interview was conducted with a senior forest officer in Bhuj. As per the information obtained from the forest office, project area does not serve as habitat for any mirgratory bird species with having high conservation status. Given the absence of any Protected Area (PA) such as National Park or Wildlife Sanctuary/ Bird Sanctuary near the project area or even an Important Bird Area (IBA) near the project area , potential impact on avaifauna from the operation of wind power is considered to be low. However, impact on other abundant bird species cannot be entirely ruled out. **Hence PS 6 is applicable**
PS7: Indigenous Peoples	The project is located in a region with no tribal population **hence PS 7 is not applicable.**
PS 8: Cultural Heritage	Champa dala dargah- a 400-year-old monument is located in close vicinity of one of the WTGs (400 m). Around 2000 pilgrims converge annually to celibrate festival. Construction activity and heavy vehicle movement if undertaken incorrectly may result in structural damage to the monument. **Hence PS 8 is applicable.**
Project Impacts – Construction Phase	*Impact on air quality:* Because of generation of fugitive dust due to movement of project vehicles and emission from diesel generators. *Water resources*: As per a report published by CGWA/CGWB, Project falls under **critical zone** from ground water perspective. During construction period (in worst case scenario), water requirement would be about 60KL per WTG to build foundation of tower and 10.5 KLD for domestic water use considering 700 workers during peak hours. It is not necessary that those 700 workers or so will be employed for 12 consecutive months during the construction period. The numbers of the labourers may be lower than what has been estimated/considered while calculating the water requirement for domestic use purpose and in this circumstance, the requirement of domestic water will be subsequently less from the estimated demand. In operational phase water will be used for the domestic use of project staff at the site, which is estimated to be around 1.8 KLD considering 15-20 technical persons present on site in shift and about 10-12 security personnel. *Conflict between migrant and local community*: Due to the large number of workers involved in the project activities. Social impact associated with migrant labourer and possible conflict with local population is envisaged. About 600-700 workers are expected during the peak construction phase. There is a risk of spread of contagious diseases among local population, carried by migrant labour (20%). Migrant labours from other part of the country and states might have different cultural outlook, which have a probability of triggering conflict between local people and migrant labour. The impact can be managed by adopting suitable mitigation measures as suggested in the ESIA report. *Traffic Load:* The road connecting SH42 and SH46 to project area will be used for movement of trailer trucks carrying WTG parts and other heavy vehicles for the

	project activity. Village roads originating from this road will be utilized during construction phase for vehicular movement and movement of labours and other project materials. Hence, the impact w.r.t increase in traffic load is envisaged. *Impact on land*: The land parcels identified for this project is government land. Private land may be purchased to build access road. For erection of transmission line towers, concenred land owners will be identified and onetime compensation will be given based on good faith negotiations. *Impact on Occupational health and safety and community:* There are likely impacts due to occupational health and safety hazard associated with project activities (during construction and operational phase) which include working at height, electrical /fire hazards, unhygienic conditions in the labour camp and physical injuries. The WTG locations are proposed on a highly undulating terrain and mostly on high ridges of hillocks. Hence, workers as well as community in proximity to construction activities may also be affected by blasting operations required for excavation of foundations for wind turbine and access roads. Shock wave can directly injure humans by rupturing eardrums, but most casualties occur because of collapsing structures and flying debris. *Impact on ecology:* Project construction would involve site clearance, which will involve loss of habitat of terrestrial flora and fauna. The soil compaction will also affect the regeneration of understory vegetation due to use of heavy equipment during construction phase. *Impact of Noise:* As the construction phase of wind turbines will involve the movement of heavy and light vehicles, influx of workers within the project site and noise from the project activities during construction, local wildlife may get impacted. *Impact due to natural disaster:* The proposed project is situated in Zone V- Very high damage risk zone of getting affected due to earth quakes as per the Seismic Zones of India Map IS 1893 – 2002, BIS.
Project Impacts – Operation Phase	*Community Health and Safety*: Impact is envisaged on community health during operation due to Electromagnetic Field (EMF) interference only in case of close proximity to EHV lines, shadow flicker and accidental blade throw. But with appropriate mitigation measures, the same can be minimized. *Shadow flicker impact:* From the “worst case scenario” analysis the shadow flickering modelling results shown that 3 WTGs (BHO-193, BHO-189 and BHO-99) will be impacting three receptors (a group of 3-4 houses, a single house and a big farm house) at Samatra, kanpar and deshalpar villages resepctively..The shadow impact at these receptors was found in the range of 68.22 – 91.58hr/year. In general, in “Real Case Scenario”, the shadow flickering impact comes substantially lower than the result shown in “Worst Case Scenario”. Anyways, suitable mitigation measures will be adopted. *Noise impact* From the noise modeling analysis (through windpro software) it was found that about 6 WTGs will be impacting 7 receptors in terms of the night time noise level (NAQQS) prescribed by Ministry of Environemnt, Forests and Climate Change (Govt of India). The WTGs are BHO-164, BHO-189, KUT-73, BHO-97, BHO-111 and, BHO-160. The level of noise estimated at those receptors will be between 45.3 to 46.3 d(B)A, which slightly exceed the NAQQS standards (45 d(B)A) set for night time noise standard. Hence, the level of impact from operational turbines cannot be considered as any issue. *Impact on ecology*: The modification of faunal habitat and bird collision risk cannot be ruled out in the operational phase. During vantage point study undertaken for five

	days, 80 avifaunal species were sighted of which there are eight Schedule-I species and four near threatened bird species. Bat roosting sites were also discovered during site survey. Because of not having any Protected Area or an Important Bird Area (IBA), the impact on birds and bats due to the project activity during the operational phase is considered to be Low, although the avifaunal collision risk and mortality due to operation of wind turbines cannot be ruled out. *Impact due to natural disaster:* The proposed project is situated in Zone V- Very high damage risk zone of getting affected due to earth quakes as per the Seismic Zones of India Map IS 1893 – 2002, BIS. *Impact Due to Transmission Line:* The proposed 220 kV transmission line is of 62 km (approximately). A total of 190 towers of DA+DB+DC+DD+DDE type have been planned for power evacuation, which will cross eighteen villages. The approach route identified for the transmission line was based on a criterion to reduce the environmental and socioeconomic footprint of the transmission line. Based on the observation made pertaining to the proposed transmission line and the information provided by Ostro, it was observed that the line route does not fall under any habitations and thick vegetation/forest cover. No households or community structures are in the route of the transmission line. There are no environmentally sensitive sites, archaeologically significant sites, areas of ecological and cultural significance present on the proposed transmission line route. The transmission lines will cover mostly along the scrub lands or abandoned waste lands. Therefore, the impact due to proposed transmission line is considered to be low. *Impact Due to Flooding:* The landscape of the project area is largely undulating with some parts of flat terrain. The elevation range of the study area lies between 400 and 850 feet. As per readily available flood hazad map of India, published by Building Materials and Technology Promotion Council, Ministry of Housing & Urban affairs, Government of India (BMTPC), Bhuj district does not fall into area vulnerable to floods. Also, there have been no reports of flood in the project area as learnt from community consultations. Therefore, any impact due to flooding, particularly to proposed pooling substation is considered to be unlikely. *Occupational Health and safety:* Electric utility workers typically have a higher exposure to EMF than the general public due to working in proximity to electric power lines. The impact may range from dizziness, fatigue, headache, nausea etc. It is noteworthy to mention that in general the electric utility workers never work on live wire, and before working a shutdown is taken for the concerned feeder. Hence, the impact is not envisaged.
Mitigation Measures	Appropriate mitigation measures have been planned and recommended in the Environmental and Social Management Plan of this ESIA report. These measures will minimise the impacts on air, water, soil, noise quality, solid and liquid effluent waste, ecology and socio-economic conditions. The activities of the project during both construction and operation phase will help in improving the socioeconomic condition of the surrounding area. Besides, the project site is located in very high damage risk zone – Zone V and hence the impact due to such natural disaster will be both during construction and operation phase. *Construction Phase* ▪ It should be ensured that the labour camp (onsite) should have basic amenities such as electricity, drinking water, health & sanitation facility, kitchen and rest room. ▪ If blasting is required then the procedure of blasting should be followed as per OSTRO's protocol for blasting. ▪ Safety signage and posters will be displayed at strategic locations across the site. ▪ Provision of first-aid kits at all work-areas onsite.

	▪ Proper water sprinkling on accessroads to WTG should be undertaken to reduce the fugitive emissions during transportation. ▪ Grievance Redressal mechanism should be followed by OKWPL and its sub-contractors. It should be ensured that a complaint register is maintained onsite so that any complaints from the locals or labours can be registered, investigated and timely resolved. ▪ The speed limit of the heavy vehicles plying on the roads should be maintained. ▪ Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvers and enclosures. ▪ Hazardous materials such waste oil, used oil should be stored at designated locations in enclosed structures over impermeable surface. ▪ During procurement of private land in case of access road and land on ROW basis for transmission tower erection, adequate compensation in terms of agreed price can nullify the impact. Type and amount of compensation should be mutually agreed through proper stakeholder engagement. ▪ Chance find Procedure should be formulated under PS 8 to ensure if any other structure or alike specimens are present or in case of discovery of any artefacts and/ or settlement of past in the future at proximity of the project area. Specific measurements should be taken to ensure that the ancient temple or alike structures are not being impacted due to the project activity. **Operational Phase:** ▪ Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding noise and shadow flickering or any other issue related to project activity is not left unnoticed. The complaints should be registered, investigated and timely resolved. ▪ Wind turbines should be designed in accordance with the international acoustic design standards. ▪ Based on the primary survey and professional judgement, it is recommended that to ascertain whether there is any impact on endangered avifaunal species due to operational wind turbines, bird and bat monitoring should be conducted in operational phase during migratory season. ▪ Use of curtains, higher fencing and planting trees can be explored at locations which will get impacted due to shadow flicker. ▪ Visibility enhancement objects such as marker balls, bird deterrents, or diverters shall also be installed along the transmission line to avoid bird collision. ▪ The tip of blades should be painted to increase visibility and avoid collision.
Conclusion	The proposed wind power project is not likely to have significant adverse environmental impacts that are sensitive[1], diverse or unprecedented. It is envisaged to have minor impact due to issues related to community safety during the construction period, insignificant impact due to generation of dust and fugitive emissions during construction phase only (short duration) and minor impact on resource utilization like land and socio economic conditions of project area villages. There may be impact on cultural resources like the Dargah and temples sighted during site survey, if the access of the same is blocked or disturbed during construction phase. The impacts anticipated during the operation phase is avifauna mortality, impact due to shadow flickering and impact due to noise emanated from the WTGs on the community in proximity.

[1] A potential impact is considered “sensitive” if it may be irreversible (e.g., lead to loss of a major natural habitat), affect vulnerable groups of ethnic minorities, involve involuntary displacement and resettlement, or affect significant cultural heritage sites.

IFC Categorisation

Based on the conclusion drawn from the ESIA study with respect to the kind of impacts of the project on environment, resources, biodiversity, labours and community, the proposed project is categorized as **Category B** *(as per IFCs categorization of projects), which specifies that this project is expected to have limited adverse environment and social impacts which can be mitigated by adopting suitable mitigating measures.*

ADB Categorisation

Asian Development Bank (ADB) uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential impacts.

Environment: Proposed projects are screened according to type, location, scale, and sensitivity and the magnitude of their potential environmental impacts, including direct, indirect, induced, and cumulative impacts.

Project Categorization: As per assessment, it is found that the impacts arising out of the project are minimal and limited. Impacts identified during both construction and operation phase include dust emissions during vehicular movement, noise from WTGs, water abstraction during construction phase and impact on avifauna collision risk. These impacts can be minimized and reversed if timely and adequate mitigation measures are undertaken. Water sprinkling should be undertaken for dust suppression. Effective noise control systems should be integrated with the WTG designing as well as integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated. Hazardous waste to be stored at designated places in enclosed containers. Considering the impact to be site specific, which can be readily corrected through adoption of suitable mitigation measures, the project is categorized as **Category B** project.

Involuntary Resettlement: The involuntary resettlement impacts of an ADB-supported project are considered significant if 200 or more persons will be physically displaced from home or lose 10% or more of their productive or income-generating assets. For those involving involuntary resettlement, a resettlement plan is prepared that is commensurate with the extent and degree of the impacts: the scope of physical and economic displacement and the vulnerability of the affected persons.

Project Categorization: The project involves only revenue land for all proposed WTGs. The government lands to be transferred for the project are primarily open scrublands and are without habitation. This was confirmed based on site observations and consultations. The project hence does not involve any involuntary resettlement, hence the project is categorized as **Category C.**

Indigenous Peoples: The impacts of an ADB-supported project on indigenous peoples is determined by assessing the magnitude of impact in terms of

- customary rights of use and access to land and natural resources;
- socioeconomic status;
- cultural and communal integrity;
- health, education, livelihood, and social security status; and
- the recognition of indigenous knowledge; and the level of vulnerability of the affected Indigenous Peoples community.

	Project Categorization: The project does not involve any uptake of any land from indigenous people. The study area located in Kutch district does not fall in any notified tribal area of Gujarat. The project is categorized as **Category C** project.
This Executive Summary should be read in conjunction with the full report and reflects an assessment of the Site based on information received by Arcadis at the time of reporting.	

1.0 INTRODUCTION

1.1 Background

"**Ostro Energy**" is an independent power producer company, committed to leading a change in the country's current energy portfolio by delivering cleaner and smarter energy choices and thereby reducing India's carbon footprint. ACTIS[2] has committed to fully fund OSTRO's business plan with a funding commitment of US$230 million thereby ensuring availability of equity for all its projects. Ostro Energy currently has commissioned capacity of 650 MW Wind Projects in states of Rajasthan, Madhya Pradesh, Andhra Pradesh and Karnataka. Currently over 450 MW of Wind & Solar Projects are contracted out & under active construction across Andhra Pradesh & Madhya Pradesh.

M/s Ostro Kutch *Wind* Private Limited (hereafter known as OKWPL) - a Special Purpose Vehicle (SPV) of Ostro Energy intends to develop 250 MW wind power project in Kutch district of Gujarat. The plant is proposed to be connected via a 220kV D/C Surajpur - Bachau transmission line to the pooling substation (PSS) of 33/220 KVA capacity identified to be located in Surajpur village, which in turn would be connected to the 220/400 KV grid substation(GSS) located in Bachao village. Total length of transmission line would be 62 km approximately.

OSTRO will sign a lump sum turnkey contract with Vestas for development of this proposed project. Vestas will be responsible for construction of WTG and pooling substation and laying of transmission line and will be responsible for long term operation and maintenance of the site as well. Micro siting of the wind turbines is complete. OKWPL has completed various key activities with respect to the project viz. approval for grid connectivity for power evacuation, wind monitoring, wind resource assessment, micro-siting, land survey and application submission for land procurement etc. The proposed project involves construction and operation of 125 wind turbine generators (WTGs) of capacity 2MW each.

ARCADIS India has been appointed by OKWPL as an independent environment consultant to undertake the ESIA study. The ESIA was conducted to assess any potential impacts (both negative and positive) that may arise from the construction, operation and decommissioning of the proposed wind turbines. The goal of the ESIA is to enhance sustainability of vital ecosystem and to improve or restore ecosystem health and biodiversity.

The Environmental and Social Impact Assessment (ESIA) study for the project has been undertaken in accordance with International Finance Corporation's (IFC) Performance Standards (PS) on Social and Environmental Sustainability, 2012; Environment, Health and Safety Guidelines, Equator Principles; Relevant ILO conventions covering labour standards. The study will also assess the sustainability of the project w.r.t the local and national regulations relevant to the project.

Besides IFC guidelines, ADB's safeguard policy framework on three Operational policies such as environment, Indigenous Peoples and Involuntary Resettlement were also referred. The project involves only revenue land for all proposed WTGs. The government lands to be transferred for the project are open scrublands and are without habitation. This was confirmed based on site observations and consultations. The project hence does not involve any involuntary resettlement,

Other policies viz ADB Policy on Gender and Development (GAD), ADB's Social Protection Strategy (2001), ADB policy on Public Communication policy, ADB policies on participation guides, ADB's Safe Guard Policy Statement (2009) are applicable to project activity.

ADB policies on 2010 on Gender mainstreaming guidelines is not applicable since the project would constitute of very short-term construction period and a limited manpower requirement during operation. The project influence is limited within project boundary and there is limited or no opportunity of gender mainstreaming by the project activity.

A wind power plant is a superior and a clean option for power generation in comparison to non-renewable fossil fuels. Ministry of Environment, Forest and Climate Change (MoEFCC) in its **Office Memorandum No. 86/195/97-WE (PG) dated 20th Nov, 1997** (**Appendix-A**) stated that the wind power projects are not covered

[2] *ACTIS is a pan emerging market equity firm. It invests in various sectors including energy where it invests in distribution, power generation and transmission both for renewable and non-renewable sources.*

under the ambit of EIA Notification, 2006 and therefore does not require prior environmental clearance. In addition to this, CPCB issued notification vide **File No. B-29012/ESS (CPA)/ 2015-16 dated 7th March 2016** regarding harmonisation of classification of industrial sectors under Red/Orange/Green/White categories, which states that wind power generation is a "White Industry" and does not require obtaining consent to establish and consent to operate.

However, considering the scale of development, ESMS requirement of Ostro Energy and in light of environment and social risk to and from the project activity as highlighted in this study an ESIA has been conducted by Arcadis to safeguard its investment from any possible environment and social risk.

The ESIA study has been carried out, including the reconnaissance survey of the site, environmental monitoring, data analysis, public consultations and discussions with other relevant stakeholders such as villages communities, forest department and land depatment. The assessment identifies significant environmental and social risks associated with the project and recommend the appropriate mitigation measures to comply with the requirement of the specified reference framework.

1.2 Purpose of ESIA Study

The purpose of the ESIA study is to identify, evaluate and manage environmental and social impacts that may arise due to construction and operation of the proposed project. The document has been made to comply with the requirements of IFC Performance Standards, IFC EHS guidelines, 2007; ADB's three Operational policies such as environment, Indigenous Peoples and Involuntary Resettlement, ADB Policy on Gender and Development (GAD), ADB's Social Protection Strategy (2001), ADB policy on Public Communication policy, ADB policies on participation guides, ADB's Safe Guard Policy Statement (2009) as well as applicable local and national regulations. To comply with other lender's requirements, the document also addresses Equator Principles. The objectives of ESIA study are to:

- Undertake categorisation of the project with reference to identified environmental and social risks.
- Identify and establish the baseline environmental and socioeconomic conditions, to analyse the environmental and social risk and impacts of the project and its associated components (facilities like transmission line, access road etc.) as per IFC performance standards and Equator Principles.
- Prepare an inventory of biodiversity (flora and fauna) of project site prior to implementation of the project to evaluate the possible impacts on birds and bats, if any.
- Review of the land lease process to assess any legacy or current/existing issues (like informal settlers, livelihood dependence, other usage etc.) on the purchased/leased land through suitable survey using acceptable socioeconomic tools. This will help in assessing the impact of the project on the community/villagers.
- Undertake socio-economic consultation with local community, stakeholders, to identify the needs and problems of community with respect to the project activities.
- Undertake shadow flickering assessment and study of impact of flickering on the nearby community.
- Undertake Primary bird & bat survey assessment. Identification of established migratory flyway of birds (if any) through secondary sources. One week of ecological survey of the site by team of ecologist.
- Suggest appropriate safeguards for the associated environmental and social risk, which may not lead to project investment and activities at risk.
- Develop action plans (ESMP) for implementation & monitoring of the mitigation measures to safeguard the project envelop.

1.3 Approach and Methodology of ESIA

Preliminary documentation review was undertaken prior to mobilisation for site visit. During site visit, potential environmental and social risks associated with the project were assessed. Mitigation measures / further studies

were proposed based on the assessment. Detailed approach and methodology adopted to conduct ESIA for the project is described below.

- **Preliminary Discussion with project proponent:** At this stage, size and location of the project, scheduled date of site visits, scope of work, timelines for report submissions, concerned point of contacts were understood from the project proponent. List of further information required such as status of applications made, clearances obtained, project schedule, proposed plant layout, topo sheets, WTG specifications, noise curves etc. was formally requested from project proponent.
- **Desktop Review of the project area:** After confirming the project area and site location, review of the site area was undertaken using readily available sources such as google earth, google maps, GIS, land use maps of the area. With the help of desktop review, assessment was made on how the site/project and its components such as proposed WTG locations, pooling substation, transmission line etc. are located regarding the nearby villages, forest areas, bird sanctuaries, or any other protected areas (if any), major water bodies, rivers, national and state highways, commercial and defence airports (if any).
- **Review of relevant secondary information:** Secondary information on geology, hydrology, prevailing natural hazards like floods, earthquakes etc. have been collected from literature reviews and authenticated information made available by government departments. Primary surveys were carried out to understand and record the biological environment prevailing in the area and the same was verified by the forest officials and against published information and literature. The socioeconomic environment has been studied through consultations with various stakeholders within the site. Additionally, socioeconomic data has been obtained from Census 2011.
- **Site Investigation through site visit:** After gaining a fair idea from the desktop review of the project area, a team of experienced professionals including an environmental expert, a social expert and a biodiversity expert visited the project area for site reconnaissance and consultations with relevant stakeholders such as project area related community, project developers, relevant government offices such as local forest department office, revenue department office etc. were held.

  To understand and assess the environmental and social risks associated with the project, the study area was divided into core area (500 m around each of the WTG location) and buffer area (5 km around each of the WTG location).

  a. **Investigation of Project Components:** After getting the exact locations of different project components such as proposed WTG components, PSS, GSS, proposed transmission line, proposed land for batching plant and labour camps, the environmental and biodiversity expert visited all the project component locations along with the Ostro representative. This was done to verify the locations, professionals use GPS to track exact locations of project component. While visiting every location, careful visual observation was made to notice sensitive receptors like residential houses, villages, major water bodies, or other structures like high tension line, main roads located within nearby surroundings of a project component. Further, observations were also made pertaining to what is the land use of the area i.e. agricultural or barren, private or government, whether assigned by local/ state government to some vulnerable communities, whether a reserved forest land etc. All the aforementioned observations are noted in a standard format for reference which is used during report preparation. WTG locations located close to any sensitive receptors have been selected for noise and shadow flicker modelling to further ascertain whether concerned WTG locations will have noise and shadow flicker impact on nearby receptors identified during site visit.
  b. **Survey of Proposed Transmission Line Route:** The review of google earth imgaries for the proposed transmission lines was made prior to the site visit to see whether the transmission line pass through any forest area or human settlements. During site visit, an overview (ground truthing) of the area of the proposed transmission line was also made. While roaming across the project area, observations were made to see presence of any village settlements, forest areas falling across or near the proposed transmission line. Also, as reported by Ostro, the proposed transmission lines

are planned in a way, to avoid village settlements and forest areas, if any.

c. **Sampling for Environmental Baselining:** The baseline environmental sampling and monitoring was conducted in the month of April 2017. Results for the same are presented in subsequent sections of this report. While selecting locations for primary monitoring of air, noise, ground and surface water, emphasis is given to collect the representative baseline data. Monitoring stations for air and noise were selected in proximity to the WTG locations as well as approach roads and settlements. Closeness to the sensitive receptors were considered for selecting noise and air monitoring locations. Monitoring locations for surface water quality was selected based on the macro and micro watershed and drainage pattern of the area.

d. **Biodiversity Assessment: A five day long ecological assessment was undertaken including terrestrial flora, fauna along with avifauna.** While travelling across project area the biodiversity expert observed and noted the nature of habitat, local flora & fauna, mammal & reptile species and avifaunal species present in the project area. Major water bodies present within the project study area were visited during sunrise and sunset hours to observe the diversity of avifaunal species present in the project area. In general, area within 5 km radius of the project site is considered for biodiversity assessment. Biodiversity expert also made visit to demarcated forest areas and wetlands located within the project area or the project located within the buffer zone. Further, to gain more information about mammal and avifaunal species of the project area, visit was made to local forest department and interviews are conducted with the concerned officials.

   Selection of Vantage points: The selection of the vantage points for assessing the bird and bat presence within the project site and surroundings has been made keeping in mind that the entire study area is properly represented and all type of habitats present within the study area is covered during the study. A total of eight vantage points were selected for the study and three type of habitats viz forest area, scrub land and water body were covered during the assessment.

e. **Community Consultations:** The social expert conducted village community consultations in presence of site representatives. During community consultations, baseline information of villages pertaining to population, different castes, presence of any vulnerable communities, availability of water and electricity, schools and primary health clinics, general occupation of local people, other income sources etc. has been sourced. During consultation, the social experts tried to understand the probable perspective of village communities towards the proposed project.

f. **Consultation with concerned Government offices:** Visit to respective government departments viz revenue department, health department, panchayat office, B.D.O office etc has been undertaken to collect information for the proposed project site and the stakeholders involved with the project.

g. **Consultation with project developer:** Concerned persons from developer's team have been interviewed to understand the land procurement process, project construction schedule, estimated workers required during construction and operations, plans for arrangement of water required during construction and operation, procedures to address occupational health and safety, waste management plan, emergency response plan etc.

h. **Identification of Potential Environmental and Social Impacts:** The assessment process has taken into consideration the impacts due to project sitting, land preparation, and construction and operation of the project. The risks and impacts of the proposed wind power project have been assessed on the social and physical environment. To study the environmental and social impact, study area was divided into core area and buffer area based on the extent of influence of project activities. Primary impacts are assessed for a radius of 500m around the project site and secondary impacts are assessed beyond this radius for the proposed project. Also, 100 m RoW along the transmission line route is also considered for impact assessment. The Environmental & Social Impact Assessment (ESIA) has been taken into consideration for the following:
   - Applicable National Regulations;
   - IFC's Performance Standards and ADB's SPS etc;
   - Outcomes of the community consultation
   - Baseline environmental monitoring;
   - IFC General EHS Guidelines.

i. **Development of Project Specific Environmental and Social Management Plan:** The project related activities are understood through desktop review of documents like permits/clearances (if any), maps, etc. and reconnaissance survey to the project location and surrounding area was conducted for familiarization with the project location. The site setting and sensitivities was identified and the environmental and social risks associated with the project with respect to applicable national regulations and IFC performance standards was understood. The identified gaps will thereby lead to derive an environmental and social management and action plan (with timelines & responsibilities) to address these gaps.

1.4 Limitations

The study is based on the project planning information and document provided by the project proponent, community consultation and observation recorded during site survey. The baseline condition is an extrapolation of surrounding areas to site. Any significant change in the proposed activities may result in variation of outcomes. Presented information and fact has been analyzed and inferences have been drawn through the professional judgement. Limitations for the ESIA study was that the transmission line route mapping and access road planning was not finalized at the time of Arcadis site visit in March 2017, hence the associated risk has only been assessed based overview of the area from where the transmission line was proposed supported by information provided by OKWPL.

In addition to this, 53 WTG locations out of total 150 proposed WTG locations were revised in July, 2017 by OKWPL for which Arcadis has not undertaken any site visit and the analysis is based on information provided by client as well as satellite imagery.

1.5 Benefits of the Project

This wind power project will offer the following advantages:

- The technology of electricity generation from wind has been developed fully for smooth and trouble-free operation as well as for its economic viability.
- It is renewable, pollution free and eco-friendly;
- Low gestation period – less than six months from concept to commissioning, enabling fast bridging of power gap even in remote areas.
- With no fuel consumption, power generation becomes almost free after recovery of capital cost. Operation & Maintenance (O & M), cost is nominal.

- It can be developed in modular form with facilities for extension at a later date.
- No adverse social impact, such as resettlement and rehabilitation;
- Wind power plant provides energy security by minimizing the dependency on fossil fuels for power generation;
- Availability of government incentives to renewable projects in India.

1.6 ESIA Team

Arcadis has mobilized a diverse team of multidisciplinary experts for conducting the ESIA study. A number of these experts are accredited professionals by Quality Council of India to conduct regulatory EIA. These experts have provided consultancy services to over 75 wind power projects across India with over 3000 MW of installed capacity. The experts have been continuously working with funding agency, who understand the modalities and procedures of evaluating and addressing environment and social risk associated with large scale investment.

2.0 PROJECT DESCRIPTION

2.1 Introduction

M/s Ostro Kutch Wind Private Limited (OKWPL) is developing the proposed wind power plant under Gujarat Wind Power Policy, 2016. The technical details of the project are provided in **Table 2.1** and satellite imagery of the project site is shown in **Figure 2.1.**

Table 2 -1: Project snapshot in Brief

Project Owner	M/s Ostro Kutch Wind Private Limited (OKWPL)
Location of Site	**Villages**: Sedata, Jadura, Reha Nana, Vadva, Harudi, Sakrai Timbo, Vavdi, Gandher, Chubdak, Reha Mota, Bandhara Nana, Sanosara, Vadajar, Bandhara Mota, Naranpar Ravli, Nagiyari, Samatra, Kurbai, Vadasar, Godpar, Meghpar, Godpar Sarli, Kanpar, Ludva, Virani, Nabhoi Moti, Filon, Deshalpar, Bharasar and Ajapar village. **Tehsil:** Bhuj **District:** Kutch, Gujarat
Broad Geographical Coordinates of the site	23°11'6.88"N, 69°21'47.42"E and 23° 8'55.76"N, 69°52'51.35"E
Project Capacity	250 MW
WTG make	Vestas
WTG model	V110-2.0 MW
Hub Height	110m
Rated Capacity (MW)	2MW
Rotor diameter	110 m
Cut in wind speed	3 m/s
Rated wind speed	11.5 m/s
Cut-out wind speed	21 m/s
Blades dimensions	Length: 54 m; Max chord: 3.9 m
Swept area	9503 m^2
Type of tower	Tubular steel tower
Frequency	50Hz
Generator Type	4-pole (50 Hz)/6-pole (60 Hz) doubly fed generator, slip rings
Rated Power	2,000 kW
Location of Pooling sub-station	Surajpur village, Bhuj talukal, Kutch district
Capacity of pooling sub-station	33/220 KVA
Transformers Location of Grid sub-station	220/400 KV grid substation(GSS) in Bachao village

Access routes to proposed WTGs were not planned during the site visit. The WTG locations have been plotted on SOI toposheet No. F42 D08, F42 D012, F42 D16 of 1: 50,000 scale and shown in **Figure 2.1 and Figure 2.2**

Figure 2-1 Location of the WTG on Toposheet (East side of project)

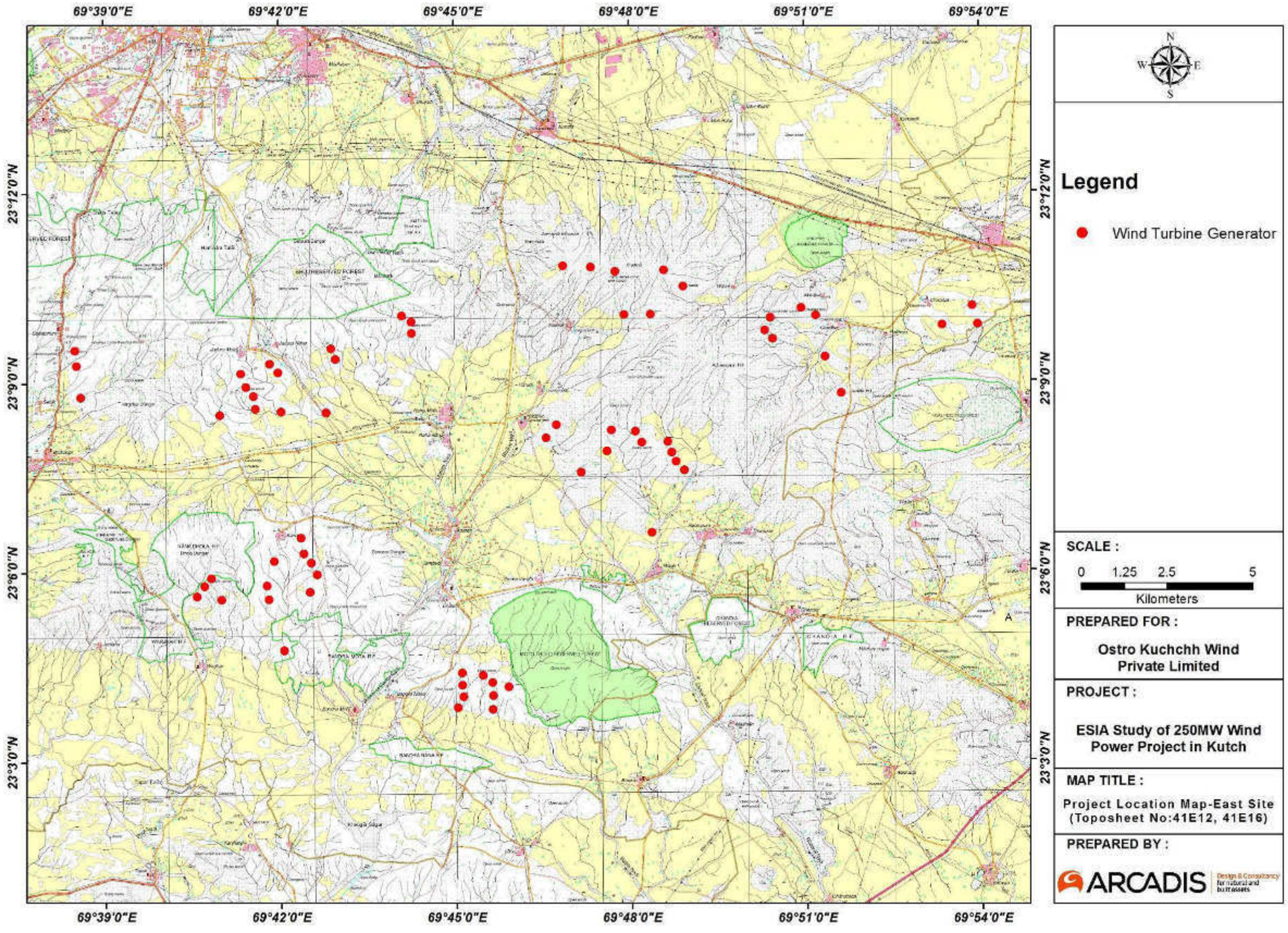
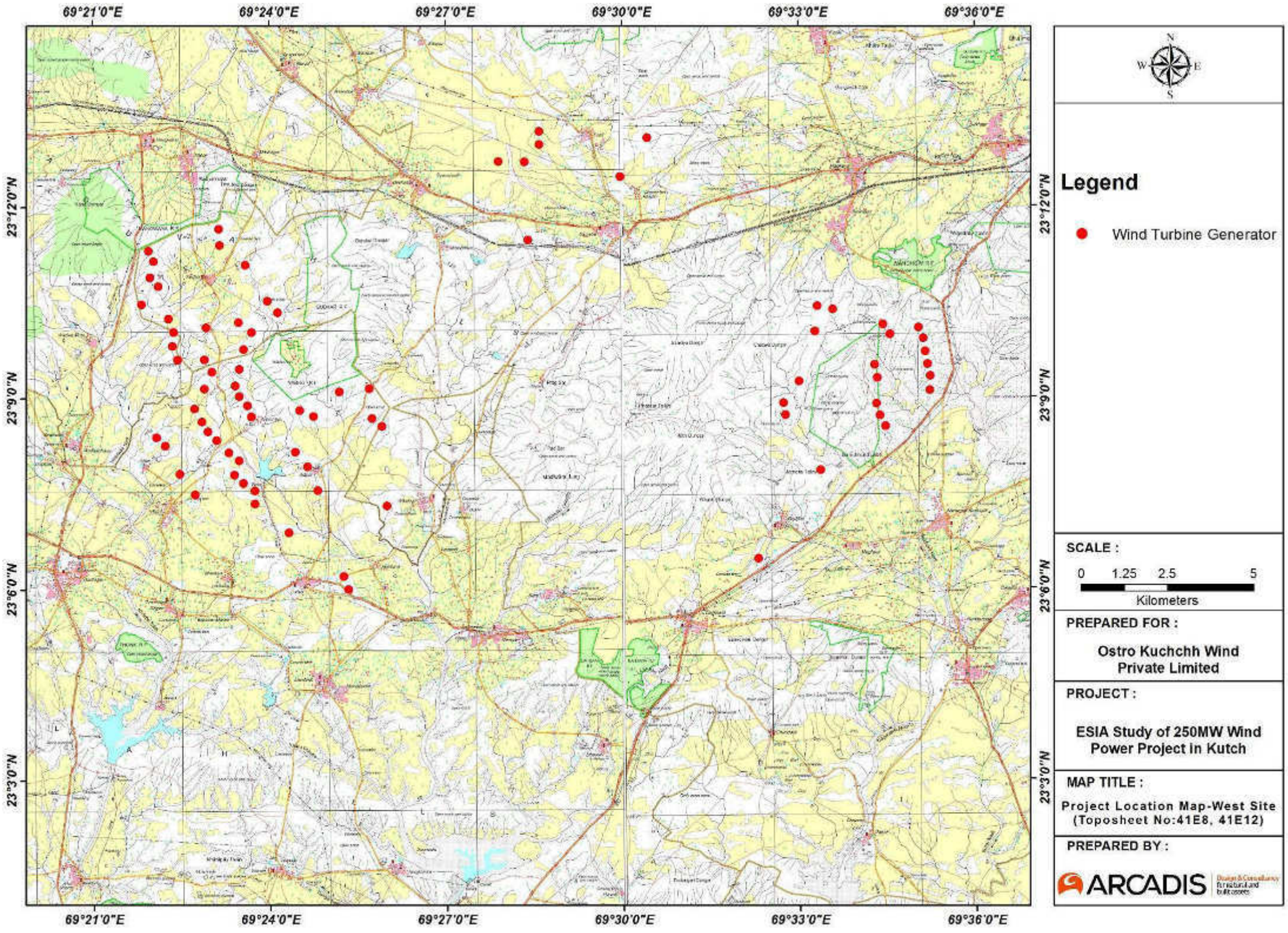


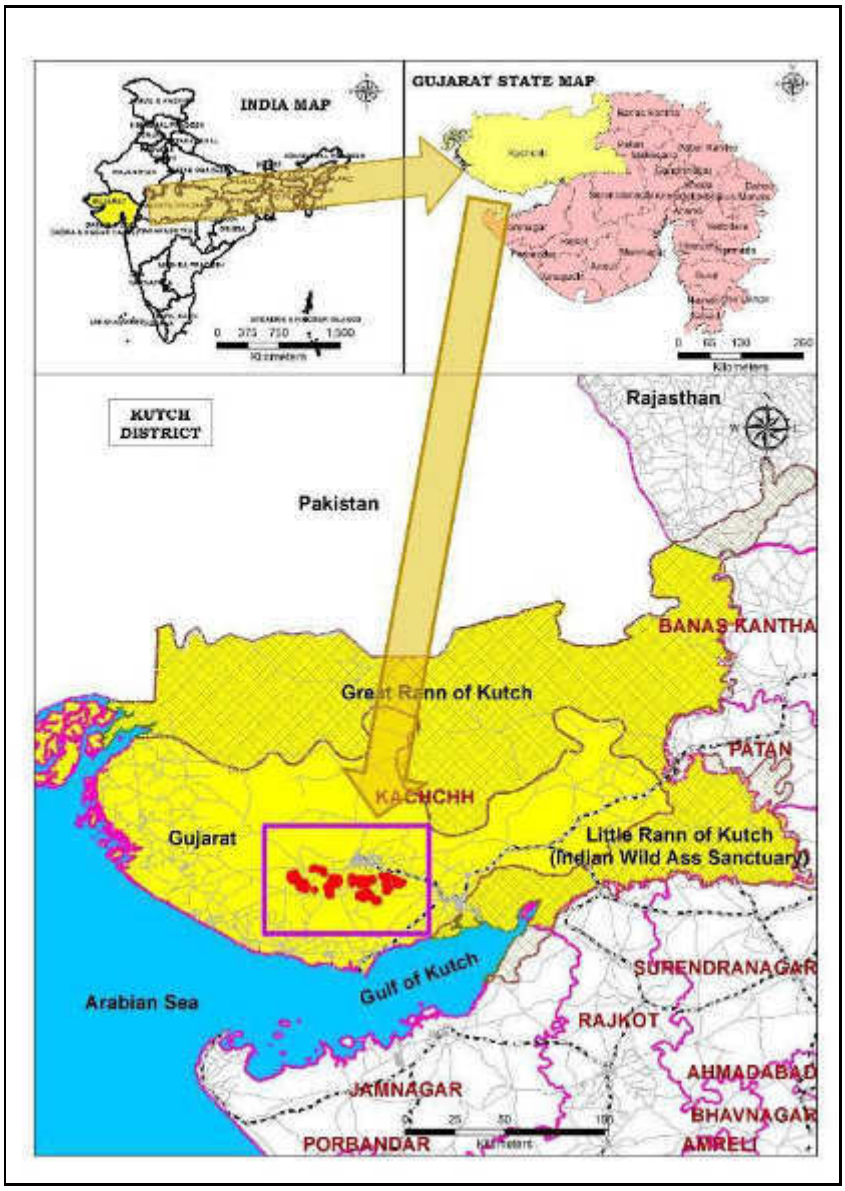
Figure 2-2 Location of the WTG on Toposheet (West side of project)



2.2 Project Location

The project consists of 125 WTG's each with 2 MW installed capacity and is proposed in 30 villages viz. Sedata, Jadura, Reha Nana, Vadva, Harudi, Sakrai Timbo, Vavdi, Gandher, Chubdak, Reha Mota, Bandhara Nana, Sanosara, Vadajar, Bandhara Mota, Naranpar Ravli, Nagiyari, Samatra, Kurbai, Vadasar, Godpar, Meghpar, Godpar Sarli, Kanpar, Ludva, Virani, Nabhoi Moti, Filon, Deshalpar, Bharasar and Ajapar village falling in Bhuj taluka of Kutch district in Gujarat. The project location map is provided in **Figure 2.3**

Figure 2.3 Project Location Map



2.3 Project Phase and Status of Permits

The proposed wind power plant will consist of 125 WTG's, the micro siting of WTGs has been completed. The status of permits and approvals required before the onset of construction phase has been summarised below:

Table 2-2 Status of permits for the proposed project

S.N	Permits/Approvals	Status
1	Consent to Establish from Gujarat State Pollution Control Board	Wind power generation activity falls in "White industry: and hence CTE/CTO is not required as per CPCB issued notification vide **File No. B-29012/ESS (CPA)/ 2015-16 dated 7th March 2016 (Appendix B).** In addition to this as per CPCB issued notification (No. B-29012/ESS/CPA/2016-17) dated 18.01.2017, it is also clear that all wind power generation plants of all capacities are exempted from obtaining CTE and CTO **(Appendix C).**
2	NOC from State Electricity Board for grid connection.	NOC from Gujarat Power Grid Corporation of India Limited for connection of 250MW wind power plant at 220/400 KV grid substation (GSS) located in Bachao village has been reportedly obtained.
3	Land Allotment letter	Land allotment letter for 56 locations has been obtained from the collector office. Demand note for 49 locations is under progress.
4	NOC from DLIR department	NOC from DLIR department attached in **Appendix D**
5	Permission from Forest department	Permission from forest department attached (**Appendix E**)
6	NOC from Mining Department	NOC from Mining department attached in **Appendix F**
7	NOC from village panchayat	Reportedly in process
8	NOC from Airports Authority of India (AAI) and Ministry of Defence.	Application to AAI has been made and process is under progress.
9	Connectivity Approval	Power Evacuation Approval has been obtained Power Grid Corporation of India
10	Power Purchase Agreement (PPA)	PPA signed with PTC India

2.4 Project Features

- **Wind potential at the site:** The wind velocity in the district varies from about 124 km/d during November and 375 km/d during June. The site has a good wind resource potential as per the monitoring carried out by various CWET monitoring stations.
- **Topography:** The landscape is largely undulating with some parts with flat terrain. The elevation range of the study area lies between 400 and 850 feet.
- **Substation proximity:** The 220kV D/C Surajpur - Bachau transmission line of 62 km length will connect the pooling substation (PSS) of 33/220 KVA capacity in Surajpur village to the 220/400 KV grid substation(GSS) located in Bachao village.
- **Transmission line route planning:** A total of 190 towers are planned of DA, DB, DC, DD and DDE type to evacuate power from 125 WTG's , which will run a total length of 62km covering 18 villages viz. Bhimasar, Lakhapar, Ajaapar, Khara Pasavariya, Satapar, Jaru, Sapeda, Sugariya, R.K Nagar, Ningal, Gandher, Tharavada Mota, Hajapar, Kotka Chakkar, Sanosara, Near sapra Timbo, Bharapar and Surajpur.

- **Geological and soil conditions:** In general, alluvial sandy (affected by salinity and alkalinity-gray and brown soils impregnated with salts), medium black, saline alkaline (a special class of soil that occur in the extensive saline flats bordering the Rann of Kachchh, unfavorable to tree growth), desert (included in desert soil-grey and brown soils), loamy, lateritic, reds are noticed in different parts of the Bhuj taluka.
- **Water availability and quality:** OKWPL will procure water from the authorised tankers for which reportedly the No objection certificate (NOC) has been obtained from the village panchayat.
- **Near and far shading effects due to objects like transmission lines, trees, hills, wind farms etc.** The project site is spread across 55km from west to east direction and is largely undulating. The area comprises of small hillocks with rocky terrain. The region is barren with some scanty short woody shrub growth.
- **Land availability:** Reportedly, all identified WTG locations fall on government land and the application for procurement of the same as been submitted to the Revenue Department and the same is in process. All WTG locations have been found to be technically feasible for wind power development as per all factors discussed above.
- **Climatic[3] parameters like temperature, wind speed, rainfall, etc.:** The climate of the district can be defined as characterised by hot summers with generally cold winters. The mean maximum temperature ranges between 26.7°C during January to about 39.5°C during May and the mean minimum temperatures vary between 9°C during January and 27°C during June. Long-term average annual rainfall for Bhuj IMD station is 378.2 mm. Most of the rainfall (about 345 mm) is received during south-west monsoon between June and September. The relative humidity in Kachchh as per IMD varies between 43.5% during March and 77% during August. Average rainfall recorded Hydromet division, IMD, Delhi for the last five years (2011-2015) for Kutch district is 38.7mm.

2.3 Project Settings

A total of 150 locations were visited though only 125 WTGs are proposed for this current project. The key physical features of the project site have been described below:

- Majority of 150 WTG's are proposed on ridges of hillocks and some on flat terrain. Some of the WTG's have agricultural land in its site surroundings.
- The Bhuj airport and the India air force base named "Bhuj Rudra Mata Air Force Base" is located at 12.5km NE from the project site. Bhuj Indian Air Force base shares its runway with the Bhuj airport. As per the guidelines, "No objection" for height clearance is not required from Airport Authority of India (AAI) if the structure falls below the colour coded zoning map (CCZM) i.e. if the height of the structure is below 150m above ground level4. In addition to this, structure located within 20km as per Visual Flight Rules, also requires NOC.

  The hub height of Vestas model V110-2.200 is 110m to which the rotor blade length will also be added. Besides, the project site is located at a distance of 12.5km south; hence NOC for height clearance is required from AAI and Ministry of Defence[5].
- The military area is located in Gandhidham city, which is about 26 km SE away from the nearest point of WTG location in the eastern part of the project site. Since the military base is more than 10 km away, it attracts no permission/approval from regulatory authorities.
- Two dams viz. Vijay Sagar Dam and Khengar Sagar Dam are located 10 km and 5 km south respectively of the project site. A number of dry drainage channels originating from Bhukhi Nadi, Rudrani Nadi,

[3] *Groundwater Information Booklet, Kutch district, 2013*

[4] *http://nocas2.aai.aero/nocas/#*

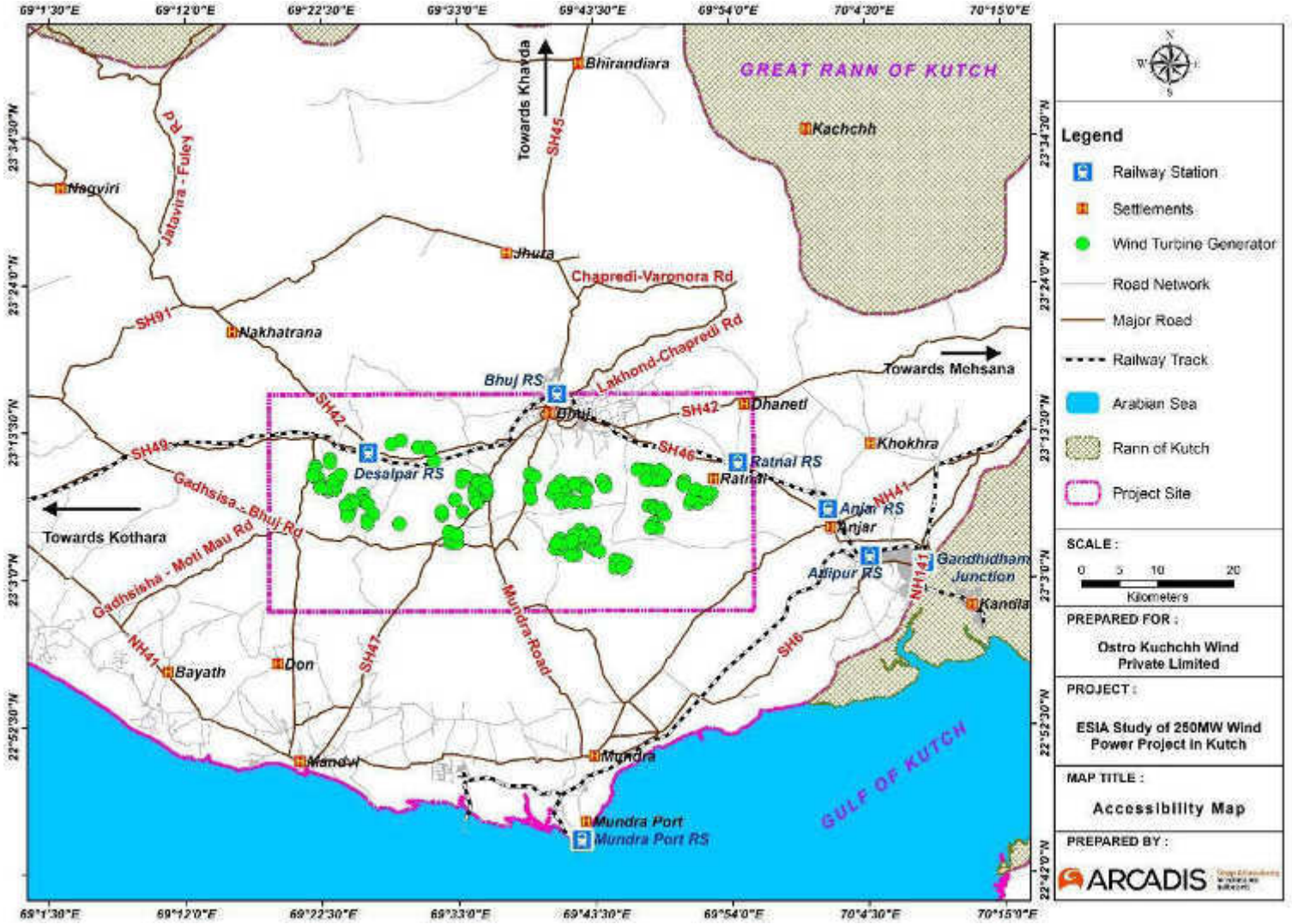
[5] *http://nocas2.aai.aero/nocas/AAI_Links/FAQ_1st_April_2015.pdf*

Rukmawati Nadi, Viraniwali Nadi were also observed during the site visit. All these water channels are rain fed, which however is erratic in the region. Small and medium scale ponds were also observed in the study area viz. Prag Sar, Jamora Talav and Kurbai pond, which serve as habitats for waterfowls.

- On discussions with the Assistant to Deputy Conservator of Forest (D.C.F), Bhuj Forest Division, it was confirmed that no ecological sensitive area i.e. National Parks or Wild life sanctuaries falls within 10 km radius of the project site. However, a total of twenty-one (21) reserve forest areas are demarcated within the study area.
- None of the WTG's fall within the reserve forest boundary as per the RF area demarcated on the toposheet No. F42 D08, F42 D012, F42 D16. No updated maps are available in the DCF office for verification on the same in case of any change. However, as per the land records obtained from OKWPL none of the land parcels fall within the reserve forest area.
- Reportedly, only government land has been identified for proposed WTG's and the pooling substation, the application for the same has been submitted to the Revenue department.
- Considering the wind potential of the site, many other wind farms may be developed in future, however no other wind farm was observed onsite during the time of site visit. Besides, no large industry is observed in the area, though some small-scale factories like Alumina refinery, Perfoclay manufacturing units (located about 3-4km from WTG no. BHO 45, 46 and 102) along with some stone quarry units (located around 240m from WTG no. BHO 24 and 25 and 320m away from BHO 132) are operational in the study area. No impact is envisaged due to presence of the aforesaid manufacturing units on the proposed wind project and vice versa.
- A railway line passes close to WTG no. KUT 48 which is at a distance of 1.6km north.
- The site is located in a high damage risk zone as per Seismic zone map of India and has high susceptibility of earthquakes.
- In around the proposed project area, no other wind farm is observed.

The detailed WTG site settings has been given in **Appendix G.** The proposed site is accessed through State Highway SH-42 and SH46, which further connects the wide project site through various villages Samatra, Jamura and Kukma village (adjoining the project site area). **Figure 2.4** below shows the accessibility of the project site.

Figure 2-4 Accessibility Map of the Project Area



2.4 Project Design, Technology and Component

The wind turbines consist of a hollow steel tower with a nacelle to which the fibreglass rotor with three blades are attached. The nacelle houses the generator, gearbox, and control systems. The make of the wind turbine is Vestas 110 2MW and has a hub height of 110m. The rated capacity of each wind turbine is 2MW. The blade length of the wind turbine is 54m with the rotor consisting of 3 rotor blades made of high quality epoxy glass fibre/carbon fibre. The Vestas V110-2MW model is covered in the list of wind turbine models possessing valid type approval/certificates as published by C-WET under "*Main List*" of "*Models & Manufacturers of Wind Turbines*".

The project comprises the wind turbine generators, a pooling sub-station and transmission facilities. The associated facilities include access roads and operation and maintenance facilities.

Wind Turbine Generators: Each wind turbine consists of three major mechanical components, i.e., tower, nacelle and rotor.

Rotor: The rotor consists of three fibre glass blades that extend out of the hub. The rotor is mounted to a driveshaft within the nacelle (as defined below) to operate upwind of the tower. The rotor attaches to the drive train emerging from the front of the nacelle. Hydraulic motors within the rotor hub feather each blade according to the wind conditions, which enables the turbine to operate efficiently at varying speeds. The rotational speed of the rotor is controlled by blade pitch control. Pitch control helps in lowering the peak loads during high windy conditions.

Nacelle: The nacelle is a large housing that sits on top of the tower behind the rotor. It houses the main mechanical components of the wind turbine: drive train, yaw system and its accessories, etc. The nacelle is externally equipped with anemometer and a wind wane that signals wind speed and direction information to an electronic controller. The nacelle is mounted over yaw gear, which constantly positions the rotor upward of the tower.

Tower: The tower supports the nacelle and rotor. The towers are tubular and are double coated with anti-corrosion paint inside and Triple coated with anti-corrosion paint from outside. The towers have an access door and an internal safety ladder to access the nacelle.

2.5 Project Activities

PROJECT KEY ACTIVITIES

Construction phase: The key activities to be undertaken under this phase include site investigation, road improvements along the agreed off-site access route to the site as required; construction of internal access road, temporary fencing, excavation and construction of wind turbine foundations, construction of storage yard, porta cabins and pooling substation, transmission line laying, above ground electrical distribution cabling between turbines.

Operation Phase:
During operation phase, activities would involve repairing of WTG components during the times of need. Most preventive and corrective maintenance work would not normally involve the use of any large machinery or specialist vehicles. However, in some circumstances, cranes and other specialist may need to visit the site when, for example, large turbine components need to be repaired or replaced.

Decommissioning Phase:
De-commissioning of the wind farm would require de-installation and removal of all physical components and machinery from the site. The transmission line, sub-station and control building would be removed. Concrete turbine pads and building foundations will be removed.

The detailed activities to be undertaken during the different phases of the project include the following –

PRE-CONSTRUCTION PHASE

Wind Resource Assessment: The wind resource assessment unit of Centre for Wind Energy Technology (CWET) - autonomous R&D institution by the Ministry of New and Renewable Energy (MNRE), Government of India identifies wind resource rich regions in the country by conducting wind resource micro survey. A number of CWET wind monitoring mast have been installed in the region. The nearest mast (224m) is in Kukma village approx. 4km north from project site along with Kera CWET station (120m) ~7 km away south, Shinugra CWET monitoring mast (100m) ~15km away south east and Polidiya CWET monitoring mast (138m) ~20km south west of the project region6. OKWPL has also installed four mast within the study area as shown in table 2.3

Table 2 -3: Wind mast locations

S. N	C WET wind monitoring mast	Distance
1	Bheraiya mast	2.9km South west
2	Jadura wind mast	Within the study area
3	Gandher wind mast	1km from BHO 87 extreme east
4	Deshalpur wind mast	north east

Micro siting: Micro siting involves assessing the location by reference to topographical maps, satellite images and by physically examining the site. This data is used to create a computer model with digital elevation models as well as a roughness description which can include obstacles, trees, reliefs, roads and existing wind turbines. On the basis of this data, it is possible to select the appropriate turbine type, the tower height and optimum wind farm layout. In order to make sure that every turbine receives the full benefit of the wind turbines should be located two rotor diameters apart in the direction prevailing to the wind condition and at least 10 rotor diameters apart in the direction perpendicular to the prevailing wind condition. During micro siting, the WTGs are placed in a manner which ensures maximum WTGs in a given area, so as to maximise the generation from the wind farm. Based on micro siting, the planning team releases the Land Purchase Indent (LPI) to land team which then pursues the land purchase process.

CONSTRUCTION PHASE

Site Preparation and access road development or strengthening: No construction was initiated during the time of site visit. The activities involved in site preparation include clearing of vegetation, levelling of land, compaction of soil, trenching, cable laying, excavation, foundation and crane pad construction. Access road to the WTG's were not finalised by OKWPL during site visit and hence no assessment on the same could be undertaken at the time of site visit.

Wind turbine tower erection: Activities include trenching, cable-laying and turbine and tower installation and interconnection with pooling substation

Power Evacuation: The wind farm is proposed for 250MW capacity with an individual WTG capacity of 2MW. The project site will be connected through a 220kV D/C Surajpur - Bachau Transmission Line to the pooling substation (PSS) of 33/220 KVA capacity identified to be located in Surajpur village, which in turn would be connected to the 220/400 KV grid substation(GSS) located in Bachao village. A total of 3 x 100 MVA transformers would be installed onsite.

Transmission Line: Power will be evacuated via a 62km (approximately) long 220kV transmission line. A total of 190 towers of DA+DB+DC+DD+DDE type have been planned for power evacuation, which will cross

[6] *MNRE as on 31.03.2017*

eighteen villages. Necessary metering and protection will be provided to ensure acceptable billing and safety to equipment and work force. Paschim Gujarat Vij Company Limited (PGVCL) is the government agency responsible for electricity distribution in the state. The approach route identified for the transmission line was based on a criterion to reduce the environmental and socioeconomic footprint of the transmission line. The shortest feasible route after considering these factors has been selected for the transmission lines along with the following factors:

- Transmission line route does not fall under any habitations and thick vegetation.
- No households or community structures are in the route of the transmission line.
- All environmentally sensitive sites, archaeologically significant sites, areas of ecological and cultural significance were avoided while selecting the route.
- Right of way/access roads are shared with local residents of the area wherever possible.

2.6 Resource Requirement

2.6.1 Land

Type of Land: All the 125 WTG's fall on Government land. The procurement of land for WTG's is under process. The topography of the project site is largely undulating.

Land requirement: A total of 1 hectare of land is required for each WTG location. It is assumed, around 125 hectares of land is required for 125 WTGs. A central parcel of land is required for routine operation and maintenance activities. This is retained for routine maintenance activities as well as from safety point of view in case of accidental breakoff of the blades or any other part of WTG. No agricultural activities are allowed in this area. Remaining land is retained for emergency O&M activities. The break up of land required has been shown below:

Table 2-4: Land break up requirement for the proposed wind power project

Land area of WTG	WTG footprint area for operation and maintenance	Land on ROW basis for transmission line	Total length of access road and type of land	Pooling substation land area
125 Hectare for 125 WTG(1 Hectare for each WTG)	125 hectares	One time compensation	Approximately 43.75 Hectare (125*500*7=437500). Majority of the land for road will be Revenue land.	Location Naranpar ravli village Type of land: Private land Khasra no. 106

The details of application submitted to Revenue department for allotment of land to OKWPL is shown below in table 2.5

Table 2 -5: Details of application for land submitted to Revenue department

Date of Application	Number of WTG locations	Locations cleared by DLIR
3rd Aug, 2016	46	38
9th Aug, 2016	24	23
10th Oct, 2016	24	11
6th Feb, 2017	56	

13th April, 2017	18	
Total	**168**	**72**

Land for Access route: It is assumed, that the width for access road will be approximately 8-10 m in width. An exclusive access to the construction site is usually required prior to the mobilization of manpower and machinery. The construction of access road will be linked with village main road and district major road. All WTG location required to be connected with the main approach road. Majority of the land will be revenue.

Land for Transmission line: Additional lands are required for pooling sub-station (PSS), access roads and other facilities. Land is required for construction of transmission line connecting WTGs to PSS and to GSS. A relatively small area of 8mx8m is normally used for the purpose. Generally, it is done by paying a one-time compensation based on negotiation with private land owners (which includes the compensation for crops in the Right of Way of transmission towers & transmission line).

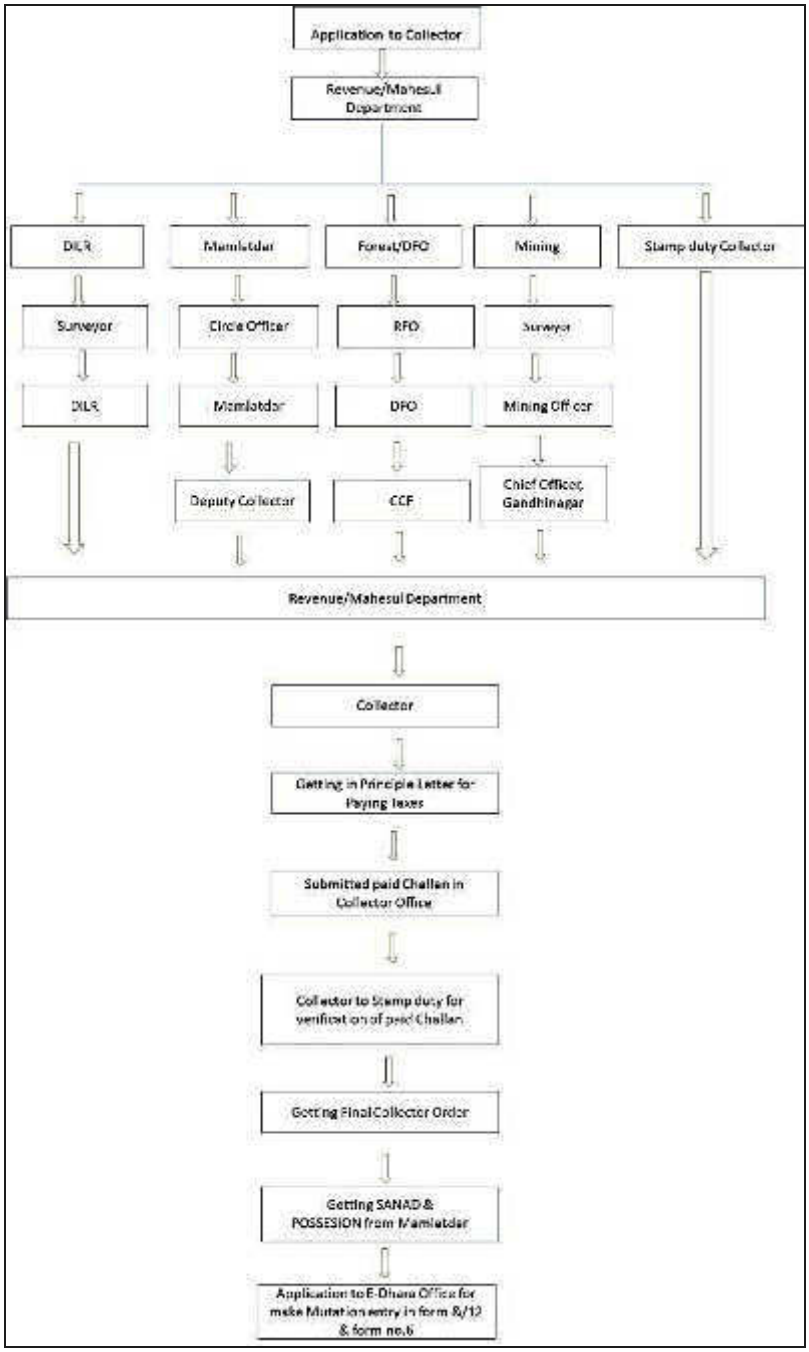
Land for Pooling substation: Private land has been identified in Naranpur Ravli village which will connect the evacuated power from wind power plant to grid substation

Land Purchase Procedure: The 250 MW wind power project in kuchch is in its initial stage. As per consultation with Ostro representative, it is known that all 125 WTG's will fall on Government land. However, there would be private land requirement on a ROW basis for erecting transmission tower.

Government land purchase procedure

A land procurement procedure followed by Ostro as per mentioned in its Environment and Social Management System for Government land as well as procedure followed in Revenue Department, Gujarat is shown in the flowchart below:

Figure 2-5 Government land purchase process



It should be noted that since the land procurement process may vary across states, OSTRO shall undertake a review of the government land allotment process for wind power projects prior to filing an application for the same. In case any government land is identified for procurement, OSTRO shall:

- Undertake an Environmental and Social Impact Assessment study to assess the environmental, ecological and social concerns that may arise due to the project, with a specific emphasis on impact on biodiversity and identification of local community user rights in terms of common land for grazing, commuting and culturally significant sites.

- Undertake a legal due diligence through a third-party consultant (refer to details of the legal due diligence below)
- Recognize community access to certain assets like grazing land, rivers, ponds, forest produce collection, or access routes etc.
- Avoid (to the extent possible) or minimize, where unavoidable, any impact on culturally significant areas.
- While opportunistic squatting rights shall not be compensated for, in case livelihood dependency or usufruct rights to land are established, OSTRO will ensure that such claims are addressed and adequately compensated;
- Ensure that the local community has access to a grievance redressal mechanism and a regular community engagement process to address any grievances, queries or concerns that the community may have in terms of land procurement

As retrieved from the website portal of revenue department[7], Government of Gujarat the circle rates of the study area are provided in Table 2.6

Table 2 -6: Village Wise Govt. Circle Rate of Land in the Study Area

Taluk & District	Village Name	Land type and unit		
		Fellow Land (Per Acre)	Cropland (Per Acre)	Shrubland (Per Acre)
Bhuj Taluk, Kutch District	Bandhara Mota	1,17,360	1,49,740	52,610
	Bandhara Nana	97,130	1,49,740	72,850
	Chubdak	1,17,360	1,37,600	72,850
	Gandher	1,01,180	1,01,180	72,850
	Jadura	72,850	84,990	60,710
	Naranpar Pasayati	1,57,830	1,78,060	1,21,410
	Reha Mota	1,01,180	1,09,270	76,900
	Reha Nana	60,710	89,040	72,850
	Sanosara	80,940	1,21,410	80,940
	Sedata	89,040	1,05,220	89,040
	Vadasar	64,750	84,990	56,660
	Vadva	80,940	84,980	80,940

Source: https://revenuedepartment.gujarat.gov.in/downloads/kachchh_rural_agri.pdf

Private land procurement procedure

The private land procedure which will be adopted by Ostro has been detailed below in steps.

STEP 1: Title Clearance

STEP 2: ATS & Sale deed

STEP3: Application & obtaining the 89A permission

STEP 4: Conversion to old tenure land & payment of premium

STEP 5: Apply & obtaining 65 kh permission (Non-agriculture - NA)

7 Source: https://revenuedepartment.gujarat.gov.in/jantari

Land Due Diligence

- OSTRO appoints a third-party consultant such for conducting land diligence.
- The third party appoints a local counsel, where land procurement has to happen to conduct land diligence. The local counsel is supervised and guided by the third-party consultant. Reports prepared by the local counsel, under the guidance and supervision of the third-party consultant appointed by Ostro, and are then submitted to OSTRO.
- Ostro provides land related information available with the OEM to the third-party consultant.
- In addition, to reviewing the information made available by the OEM, the appointed third party consultant / their local counsel also conducts independent review of the revenue records / land ownership records, and seeks clarification from relevant local departments as required.
- Subsequently, third party consultant shares the due diligence report with Ostro.
- If the report does not raise any issue, then Ostro asks third-party consultant to finalise the report. If issues are raised (mortgaged land, land in defence area etc.) then Ostro seeks further clarification from the OEM and provide OEM's responses to finalise the report.
- Subject to the nature of issues raised in the final report, Ostro ask the OEM to address and take remedial measures to the issues raised before transferring the land to Ostro. If any issue raised which can't be remedied – then Ostro does not acquire the related land parcel.

Provision of Land procurement/ acquisition in Gujarat Wind Power Policy 2016

Gujarat Energy Developer Agency (GEDA) shall be the State Government Nodal Agency for facilitation and implementation of the Gujarat Wind Power Policy-2016. The nodal agency will facilitate and assist the project developers to undertake the following activities in achieving the objectives of the Policy.

- Registration of projects;
- Respond to queries and problems of Developers of Wind Power projects; and
- Accreditation and recommending Wind Power Projects for registration with Central Agency under REC mechanism

The WTGs may be set up on private land, or revenue wasteland allotted by the State Government / GEDA land, if available. The allotment of GEDA land on lease shall be done upon approval of the Coordination Committee consisting as given in Table 2.7. Issues other than the allotment of land including interpretation of any of the provisions of this Policy will also be decided by the said Committee members:

Table 2.7: Land Committee Members

S N.	Departments	Designation
1	ACS/PS/Secretary (CCD)	Chairman
2	AS/JS/Deputy Secretory (EPD)	Member
3	Chief Electrical Inspector & Collector of Elect. Duty	Member
4	General Manager (Comm), GUVNL	Member
5	Respective District Collector	Member
6	Director, GEDA	Member Secretary

Source: https://geda.gujarat.gov.in/policy_files/Gujarat%20Wind%20Power%20Policy-2016.pdf

2.6.2 Water Requirement

Water required for plant civil works, such as WTG foundation, will be sourced from authorized water tankers by contractors. During construction period, water requirement would be about 60KL per WTG to build foundation of tower and 31.5 KLD for domestic water use considering 700 workers during peak hours. Labour camp will be constructed onsite. Maximum percentage of local employment would be undertaken, a ratio of 80:20 for employment of local to that of migrant labour would be followed. The water requirement during construction phase may go up depending on the number of labours in labour camp.

In operational phase water will be used for the domestic use of project staff at the site, which is estimated to be around 1.8 KLD considering 15-20 technical persons present on site in shift and about 15-20 security personnel.

Water to be supplied through tankers by local water suppliers during construction phase of the proposed project to meet domestic and construction water requirements. Drinking water requirements of personnel in operational phase will be met by packaged drinking water. The estimated quantities of water required during the construction and operation phases are presented below in **Table 2.8**

Table 2-8 Water requirement during construction and operation phase

Phase	Activity	Max. Consumption
Construction	Civil works water requirement as reported by *OKWPL*	60KL/ WTG location 7500KL for 125WTG's
	60 KL per WTG is including curing of foundation	
	Domestic use – drinking and washing by 600-700 workers staying onsite (during peak construction phase)	31.5KLD*
Operation	Domestic use – drinking and washing by 15-20 site personals	0.9KLD*
	Security guards	0.9KLD*

* *Considering 45 LPCD water demand for workers in industrial area as per CPHEOO guideline*

In operational phase, water requirement will be only for drinking, which will be met by packaged drinking water.

2.6.3 Manpower Requirement

About 600-700 labors reportedly would be employed in the peak phase for WTG construction, which involves the foundation structural work and erection of wind turbine. The contractor workforce is comprised of both skilled and unskilled labours and is being sourced from the nearby village settlements depending on their skills and capabilities. In operational phase, a total of 15-20 personnel will be required onsite including security guards, operation and maintenance officer and site engineers.

2.6.4 Waste Water Treatment and Disposal System

During the current phase, the waste water or sewage from site office toilets is being disposed in a septic tank. Septic tanks have also been constructed for the onsite labour camps, however it was reported that the same are maintained to manage the waste water. Waste water generation during the operation phase is limited to the domestic waste water from the toilets.

2.6.5 Logistic Arrangement

Labour Camp*:* It has not been decided yet whether the labour camps will be established on site. Whatsoever it may, the accommodation for labourers provided by *Ostro's* subcontractor will be equipped with the basic facilities like beds, kitchen, toilets, fans, drinking water and power supply. The labour camp should have a

separate kitchen. Considering the basic amenities and the housing standards provided to the labours, the same should meet the International Labour Organization (ILO) standards (**Appendix E**).

2.6.6 Project Vehicles

Project vehicles such as water tanker, tractors, JCB, and cars have been hired to support various operations during construction phase and further efforts will be made to hire vehicles from local community.

2.6.7 Implementation Schedule for the Project

The project is scheduled to commence in June18 and completed by Aug18

2.7 Analysis of Alternatives

Gujarat has recorded significant economic growth over the past decade. Gujarat leads the country in the per capita consumption of electricity. Gujarat is planning huge investments so as to generate a much larger and stronger economic momentum. The projected industrialization levels coupled with increase in urbanization and income levels would lead to substantially higher demand for power. The energy units required by 2020 would be nearly two and half times the existing generation. Gujarat also has a large untapped potential for energy generation through renewable sources and it needs to exploit the same. Gujarat is blessed with good wind speeds for harnessing of wind energy of more than 35000MW.

2.7.1 Project versus No Project Scenario

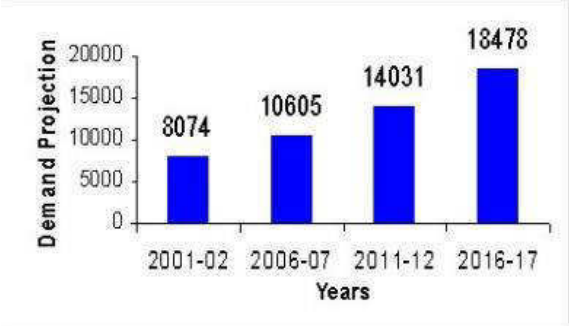
There is a need to bridge the gap between the demand and supply, renewable/non-conventional sources of power to supplement the conventional sources. The proposed project intends to contribute towards bridging this demand supply gap being a non-conventional source of power generation.

As per the assessment of Ministry of New and Renewable Energy (MNRE), the estimated wind power potential in Gujarat state at 100m above ground level is 84431MW. The cumulative wind power installed capacity operational at the end of fiscal year 2016 is 3948.61MW[8]. The percent of wind power utilized is 4.68% as of date 31.03.2016.

2.7.2 Power Demand- Supply Position of Gujarat

Gujarat[9] state has an installed capacity of 13566 MW including wind generation and is third highest in the country after. Maharashtra 20868 MW & Tamil Nadu 14408 MW. The demand projected by 2017 is 18478 MW for Gujarat state as on date. It is estimated by 2017, Gujarat has a capacity to generate 40,039 MW (double the projected demand) to meet the requirement of any additional projects due to the rapid industrialization.

Demand Projection of Gujarat from 2001 – 2017



[8] http://mnre.gov.in/file-manager/UserFiles/State-wise-wind-power-potential-utilized.pdf
[9] http://www.gidb.org/power-demand-supply-scenario

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 of the surrounding region. The Project being a wind power project will not lead to CO_2 and SO_2 emissions during the operation phase. It does not deplete the natural resource except a small part of land will be occupied by the turbines, ancillary facilities and access roads. Project has a life of 25 years.

2.7.3 Alternate method for power generation

Wind power is a free and inexhaustible ("renewable") source of energy. Unlike fossil fuels such as coal and oil, which exist in a finite supply and which must be extracted from the earth at great environmental cost, wind turbines harness a boundless supply of kinetic energy in the form of wind.

The environmental impact of wind power when compared to the environmental impacts of fossil fuels, is relatively minor. According to the Intergovernmental Panel on Climate Change (IPCC), in assessments of the life cycle global warming potential for energy resources, wind turbines have a medium value of between 12 and 11 (gCO2eq/kWh) depending on whether on and off shore turbines are being assessed. Wind turbines have the lowest global warming potential per unit of electricity generated.

Wind farm may cover a large area of land, many land uses such as agriculture are compatible with it as only small areas of turbine foundation and infrastructures are made unavailable for use.

Green House Emission's: As per the estimations of International Atomic Energy Agency (IAEA), carbon emission (including CO_2, CH_4, N_2O) per gigawatt hour of electricity (CO2e/GWh) for wind energy projects is low and scores favourably, when compared with other forms of conventional and non-conventional sources of energy. The comparative analysis of various power generating options has been shown in **Table 2.9**

Table 2.9 Comparative analysis of various power generation options

S.N	Alternative Power Source	Average Lifecycle GHG Emission (tonnes CO_2e/GWh)
1	Coal	888
2	Natural Gas	500
3	Hydro	26
4	Nuclear Power	28
5	Wind Energy	26
6	Solar	85

Source: World Nuclear Association report

2.7.4 Alternate location for the proposed project

The wind velocity in the district varies from about 124 km/d during November and 375 km/d during June. The site has a good wind resource potential as per the monitoring carried out by various CWET monitoring stations as well as the data received from the four wind masts installed by OKWPL in the project site. Besides, there are no ecological sensitive area such National Parks or wildlife sanctuaries in the radius of 10km from the project area. Availability of large area of revenue land further adds to the feasibility of the project in the area.

2.7.5 Alternate routes for transmission lines

The route of transmission line was not finalised during the site visit. However later OKWPL along with Paschim Gujarat Vij Company Limited (PGVCL) studied three different route alignments with the help of published data/maps and walk over survey to arrive at the most optimum route for detailed survey. Based on the same, a comparative analysis of route alignments was undertaken as shown below–

Table 2.10 Comparative analysis of transmission line route

S. N.	Description	Alternative RA-1 (Selected)	Alternative RA-2	Alternative RA-3
1	**Route Particulars**			
a)	Route Length Kms	62.171	63.784	63.824
b)	No. of Angle Points	42 Tower's	49 Tower's	49 Tower's
c)	Total Tower	190 Nos.	195 Nos.	195 Nos.
2	**Environmental Impact**			
a)	Town in Alignment	The line is not passing through any town, vicinity towns are Surajpur, Anjar, Bhimasar	The line is not passing through any town, vicinity towns are Surajpur, Anjar, Bhimasar	The line is not passing through any town, vicinity towns are Surajpur, Anjar, Bhimasar
b)	House Within ROW	NIL	NIL	NIL
c)	Forest Involvement	NIL	NIL	NIL
d)	Endangered species, if any	NIL	NIL	NIL
e)	Major Crossing:			
I	River	0	0	0
Ii	Power Lines	19	20	21
iii	Railway Lines	1	1	1
iv	National Highways	0	0	0
v	Airport	1 (Bhuj)	1 (Bhuj)	1 (Bhuj)

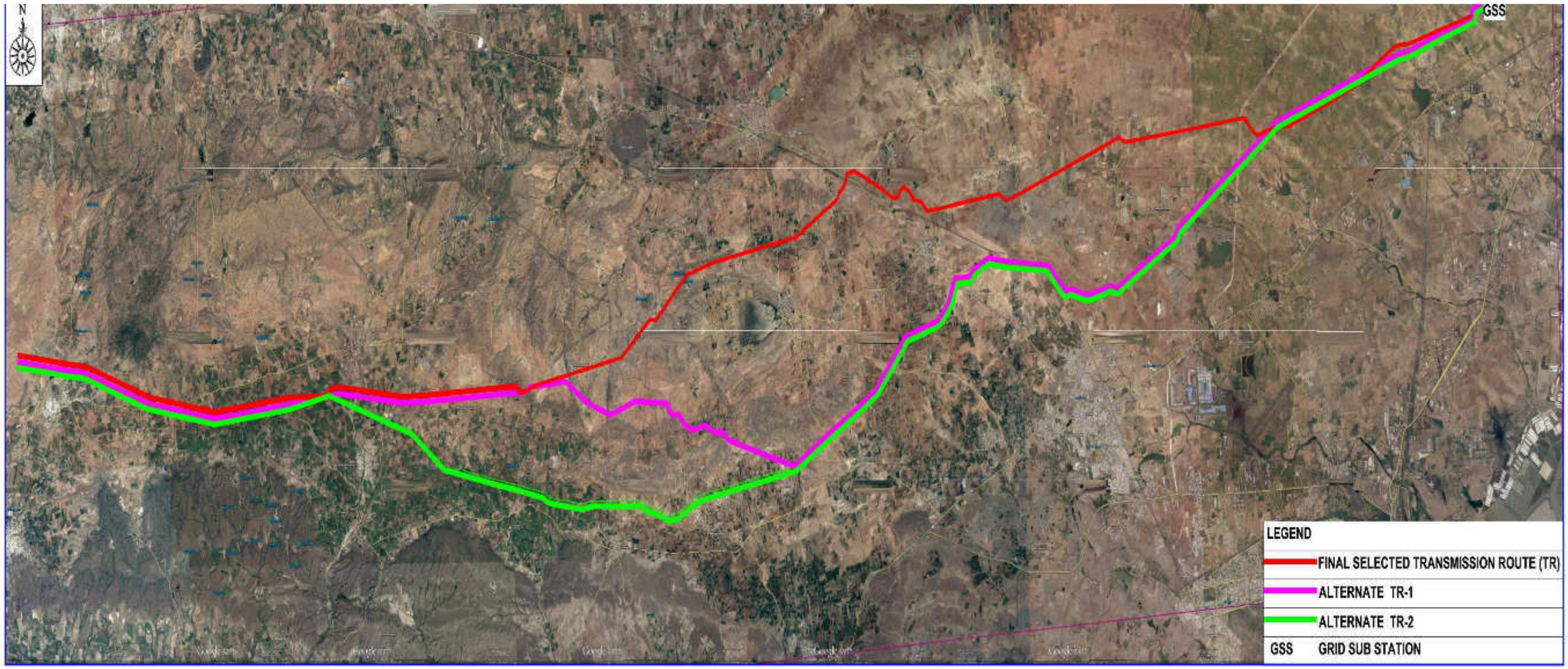
The Figure 2.6 below provides a clear picture of the three transmission line routes studied.

Out of the three mentioned above, alternative route (RA)-1 for the transmission line has been 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 should 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.

Figure 2-6 Comparative presentation of three transmission line route alignment



3.0 APPLICABLE LEGAL, REGULATIONS AND ADMINISTRATIVE FRAMEWORK

This section describes regulations, statutory guidelines and obligatory standards that are applicable to the social and environmental performance of the proposed project.

3.1 National Regulations

Environmental Protection has been given the constitutional status. Directive Principles of State Policy states that, it is the duty of the state to 'protect and improve the environment and to safeguard the forests and wildlife of the country'. It imposes Fundamental duty on every citizen 'to protect and improve the natural environment including forests, lakes, rivers and wildlife'.

In India the Ministry of Environment, Forests and Climate Change (MoEFCC) is the apex administrative body for (i) regulating and ensuring environmental protection; (ii) formulating the environmental policy framework in the country; (iii) undertaking conservation & survey of flora, fauna, forests and wildlife; and (iv) planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. Several laws have been framed for protection of environment and for Occupational Health & Safety in India by the Central Government. The relevant regulation pertaining to the project activity has been discussed as under. The compliance to all environmental, health, safety and social regulation have been presented in **Table 3.1**

Table 3.1: Applicable Environmental, Health, Safety and Social Regulation

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
1	The Air (Prevention & Control of Pollution) Act 1981	Gujarat Pollution Control Board (GPCB)	As per the re-classification of industries into Red, Orange, Green and White Category, issued by Central Pollution Control via File No. B-29012/ESS (CPA)/ 2015-16 dated 7th March, 2016 regarding harmonisation of classification of industrial sectors under Red/Orange/Green/White categories which states that solar power generation is a "White Industry" and does not require to obtain consent to establish and consent to operate **(Appendix B)** In addition to this as per CPCB issued notification (No. B-29012/ESS/CPA/2016-17) dated 18.01.2017, it is also clear that all wind power generation plants of all capacities are exempted from obtaining CTE and CTO **(Appendix C).**	*Not Applicable*
2	The Water (Prevention & Control of Pollution) Act 1974	Gujarat Pollution Control Board (GPCB)	As per the re-classification of industries into Red, Orange, Green and White Category, issued by Central Pollution Control via File No. B-29012/ESS (CPA)/ 2015-16 dated 7th March, 2016 regarding harmonisation of classification of industrial sectors under Red/Orange/Green/White categories which states that solar power generation is a " White Industry" and does not require to obtain consent to establish and consent to operate **(Appendix B)** In addition to this as per CPCB issued notification (No. B-29012/ESS/CPA/2016-17) dated 18.01.2017,	*Not Applicable*

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
			it is also clear that all wind power generation plants of all capacities are exempted from obtaining CTE and CTO **(Appendix C).**	
3	Forests (Conservation) Act, 1980 and Rules 1981	Principal Chief Conservator of forests, Forest Department, Gujarat	The Forest Conservation Act and Rules mandate projects requiring diversion of forest land for non-forest purposes to seek Forest Clearance from the Ministry of Environment and Forests.	*Not Applicable* *As per the demarcated reserve forests (RF) on toposheet no F42 D08, F42 D012, F42 D16 of 1: 50,000 scale none of the WTG's fall within the boundaries of RF. There are no recent updated maps available as the forest maps are being updated as per the forest sub division office, Bhuj.*
4	The Environmental (Protection) Act 1986 and Rules	MoEF&CC CPCB GPCB	Requirement of the law states that establishing the project should ensure that there is no impact or minimal impact on the environment due to project activity.	*Applicable during construction & operation Phase*
5	Environmental Impact Assessment (EIA) Notification 2006 & MoEFCC Office Memorandum dated 30thJune'11.	MoEF&CC	The EIA Notification 2006 and thereafter the MoEF&CC Office Memorandum dated, 13th May '11 exempts wind power project from obtaining prior Environmental Clearance from the regulatory authorities. But, under the provision of MoEF&CC office memorandum dated 30th June 2011, requisite permission is required to be obtained from competent authority for water and land usage.	*Not Applicable. However, permission will be taken from the concerned authority for usage of water.*

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
6	Environment (Protection) Seventh Amendment Rules 2009	CPCB	Ambient air quality monitoring has to be carried out and the concentration limits for the air quality parameters should be in compliance with NAAQS 2009. Activities in the project especially during construction should not result in exceeding National Ambient Air Quality Standards (NAAQS) for ambient concentrations of air pollutants (such as particulate matter). If violation of the Rules takes place then the penalty will be decided on the basis of the parent Air Act 1981.	*During construction phase and if required during operation phase*
7	Noise (Regulation and Control) Rules 2000 amended in 2010	GPCB	The Rules stipulate ambient noise limits during day time and night time for industrial, commercial, residential and ecologically sensitive areas. The rules apply both during the construction and operation of the project. Violation of the standards for assessing the noise quality due to the project will lead to penalty as under the EPA Act 1986.	*During construction phase and if required during operation phase.*
8	Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules 2016	GPCB	These Rules outline the responsibilities of the generator, transporter and recycler/re-processor of the hazardous wastes for handling and management in a manner that is safe and environmentally sound. OKWPL need to obtain consent from State Pollution Control Board for generation and storage of hazardous waste like transformer oil, etc. irrespective of quantity of waste.	*Applicable during construction and operation phase* *Currently, the construction of structural foundation work for the WTG's proposed, DG sets will be used for the civil work involved. Oil for DG sets should be stored in enclosed containers. Reportedly* OKWPL *will sell all non-biodegradable*

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
			As per the law the occupier and the operator of the facility should be liable to pay financial penalties as levied for any violation of the provisions under these rules by the State Pollution Control Board with the prior approval of the Central Pollution Control Board.	*waste generated like plastics to the authorised recyclers.* *The operation phase of the proposed project will result in generation of some quantities of hazardous waste, mostly in the form of waste/used oil.* OKWPL *need to obtain consent from GPCB for storage of transformer oil. All the hazardous waste generated due to the project activity, should be stored and disposed as per the requirements of the Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules, 2016 i.e., on a paved surface in a designated area with adequate secondary containment, with adequate labelling and before it is disposed to an GPCB approved vendor.*
9	Environment (Protection) Second Amendment Rules 2002	MoEF&CC	The DG sets installed during construction should comply with maximum permissible noise levels and noise control measures for diesel generators up to 1000 KVA capacity as specified in the Act.	*The construction is being undertaken through DG sets, which will adhere to prescribed CPCB noise level limits and noise control measures.*

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
10	The Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act 1996	Ministry of Labour and Employment	This Act provides for safety, health and welfare measures of buildings and construction workers in every establishment which employs or employed during the preceding year ten or more such workers. These measures include fixing hours for normal working day, weekly paid rest day, wages for overtime, provision of basic welfare amenities like drinking water, latrines, urinals, crèches, first aid, canteens and temporary living quarters within or near the work site. This Act also requires application of the following: Building or other construction workers' (regulation and Employment Conditions of Service) Central Rules 1998 & Workman's compensation Act, 1923 to buildings and other construction workers. These will be followed by contractor & developer during construction and operation phase.	*Applicable during construction phase* OKWPL *should ensure through its contractors during the construction phase that basic amenities are provided to the labours.* OKWPL *through its contractors should also ensure all vendors employed should have valid labour license. Compensation to workers (own and vendors) should not be below daily wage rate as specified by Government. Muster roll must be maintained. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and construction workers as mentioned in the act needs to be complied with.* *Failure to comply results in financial penalty /imprisonment of the principal employer along with vendor and closure of project*
11	Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and	Min. of Power, Central Electricity Authority Paschim Gujarat Vij	The Act is applicable for the wind power plant as the plant is going to be having electrical appliances and facilities installed for grid connected power generation. As per the act, all equipment's and system installed should comply with the provision of the statute, regulations and safety codes.	*Applicable both during construction and operation phase* OKWPL *under provisions of the CEA regulations ensure that the health and safety requirements and provisions for*

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
	Electrical Lines) Regulations 2008, (CET)	Company Limited (PGVCL)		*transmission lines specified under the rules are compiled.*
12	Workmen's Compensation Act, 1923 & Rules 1924	Gujarat Labour Welfare Board	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 should be liable to pay compensation in accordance with the provisions of this Act.	*Applicable during construction phase* *OKWPL should ensure through its contractors in case of any accident / injury / loss of life the workmen should be paid a minimum compensation as calculated under this act both during construction and operation phase of the project. The reporting of accidents needs to be done in prescribed forms as per the act and the incident / accident register needs to be maintained accordingly. The Act also gives a framework for calculating amount of compensation and wages.*
13	The Contract Labour (Regulation and Abolition) Rules, 1971	Gujarat Labour Welfare Board	The Contract Labour (Regulations & Abolition) Act, 1970 requires every principal employer of an establishment to make an application to the registering officer in the prescribed manner for registering the establishment. The Act and its Rules apply to every establishment in which 20 or more workmen are employed on any day on the preceding 12 months as contract labour and to every contractor who employs or who employed on any day preceding 12months, 20 or more workmen. It does not apply to	*Applicable during construction phase* *All vendors employed through contractors of OKWPL should have valid labour license. Compensation to contract workers (own and vendors) should not be below daily wage rate as specified by Government of India. Mustard roll must be maintained. Employee ID card must be issued (own and vendors). Safety, health and welfare measures of building and*

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
			establishments where the work performed is of intermittent or seasonal nature. An establishment wherein work is of intermittent nature will be covered by the Act and Rules if the work performed is more than 120 days in a year, and where work is of a seasonal nature if work is performed more than 60 days in a year.	*construction workers as mentioned in the act needs to be complied with. Failure to comply results in financial penalty. Failure to comply results in financial penalty.* *OKWPL should also ensure that conditions like hours of work, fixation of wages and other essential amenities in respect of contract labour are provided and in compliance with the standards.*
14	Minimum Wages Act, 1948	Gujarat Labour Welfare Board	This Act provide for fixing minimum rates of wages in certain employments and requires the employer to provide to every worker engaged in a scheduled employment to be paid wages at a rate not less than the minimum rate of wages fixed by such notification for that class of employees in that employment without any deductions except as may be authorized within such time and subject to such conditions as may be prescribed.	*Applicable during construction phase*
15	The Child Labour (Prohibition and Regulation) Act, 1986	Gujarat Labour Welfare Board	The Act prohibits employment of children in certain occupation and processes. The Act also specifies conditions of work for children, if permitted to work.	*OKWPL should ensure that no child labour is engaged at site for construction or operation works either directly or by the sub-contractors. OKWPL should include a clause in the subcontractor agreements prohibiting employment of child labour*

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
16	Companies Act, 2013	*OKWPL*	According to Schedule 135 sub -section 1, the companies meeting the threshold criteria specified should spend in every financial year, at least 2% of the average net profits of the Company made during the three immediately preceding financial years in pursuance of CSR policy.	*The project will need to comply with the requirement as stated in the law.*
17	Aircraft Act 1934	*Airport Authority of India*	*As per the guidelines, "No objection" for height clearance is not required from Airport Authority of India (AAI) if the structure falls below the colour coded zoning map (CCZM) i.e. if the height of the structure is below 150m above ground level[10]. In addition to this, structure located within 20km as per Visual Flight Rules, also requires NOC.*	*The Bhuj airport and the India air force base named "Bhuj Rudra Mata Air Force Base" is located at 12.5km NE from the project site. Bhuj Indian Air Force base shares its runway with the Bhuj airport. The hub height of Vestas model V110-2.200 is 110m to which the rotor blade length will also be added. Besides, the project site is located at a distance of 12.5km south; hence NOC for height clearance is required from AAI and Ministry of Defence[11].*

3.2 Social and Environmental Performance Standards of the International Finance Corporation

The International Finance Corporation has laid down a set of eight Performance Standards that the project developers need to comply with while establishing the project. The provisions of the Performance Standards relevant to the wind power projects are summarized below:

[10] http://nocas2.aai.aero/nocas/#
[11] http://nocas2.aai.aero/nocas/AAI_Links/FAQ_1st_April_2015.pdf

Table 3-2: IFC's Environmental and Social Performance Standards

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
PS 1: Social and Environmental Assessment and Management Systems	Conduct an Environmental and Social Impact Assessment (ESIA or EIA) of the project, appropriate to the nature of the project's environmental and social risks and potential impacts, to include issues identified in Performance Standards 2 to 5	ARCADIS has been appointed by OKWPL to undertake ESIA study to identify the environment and social risks that may arise due to the project and recommend mitigation measures for the same as provided in Chapter 8 The PS 1 is applicable to projects with environment and/or social risks and/or impacts. The proposed project is a wind power project and will have environmental and social impacts resulting from loss of grazing land, generation of noise, construction activities etc. **PS 1 is therefore applicable for the proposed project.**	OKWPL has developed an Environmental and Social Management System for its wind projects at corporate level. OKWPL is required to adhere the requirements as per management system developed as the project site and needs to fulfil the following requirements: ▪ Environmental and social action plan; ▪ Identification of risks and impacts; ▪ Management program; ▪ Organizational capacity and competency; ▪ Training for security and safety workers; ▪ Emergency preparedness and response; ▪ Stakeholder engagement/ grievance redressal; and ▪ Monitoring, reporting and review.
	Establish Environmental and Social Management Plans commensurate with the findings of the ESIA and consultation with affected communities	An Environmental and Social Management Plan has been prepared and incorporated in Chapter 8 of the ESIA report taking into consideration the potential social and environmental impacts or risks already identified & assessed in ESIA	
	Establish Action Plans where specific mitigation measures and actions are required for the project to comply with applicable laws, regulations and the requirements of these Performance Standards	An ESMP has been prepared and incorporated in Chapter 8 of the ESIA report for implementation of mitigation measures in compliance with the statutory requirements and Performance Standards	
	Provide organizational capacity and contractor / employee training to enable project to achieve continuous	Organizational structure with roles and responsibilities of the team within the organization is defined in Chapter 8	

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	environmental and social performance		
	Establish and maintain a timely process of community engagement, including a grievance mechanism, focusing on disclosure of information and consultation with local communities affected by project risks or adverse impacts that is free from external manipulation, interference or coercion to ensure relevant and understandable access to project information.	A community engagement plan needs to be developed and implemented as well as adequate reporting needs to be done. This should aim to inform the community project related adverse impacts or risks. The grievance redresses mechanism has been developed in ESIA	
	Establish procedures to monitor and measure the effectiveness of the environmental and social management program, including internal reporting of the program's effectiveness to the project's senior management, disclosure of Action Plans (including material changes to such Plans) to affected communities, and external reporting to affected communities on the results of Action Plans, commensurate with the concerns of the affected communities	System of monitoring with periodic audits will be established	
PS 2: Labour and Working Conditions		The PS 2 applies to workers directly engaged by the client (direct workers), workers engaged through third parties (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers).	The sub-contractor of OKWPL should ensure that adequate facilities and amenities are provided in the labour accommodation for construction workers including: adequate living/sleeping facilities and space per person; potable water that meets national standards and standards as laid down by

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
		The proposed project will involve employment of direct and contracted workers during construction and operation phases. Campsite will be set up near the wind turbine locations for skilled labour that will be contracted to carry out foundation and installation works of turbines. Locals will be hired to carry out unskilled work. ***PS 2 is therefore applicable for the proposed project.***	ILO; toilets, washing and cleaning facilities; canteen/mess or fuel for cooking; locker/storage facilities; and facilities for management and disposal of garbage, sewage and other waste. The company will periodically review and monitor the condition of the labour camps. The worker accommodation standards as laid down by ILO is presented in **Appendix H** of the document. The company, as a part of the contractor oversight procedures will need regular monitoring of compliance to the aforesaid guidelines/requirements and ensure that these are met. Internal audits and follow up on corrective actions will also need to be undertaken to assess efficacy of the oversight system.
	Establishment of a Human Resources Policy consistent with the requirements of this Standard that informs employees of their rights under national labour and employment laws		Ostro Energy has HR policies at the corporate level. EPC contractor (Vestas) should inform their employees their rights under national labour and employment laws.
	Document and communicate to all employees' conditions and terms of employment.	Applicable during construction and operation phase	Vestas should hire local labour during construction phase of the project. Labour camp has been provided to the migrant labour. OKWPL should engage labours through contractors as such the contractors would be supervised by OKWPL so that the engagement of workers is in accordance to applicable rules and regulations.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
			OKWPL should provide adequate provisions such as access to clean water, sanitary facilities and other necessary facilities at the labour camps and construction sites.
	Practice non-discrimination and equal opportunity in making employment decisions	Applicable during construction phase	Complied. Equal opportunity is being given to both men and women depending on their skills and capacity wages, work hours and other benefits should be as per the national labour and employment Laws.
	Provide a mechanism for workers to raise workplace concerns.	Applicable during construction and operation phase	Grievance Redressal Mechanism has been framed by Ostro Energy at the corporate level. The same will be implemented during construction and operation phase supervised under OKWPL.
	Provide workers with a safe and healthy work environment, taking into account risks inherent to the particular project sector	Applicable during construction and operation phase	OKWPL has an EHS policy (**Appendix – I**). The same would be followed via an EHS team with designated roles and responsibilities.
PS 3: Resource Efficiency & Pollution Prevention		The PS-3 is applicable to projects resulting in increased levels of pollution and requires project to avoid, minimize, or reduce adverse impacts on human health and environment by adopting pollution preventive and control technologies throughout the Project life cycle. The proposed project is a clean energy project and will not have major pollution sources associated with it. The construction works for the development of project will result in generation of	Government land is identified for all WTG's proposed, the procurement for the same is in process. Construction of access road, pooling substation and transmission line (either pole/tower site and/or for the line right-of-way (RoW)) may involve private land, which would be obtained through a negotiated settlement. Water for project construction phase will be sourced from authorised tanker water suppliers and drinking water supply would be through packaged drinking water.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
		wastes like wastewater, waste oil and construction debris. The operation phase will result in noise emissions and generation of minor quantities of waste such as transformer oil. ***PS 3 is therefore applicable for the proposed project.***	The project, is expected to contribute to significant GHG avoidance beginning in FY2017-18. No material impact on ambient air quality is expected on account of this Project. However, temporary impacts on ambient air quality and noise levels may be expected during construction. Noise levels may also be expected during operation phase. OKWPL should implement measures during construction: for management of excavated earth and construction rubble; and minimization of fugitive dust emissions. Further, OKWPL should ensure through its contractors that other wastes (packing material, metal, debris, cement bags, drums/cardboards etc.) are collected, stored and disposed to re-users or in appropriate authorized debris disposal areas. Limited concreting work is expected for structure foundations, sub-station, and transmission towers. Cement concrete mixers will be expected to be used at site since significant concreting work is not expected. Concreting and other construction activities including use of earth moving equipment and increased traffic for material movement is expected to result in increase in ambient noise levels. However, this increase is short term during construction stage only. The construction work will be carried out only during day time and no noise generating equipment will be operated at night.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
			No material impact on surface or groundwater resources is expected on account of the project, except that the water sourcing requirement during the construction phase will need to safeguard the immediate and medium term needs of water by the local communities. The company will have to ensure that the water made available to workers and employees' meets national potable water quality norms, and preliminary information about water quality indicates some related challenges in ground water quality of the area. Appropriate facilities for collection, treatment and disposal of sewage (septic tank and soak pit) both during construction and operation phases should be provided.
	The project proponent should ensure that adequate control techniques are provided to minimize emissions or achieve a pre-established performance level and minimize pollution from project activities. The client will avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release.	During the construction phase, the vehicles involved for hauling of equipment's and materials to the project site may increase the pollution level and dust in the air.	OKWPL through its contractors should ensures sprinkling of water to reduce dust in the air. Besides, OKWPL should also ensure use of vehicles having valid PUC certificates.
	The client will implement technically and financially feasible and cost effective measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs, with a	During construction and operation phase.	OKWPL should plan and implement pollution control measures. Practices like minimal release of waste, handling of hazardous waste, safe disposal of waste, wastewater management etc. should be considered prior to each phase.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	focus on areas that are considered core business activities.		
PS 4: Community Health, Safety and Security		This Performance Standard is applicable to projects which entail potential risks and impacts to the health and safety of affected communities from project activities. The proposed project will involve transportation of large components such as rotor blades, towers which may pose safety risks to the affected communities. Impacts due to generation of noise and shadow – flicker effect will be assessed on habitations that are close to particular wind turbines. **The PS 4 is therefore applicable for the proposed project.**	The Applicability will be both to the construction and operation phase. In addition to the movement of heavy machinery / vehicles and blasting operations during the construction phase, effects due to shadow flickering and noise generated due to wind turbines will pose an impact on the community if properly not mitigated. 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
	Evaluation of risks and impacts of the project on health & safety of the affected community during the project lifecycle and establish preventive/mitigation measures to reduce/minimize the impacts. Disclosure of action plans to affected community and the government agency.	During Construction Phase	The potential occupational hazards arising from the project activities and the impacts on health & safety of the affected community have been identified and assessed in Chapter 7 of ESIA.
	Design, construct, operate and decommission of Structural elements or components in accordance with	During Construction Phase	An occupation health safety plan has been formulated (Chapter 8) of this report. All steps to reduce the impact on the health and safety of the community to minimal will be taken.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	good industrial practice to reduce impact on community health & safety.		
	Minimization of impacts on the health and safety of the community caused by natural hazards that could arise from the land use changes due to project activities.	During Construction Phase and Operational phase	A management plan has been formulated as part of ESIA process to address the issue.
	Prevent or minimize the potentials for community exposure to communicable diseases during project activities	During Construction Phase	CSR Plan and activities has been provided as a part of ESIA.
PS 5: Land Acquisition and Involuntary Resettlement	PS 5 is applicable when there is physical and/or economic displacement due to acquisition of land for the project. This PS does not apply to resettlement resulting from voluntary land transactions (i.e. market transactions in which the seller is not obliged to sell and the buyer cannot resort to expropriation or other compulsory procedures if negotiation fails). The impacts arising from such transactions should be dealt with as under PS1, though sometimes, when risks are identified, the project proponent may decide to adhere to PS 5 requirement even in willing-buyer-seller cases	**PS5 is not applicable for this proposed project.**	Under the proposed project all WTG locations fall on government land. Further to this, the government lands to be transferred for the project are open scrublands and are without habitation. This was confirmed on the basis of site observations and consultation held with Ostro representative during primary survey. However, there will be land requirement for access road construction, pooling substation as well as land (ROW basis) for erection of transmission lines which may involve private land, which will be procured on a willing to buy and willing to sell basis. Hence, PS5 is not applicable.
	Avoidance or at least minimization of involuntary resettlement by exploring alternative project designs balancing environmental, social and economic	Not applicable	No resettlement of people is required.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	costs and benefits; and by acquiring land through negotiated Settlements.		
	Compensation and benefits for displaced person as per Performance Standard	Not applicable	No locals will be displaced. However, proper compensation should be paid to the private land owner, whose land has been identified for pooling substation as well as if private land is acquired for access road or transmission line tower construction.
	Disclosure of all relevant information and consultation with affected persons and communities in decision making process related to resettlement.	Not applicable	No resettlement has taken place due to the project activity.
	Establish a grievance mechanism to record and resolve communities' concerns and grievances about the relocation and compensation	During the construction and operation phase	OKWPL should implement its framed grievance redressal framework **(Appendix J)** for onsite implementation, so that grievances from locals can be registered and timely resolved. This is also being proposed in the ESMP chapter of this report for the reference and implementation.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	As a matter of priority, the client should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible, measures to minimize impacts and restore biodiversity and ecosystem services should be implemented. Given the complexity in predicting project impacts on biodiversity and ecosystem services over the long term, the client should adopt a practice of adaptive management in which the implementation of mitigation and management measures are	The applicability of this PS should be established in ecology and biodiversity section of the ESIA. Implementation of the actions necessary to meet the requirements of this PS should be managed through the Management Plan. The operation phase of the proposed Project should ensure protection of local flora and fauna of the site and its surrounding. ***PS6 is applicable to the project***	There are neither Protected Area (N.P; WLS, Biosphere Reserve etc.) nor Important Bird areas are located within 10km radius from the study area. Bat roosts were observed and have been confirmed by local villagers within the project area. Diverse form of avifauna population was recorded. Hence, the mortality on avifauna during the operational period is envisaged. A total of 80 avifauna species were sighted during the site visit, out of which 8 were Schedule I species as per Wildlife Protection Act 1972, and five avifaunal species viz. Pallid Harrier, Darter, Painted Stork, River Tern and Black headed ibis fall in Near Threatened category as per

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	responsive to changing conditions and the results of monitoring throughout the project's lifecycle.		IUCN Red List. No threatened terrestrial floral species were sighted. Thus, considering avian fauna risk from operation of wind turbine, **PS 6 is applicable** Hence, periodic monitoring of bird and bat mortality survey should be initiated by Ostro.
PS 7: Indigenous Peoples	Performance Standard 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. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. As a consequence, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities	Not Applicable	The study area located in Kutch district does not fall in any notified tribal area of Gujarat state[12]. In addition to this, it has also been informed by the project proponent that no tribal land is being procured for the project and its associated utilities. Based on the information, PS 7 is not applicable to the project.
PS 8: Cultural Heritage –	Performance Standard 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	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	An ancient Champa dala Dargah (more than 400-year-old), is located 400m south of WTG no. BHO 27. This may get affected with project activity, if the access way to the same is used and consequently religious sentiments would be affected. Hence PS 8 will be applicable

[12]http://tribal.nic.in/Content/ScheduledAreasinGujarat.aspx

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	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.	or are proposed to be used for commercial purposes. **Hence, PS8 is applicable.**	Chance find Procedure should be formulated under PS 8 to ensure if any other structure or alike specimens are present or in case of discovery of any artefacts and/ or settlement of past in the future at proximity of the project area. Specific measurements should be taken to ensure that the ancient temple or alike structures are not being impacted due to the project activity.

3.3 EHS Guidelines of IFC

IFC has issued Environmental, Health, and Safety Guidelines for Wind Energy on August 7, 2015. These are a compilation of:

- Environmental, Health, and Safety General Guidelines
- Environmental, Health, and Safety Guidelines for Wind Energy.

The key requirements stated in the EHS guidelines have been discussed in **Table 3.3.**

Table 3-3: IFC's EHS guidelines for wind energy sector

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
1.	**NOISE AND VIBRATIONS**	
a)	Planning activities in consultation with local communities to minimize disturbance.	Preliminary modelling should be carried out to determine whether more detailed investigation is warranted. Keep stationary source of noise such as DG sets (currently used only for back up) at farthest point from the settlements. Detailed mitigation measures for Ambient Noise Quality are given under Table 7.3
b)	Avoiding or minimizing project transportation through community areas.	The speed limits of the vehicles should be maintained. Refer mitigation measures for Community and Social under Section 7.5.7
2.	**SOIL EROSION**	
I	**Sediment mobilization and transport**	
a)	Scheduling to avoid heavy rainfall periods (i.e., during the dry season) to the extent possible.	Refer mitigation measures for soil and water under Table 7.3
b)	Contouring and minimizing length and steepness of slope	Refer mitigation measures for soil and water under Table 7.3
c)	Re-vegetating areas promptly	Refer mitigation measures for Ecology under Table 7.3
II	**Waste Water Runoff Management**	
a)	Segregating or diverting clean water runoff to prevent it mixing with water containing high solids content, to minimize the volume of water to be treated prior to release.	Refer mitigation measures for soil and water under Table 7.3 and under section 7.5.4
III	**Road Design**	
a)	Limiting access road gradients to reduce runoff-induced erosion	Refer mitigation measures for soil and water under Table 7.3
b)	Providing adequate road drainage based on road width, surface material, compaction, and maintenance.	Refer mitigation measures for soil and water under Table 7.3
3	**AIR QUALITY**	
a	Dust suppression by spraying water or non-toxic chemicals to minimize dust from vehicle movements.	Refer mitigation measures for Air environment under Section 6.2.1 and mitigation measures for ambient air quality under Table 7.3

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
b	Avoiding open burning of solid waste	Refer mitigation measures under Section 7.5.4 and Table 7.3
c	Proper maintenance of vehicle for low generation of pollution load	Vehicles should have PUC certificate. Refer mitigation measures for Transport and Traffic under section 7.5.9
4	**SOLID WASTE**	
a)	Minimizing generation of solid waste	Refer mitigation measures in Section 7.5.4
5	**HAZARDOUS MATERIALS**	
a)	The hazardous waste like transformer oil , waste oil from DG sets should be kept in enclosed containers	Refer mitigation measures under Hazardous waste under Table7.3 and section 7.5.4
6	**OCCUPATIONAL HEALTH AND SAFETY**	
	Occupational health and safety hazards during the construction, operation, and decommissioning of onshore and offshore wind energy facilities are generally similar to those of most large industrial facilities and infrastructure projects. They may include physical hazards, such as working at heights, working in confined spaces, working with rotating machinery, and falling objects.	Refer mitigation measures under Section 7.5.6 under Occupational safety under Table 7.3
I	**Working at Height**	Mentioned in Sub-section 6.3.2, page No. 120
7	**COMMUNITY HEALTH AND SAFETY**	
a)	Community health and safety hazards during the construction, operation, and decommissioning of wind energy facilities. These hazards may apply to the structural safety of project infrastructure, life and fire safety, public accessibility, and emergency situations	The impacts on community health and safety has been discussed in Chapter 6 , the impacts and the possible mitigation measures has been discussed in section 6.3.3
b)	Blade Throw	Turbines must be located at an acceptable distance between wind turbines and adjacent sensitive receptors like habitations to maintain safety in the event of blade failure. Refer in Section 6.3.3 and under Occupational Health and Safety in Table 7.3

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
c)	Aviation: The wind turbines height should be maintained as per air traffic safety regulations in case there are any airport nearby the project site.	The Bhuj airport and the India air force base named "Bhuj Rudra Mata Air Force Base" is located at 12.5km NE from the project site. Bhuj Indian Air Force base shares its runway with the Bhuj airport. As per the guidelines, "No objection" for height clearance is required from Airport Authority of India (AAI) if the structure above below the colour coded zoning map (CCZM) i.e. if the height of the structure is above 150m above ground level2. In addition to this, structure located within 20km as per Visual Flight Rules, also requires NOC. The hub height of Vestas model V110-2.200 is 110m to which the rotor blade length will also be added. Besides, the project site is located at a distance of 12.5km south; hence NOC for height clearance is required from AAI and Ministry of Defence3.
d)	Marine Navigation and Safety	Not Applicable. The wind energy facility is not located near any ports or harbours.
e)	Electromagnetic Interference and Radiation: Wind turbines could potentially cause electromagnetic interference with telecommunication systems (e.g., microwave, television, and radio).	Care should be taken that the wind turbines are located away from all telecommunication lines or the television broadcaster transmitter.
f)	Public Access	During construction phase, safety flags on the roadsides should be displayed during work in progress. The WTG location should also be fenced to prohibit public access to the turbines. OKWPL has put up sign boards on the road sides.
g)	Abnormal Load Transportation	The transportation of oversized or heavy wind turbine components (blades, turbine tower sections, nacelle, and transformers) and cranes on the village access roads pose a traffic threat in the region. Hence, proper traffic management plan should be adopted as detailed in Section 7.5.7 for minimizing the same.
h)	Blasting operations	Blasting operations would be required for construction of access roads as majority of WTG locations are located on hilly ridges and rocky undulating terrain. These activities would impact workers as well as community in proximity. A detailed management plan has been provided in section 7.5.6
	OPERATION PHASE	

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
a)	Visual Impact	The settlements in the region are located at a sufficient distance from the WTGs. Further, this change is not adverse and local community had no negative perceptions about this change. Hnece, the visual impact from the development of WTG in the project area is a non-issue. Please refer sub-section 6.4.5, Page No-137.
b)	Operational Noise	The results of operational nosie from turbines are analysed and presented in Table 6.8 in page No-99 and the bried description on respective Turbines and receptors are presented in Page No.108. analysed operational nosie from the Turbines and the
c)	Bird/ Bat mortality and flight disturbance	The level of impact is mentioned in sub-section 6.4.2, Page No. 134.
d)	Shadow Flicker and Blade Glint	The findings from the shadow flickering analysis are presented in Table -6.11 Page no-122.
e)	Occupational Health and Safety - Working at Heights	Mentioned in Sub-section 6.3.2, page No. 120
f)	Community Health and Safety	Minimize the probability of a blade failure by selecting wind turbines that have been subject to independent design verification/certification Conduct periodic blade inspections for maintenance of blades. Please refer Table 7.3

3.4 Equator Principles

The Equator Principles comprise of a group of ten principles adopted by the Equator Principle Financial Institutions (EPFIs) in order to ensure that the projects funded by them are developed in a manner that is socially responsible and reflect sound environmental management practices. The applicability of each of the principles with respect to proposed project is discussed below:

Table 3-4 Compliance to Equator Principles

Equator Principle	Applicability	Project Information/Application
Principle 1: Review and Categorization	As the project is seeking financing from EPFIs, the project has to be categorized based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of IFC (Exhibit I)	Based on the IFC environmental and social screening criteria the proposed wind power project is identified as a “Category B” project with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and can be readily addressed through mitigation measures

Principle 2: Social and Environmental Assessment	An Environmental and Social Assessment has to be carried out for the project that addresses relevant social and environmental impacts and risks of the proposed project (illustrative list of issues as found in Exhibit II) and also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.	This report presents the Environmental and Social Impacts Assessment carried out for the project. The project has not acquired any settlement land and hence does not trigger the requirement of Resettlement and Rehabilitation.
Principle 3: Applicable Social and Environmental Standards	This Principle requires the Environment and Social Assessment to refer to the applicable IFC Performance Standards and the then applicable Industry Specific EHS Guidelines including the project's overall compliance with, or justified deviation from, the respective Performance Standards and EHS Guidelines.	The ESIA report has been prepared including the requirements of IFC performance standards and EHS guidelines.
Principle 4: Action Plan and Management System	The action plan will describe and priorities the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment	The action plan is given in Chapters 8 of this ESIA report.
Principle 5: Consultation and Disclosure	The project affected communities are required to be consulted in a structured and culturally appropriate manner.	Government land identified for all WTG's proposed for 250MW project. However, private land identification and purchase directly and indirectly undertaken through Land Aggregator IF required for access road and construction of transmission line towers. Documentation to be strengthened.
Principle 6: Grievance Mechanism	Proponent is required to establish a grievance mechanism as part of the management system	A grievance redress procedure should be implemented during construction and operation phase.
Principle 7: Independent review	An independent social or environmental expert, not directly associated with OKWPL is required to review the Assessment, action plans and consultation process documentation in order to assist EPFI's due diligence, and assess Equator Principles compliance.	ARCADIS has been appointed as third party expert to assess the environment and social impact of the project as per IFC safeguards through ESIA study.
Principle 8: Covenants	The covenants would be a part of the contract documents between OKWPL and financing agency as well as contractors and technology suppliers	E&S Covenants should be embedded within the contracts drawn between OKWPL and the contractors hired for construction activities and technology providers and waste handlers. Periodic reporting to the project developers.
	EPFIs will, for all Category A Projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower retain qualified and experienced	ARCADIS has been appointed as third-party expert to assess the environment and social impact of the project as per IFC safeguards as ESIA study. The requirements of the principle are also met by adhering to requirements of PS 1

	external experts to verify its monitoring information which would be shared with EPFIs.	
	This should be prepared by the EPFI	Based on the audit and monitoring reports submitted by independent agencies the EPFI will report the findings publicly at least once a year

3.5 Social and Environmental Performance Standards of the Asian Development Bank

Asian Development Bank (ADB) has laid down operational policies that the project developers need to comply with while establishing the project. These include: The Involuntary Resettlement Policy (1995), the Policy on Indigenous Peoples (1998), the Environment Policy (2002), Public Communication Policy, Gender Mainstreaming guidelines (2010) and ADB policies on participation guides

Table 3-5 ADB Safeguard Policies

ADB Policy	Objective	Project Details
ADB'S SAFEGUARD POLICY STATEMENT (2009)	ADB's safeguard policy framework consists of three Operational policies on the environment, Indigenous Peoples and involuntary resettlement.	
	Environmental Safeguards: To ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process.	The present ESIA study encompasses identification of environmental sensitivity and potential risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Recommendation of environment management plan and mitigation measures.
	Involuntary Resettlement Safeguards To avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups.	Land to be procured for the project is revenue land for all proposed 150 WTG's. Hence, this safeguard policy is not applicable.
	Indigenous Peoples Safeguards To design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems,	The project village does not fall under any notified Scheduled Tribal area, therefore special requirements of scheduled area is not applicable. Further, no land has been procured from ST people.

ADB Policy	Objective	Project Details
	and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them.	Since no indigenous population exist in the area, the land does not cater to any requirement of any indigenous population. Hence, impact on IPs are not anticipated.
ADB Policy on Gender and Development (GAD)	Requires Projects to consider gender issues in all aspects of ADB operations, accompanied by efforts to encourage women's participation in the decision-making process in development activities.	The project will follow ADB Policy on Gender Development. Participation of women workers will also be ensured wherever possible in the project.
ADB's Social Protection Strategy (2001)	The Social Protection Strategy requires that Projects comply with applicable labor laws, and take the following measures to comply with the core labor standards for the ADB financed portion of the Project: a) carry out its activities consistent with the intent of ensuring legally permissible equal opportunity fair treatment and non-discrimination in relation to recruitment, compensation, working conditions and terms of employment for its workers b) not restrict its workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment; c) Engage contractors and other providers of goods and services: i. who do not employ child labor or forced labor; ii. who have appropriate management systems that will allow them to operate in a manner which is consistent with the intent of points (a) and (b).	Ostro Energy has developed ESMS for all its Ostro sites which is line with ADB protection strategy but considerations in ESMS should also be made on fixing the working hours and comply to minimum wages act for the directly and indirectly hired labours.
ADB policy on Public Communication policy	ADB shall ensure that the project or program design allows for stakeholder feedback during implementation. ADB shall ensure that relevant information about major changes to project scope and likely impacts is also shared with affected people and other interested stakeholders. The borrower and/or client shall provide relevant environmental, resettlement, and indigenous people's information,	Reportedly, the project team held meeting with Village Sarpanch and other people to disclose the project. To receive the comments of villagers and other stakeholder, arrangement will be made under grievance redressal mechanism. This mechanism will not only facilitate receiving of stakeholder's

ADB Policy	Objective	Project Details
	including information from the documents referred such as EIA, IEE etc to affected people in a timely manner, in an accessible place, and in a form and language(s) understandable to them.	concern but also help to address the comment in time bound manner.
ADB policies on 2010 on Gender mainstreaming guidelines	ADB's Policy on Gender and Development will adopt mainstreaming as a key strategy in promoting gender equity. Gender considerations shall be mainstreamed into all ADB activities, including macroeconomic and sec-tor work, and lending and technical assistance (TA) operations. The key elements of ADB's policy will include gender sensitivity, gender analysis, gender planning, mainstreaming, and agenda setting. Focus on Developing member countries	Not Applicable.
ADB policies on participation guides	Participation in ADB-assisted operations refers to the processes through which stakeholders' influence or contribute to designing, implementing, and monitoring a development activity. Participation, rather than merely a goal in itself, helps achieve improved development results. By ensuring stakeholders understand and can participate in the decisions, resource allocations, and activities that affect their lives, it ensures attainment of the benefits from this engagement.	Stakeholder participation in this project has been ensured through stakeholder discussion and project disclosure.

3.5 Categorization of Projects

ADB CATEGORIZATION

Asian Development Bank (ADB) uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential impacts.

ENVIRONMENT: Proposed projects are screened according to type, location, scale, and sensitivity and the magnitude of their potential environmental impacts, including direct, indirect, induced, and cumulative impacts. Projects are assigned to one of the following four categories:
Category A: A proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required.

Category B: The proposed project's potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE), including an EMP, is required.

Category C: A proposed project is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.

Category FI: A proposed project involves the investment of ADB funds to or through a financial intermediary. The financial intermediary must apply and maintain an environmental and social management system, unless all of the financial intermediary's business activities have minimal or no environmental impacts or risks.

Project Categorization: As per assessment, it is found that the impacts arising out of the project are minimal and limited. Impacts identified during both construction and operation phase include dust emissions during vehicular movement, noise from WTGs, water abstraction during construction phase and impact on avifauna collision risk. These impacts can be minimized and reversed if timely and adequate mitigation measures are undertaken. Water sprinkling should be undertaken for dust suppression. Effective noise control systems should be integrated with the WTG designing as well as integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated. Hazardous waste to be stored at designated places in enclosed containers. Considering the impact to be site specific, which can be readily corrected through adoption of suitable mitigation measures, the project is categorized as **Category B** project.

INVOLUNTARY RESETTLEMENT: The involuntary resettlement impacts of an ADB-supported project are considered significant if 200 or more persons will be physically displaced from home or lose 10% or more of their productive or income-generating assets. For those involving involuntary resettlement, a resettlement plan is prepared that is commensurate with the extent and degree of the impacts: the scope of physical and economic displacement and the vulnerability of the affected persons. Projects are classified into the following four categories:

Category A: A proposed project is likely to have significant involuntary resettlement impacts. A resettlement plan, which includes assessment of social impacts, is required.

Category B: A proposed project includes involuntary resettlement impacts that are not deemed significant. A resettlement plan, which includes assessment of social impacts, is required.

Category C: A proposed project has no involuntary resettlement impacts. No further action is required.

Category FI: A proposed project involves the investment of ADB funds to or through a financial intermediary. The financial intermediary must apply and maintain an environmental and social management system, unless all of the financial intermediary's business activities are unlikely to generate involuntary impacts.

Project Categorization: The project involves only revenue land for all proposed WTGs. The government land to be transferred for the project is open scrubland and is without habitation. This was confirmed based on site observations and consultations. The project hence does not involve any involuntary resettlement, hence the project is categorized as **Category C.**

INDIGENOUS PEOPLES: The impacts of an ADB-supported project on indigenous peoples is determined by assessing the magnitude of impact in terms of

- customary rights of use and access to land and natural resources;
- socioeconomic status;
- cultural and communal integrity;
- health, education, livelihood, and social security status; and
- the recognition of indigenous knowledge; and the level of vulnerability of the affected Indigenous Peoples community.

Projects are classified into the following four categories:

Category A: A proposed project is likely to have significant impacts on indigenous peoples. An indigenous people plan (IPP), including assessment of social impacts, is required.

Category B: A proposed project is likely to have limited impacts on indigenous peoples. An IPP, including assessment of social impacts, is required.

Category C: A proposed project is not expected to have impacts on indigenous peoples. No further action is required.

Category FI: A proposed project involves the investment of ADB funds to or through a financial intermediary. The financial intermediary must apply and maintain an environmental and social management system, unless all of the financial intermediary's business activities unlikely to have impacts on indigenous peoples.

Project Categorization: The project does not involve any uptake of any land from indigenous people. The study area located in Kutch district does not fall in any notified tribal area of Gujarat. The project is categorized as **Category C** project.

IFC CATEGORIZATION

As part of its review of a project's expected social and environmental impacts, IFC uses a system of social and environmental categorisation. This categorisation 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 categories used by the IFC are:

- **Category A Projects**: Projects with potential significant adverse social or environmental risks or/and impacts that are diverse, irreversible or unprecedented;
- **Category B Projects:** Projects with potential limited adverse social or environmental risks or/and 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 risks or/and 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 categorises the project primarily according to the significance and nature of its 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.

The current project can be categorised as Category B projects based on limited environmental and social impacts envisaged.

4.0 DESCRIPTION OF ENVIRONMENT

This chapter describes the existing environmental settings of the project site and its immediate surroundings. This includes physical environment comprising air, water and land components, biological environment and socio-economic environment. Attributes of the physical environment like air, water, soil and noise quality in all blocks and surrounding area were assessed primarily through monitoring and analysis of samples collected from the area. Primary monitoring was conducted by ARIHANT Laboratory (a NABL certified laboratory). Primary monitoring was conducted in May, 2017 for ambient air, ambient noise, surface water and ground water.

Secondary information on geology, hydrology, prevailing natural hazards like floods, earthquakes etc. have been collected from literature reviews and authenticated information made available by government departments. Primary surveys were carried out to understand and record the biological environment prevailing in the area and the same was verified by the forest officials and against published information and literature. The socioeconomic environment has been studied through consultations with various stakeholders within the site. Additionally, socioeconomic data have been obtained from the Census 2011 of India reports.

4.1 Study Area

The project site is falling in Bhuj tehsil. While selecting locations for primary monitoring of air, noise, water, and soil and meteorology emphasis is given to collect the representative baseline data. Monitoring stations for air and noise were selected in proximity to the WTG locations as well as approach roads and settlements. Monitoring locations for surface water quality was selected based on the macro and micro watershed and drainage pattern of the area. Soil sample collection locations were selected based on the land use & land cover of the study area.

To understand and assess the environmental and social risks associated with the project the study area was divided into core area (500 m around the WTG location) and buffer area (15 km around the WTG location).

4.2 Baseline Conditions

4.2.1 Climate and Meteorological Conditions

Bhuj is quite hot during the summer months. The minimum temperature is about 22°C and the maximum temperature is 40°C or more. The monsoon in Bhuj starts in June and continues up to September. During July and August, the city gets the maximum rainfall and then the intensity of the rainfall decreases. Cyclones are common in Bhuj during the monsoon season. Winter months in Bhuj are from November to February. The temperature ranges between 24°C to 28°C. Summers in Bhuj are very scorching and winters are pleasant. Bhuj has dry climate as it is very close to the desert area. The relative humidity in Kachchh as per IMD varies between 43.5% during March and 77% during August.

Temperature:

Temperatures vary considerably from season to season. The summers are generally hot and winters are cool. Mean maximum temperature ranges between 26.7°C during January to about 39.5°C during May and the mean minimum temperatures vary between 9°C during January and 27°C during June[13].

Rainfall:

Long-term average annual rainfall for Bhuj IMD station is 378.2 mm. Most of the rainfall (about 345 mm) is received during south-west monsoon between June and September. The climatological data for IMD station Bhuj is given in following table in **Table 4.1**

[13] Groundwater information booklet, Kachchh district, 2013 CGWB

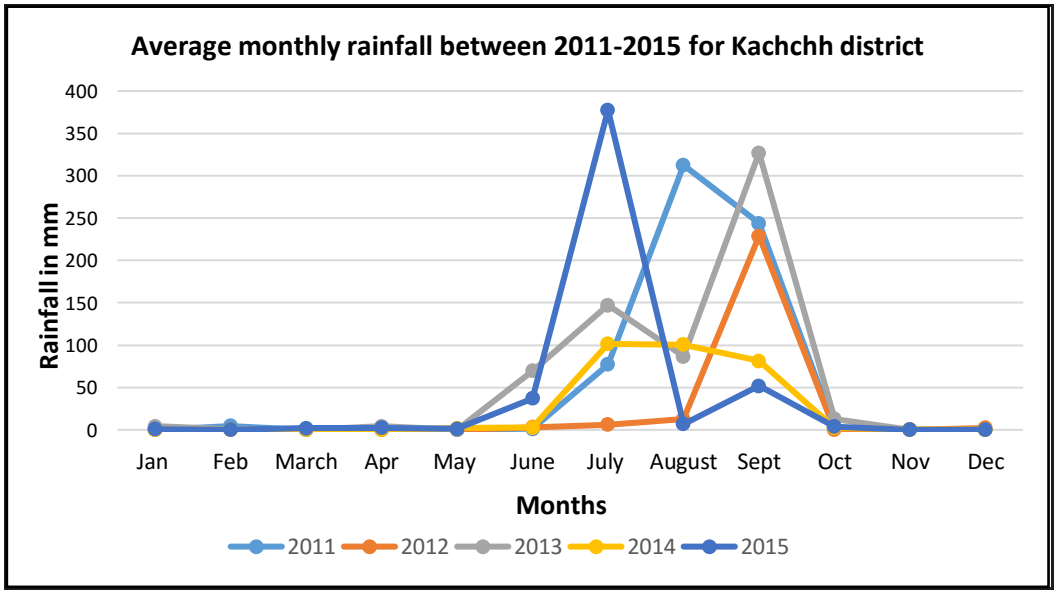
Table 4-1 Climatological table of Bhuj

MONTH	MAX TEMP (DEG. C)	MINI TEMP (DEG.C)	HUMIDITY (%)	WIND SPD. KMPD	SUNSHINE (HOURS)	SOLAR RAD. (MJ/M2/D)	ETO (MM/D)	RAINFALL (MM)
January	26.7	9.0	47.0	138.2	8.9	16.7	3.6	2.0
February	29.8	12.0	45.5	149.0	9.5	19.5	4.5	1.1
March	34.9	17.6	43.5	177.7	10.1	22.8	6.2	2.9
April	38.7	22.1	44.5	217.2	10.8	25.6	7.9	0.7
May	39.5	25.2	53.5	330.3	11.4	27.1	9.2	1.7
June	37.1	27.0	65.0	375.2	8.7	23.1	7.7	33.9
July	33.6	26.2	75.0	346.5	5.3	17.9	5.4	136.3
August	32.5	25.2	77.0	307.0	5.4	17.6	4.9	120.7
September	33.7	23.8	70.5	229.8	7.9	20.2	5.4	54.2
October	35.9	20.6	52.5	141.8	9.6	20.4	5.3	15.4
November	32.4	15.5	48.0	123.9	9.3	17.6	4.1	7.7
December	28.1	10.5	49.0	131.0	8.9	15.9	3.4	1.6
Total	-	-	-	-	-	-	-	378.2
Average	33.6	19.6	55.9	222.3	8.8	20.4	5.6	-

Source: CGWB, 2013

The rainfall distribution of Kuchch district for the five-year period (2011-2015) has been presented in **Figure 4.1** below.

Figure 4-1 Rainfall Distribution of the district

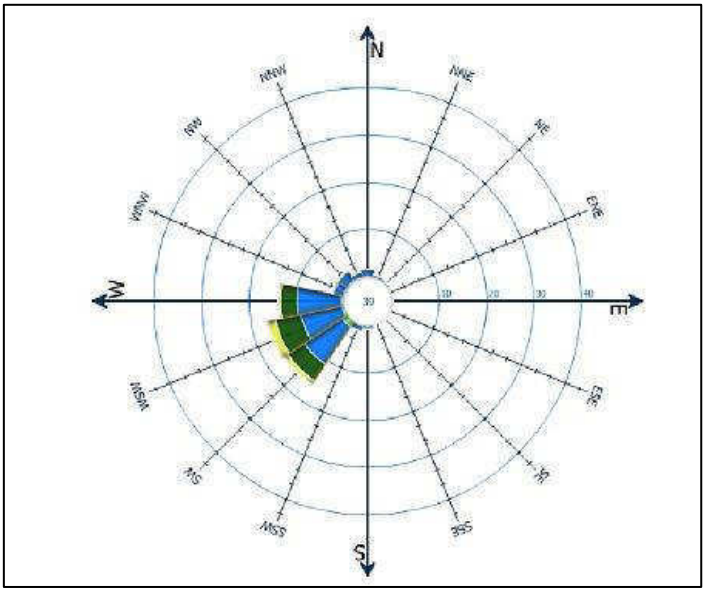


Wind speed:

The wind velocity in the district varies from about 124 km/d during November and 375 km/d during June[14]. The potential evapotranspiration, calculated using Penman"s Method varies between 3.4 mm/d during December and 9.2 mm/d during May. As per the Atlas of wind rose for the period of 1971 – 2000 published by IMD, Pune, the annual wind rose prepared shows pre-dominant wind direction from west south west direction. The annual wind rose is presented in **Figure 4.2**

[14] Groundwater information booklet, Kachchh district, 2013 CGWB

Figure 4-2 Annual wind rose for Bhuj (IMD Pune 1971-2000)



4.2.2 Topography

The landscape is largely undulating with some parts with flat terrain. The elevation range of the study area lies between 400 and 850 feet. Some of the site pictures are shown in **Photo 4.1.**

Photo 4-1: Topography of the project site

Considering the vast spread of the proposed WTG farm across 55km, map preparation was undertaken by preparing a grid of the site area and taking a reference point on the eastern and western part to present a map with 15km radius so as to cover the entire site area of 150 WTG's. The Digital elevation map for the eastern and western side of the project site is shown below in **Figure 4.3 and Figure 4.4.** The elevation difference in the project site is between 4 – 430m above sea level.

Figure 4-3 Digital elevation map of the project area (East side)

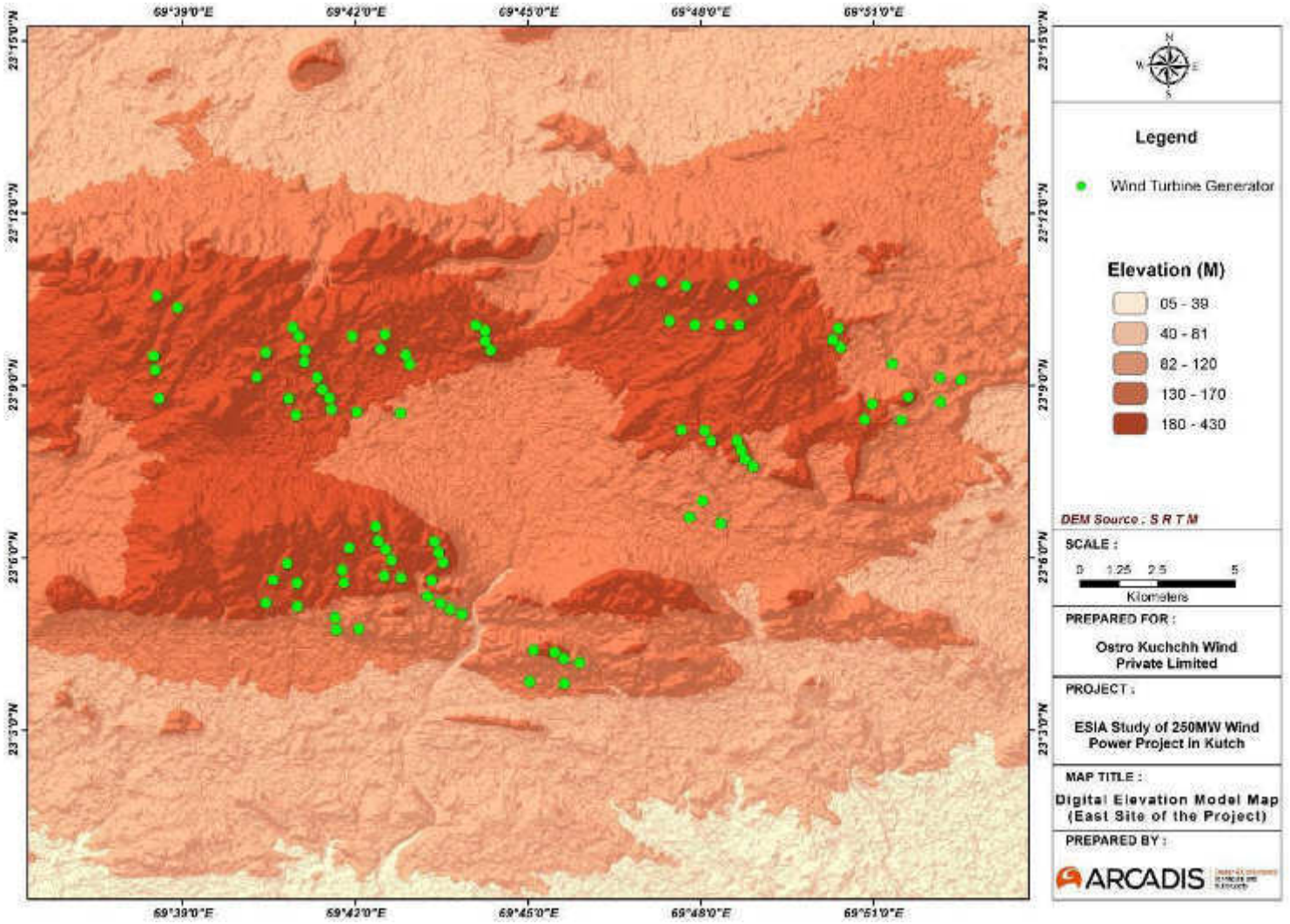
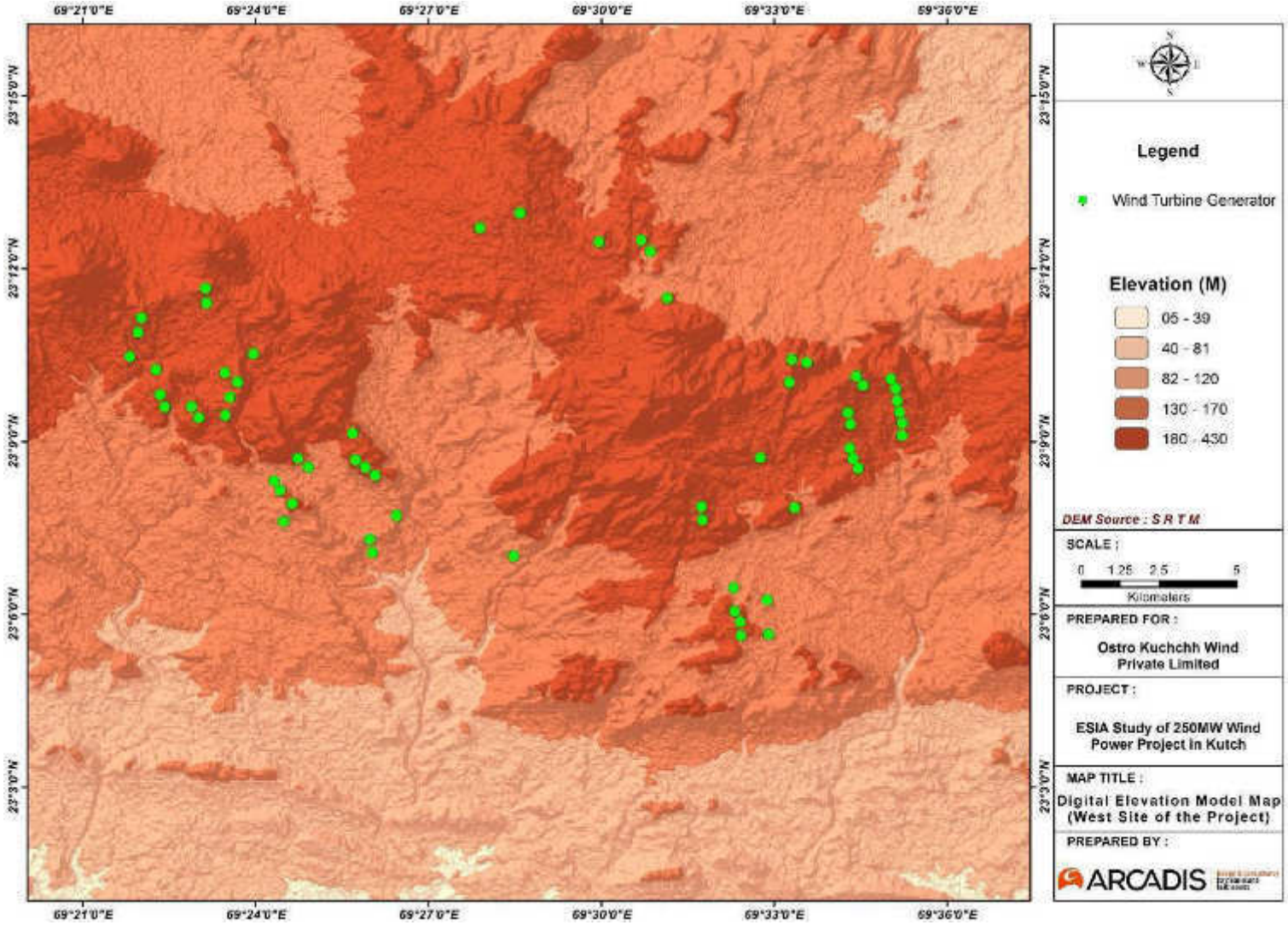


Figure 4-4 Digital elevation map of the project area (West side)



4.3 Landuse Analysis

The land-use and land-cover of the study area (15kms) has been interpreted from visual interpretation, survey maps of the area, and subsequently by ground checking during field surveys. Considering the vast spread of the proposed WTG farm across 55km, map preparation was undertaken by preparing a grid of the site area and taking a reference point on the eastern and western part to present a map with 15km radius so as to cover the entire site area of 150 WTG's. The aim is to provide a clear view of the land use of the entire site area in two maps.

Land use of the proposed project site (east) is mainly a mix of agricultural land and rocky terrain. Land use map showing a radius of 15 km of the project site is provided in **Fig 4.5 and Figure 4.6** The land use at the project site comprises mostly of agricultural land (40.61%) followed by rocky terrain (40.18%). Other land use in the project study area is characterized by i) open scrub (5.25%) ii) Reserve Forest land (8%) iii) Cultural Place (0.01%) iv) Settlement (4.48 %) v) Water Body (0.91%) and vi) Industry (0.12%).

The land use at the project site (west) comprises mostly of agricultural land (36.85%) followed by rocky terrain (40.49%). Other land use in the project study area is characterized by i) open scrub (2.56%) ii) Reserve Forest area (5.30%) iii) Settlement (3.35 %) iv) Water body (3.11%) v) Settlement (3.35%) . Land use map showing a radius of 15 km of the project site is presented in two maps to get a clear understanding on the land use status of the vast project area spread across 55km from west to east.

Figure 4-5 Land use map of the project area (East side)

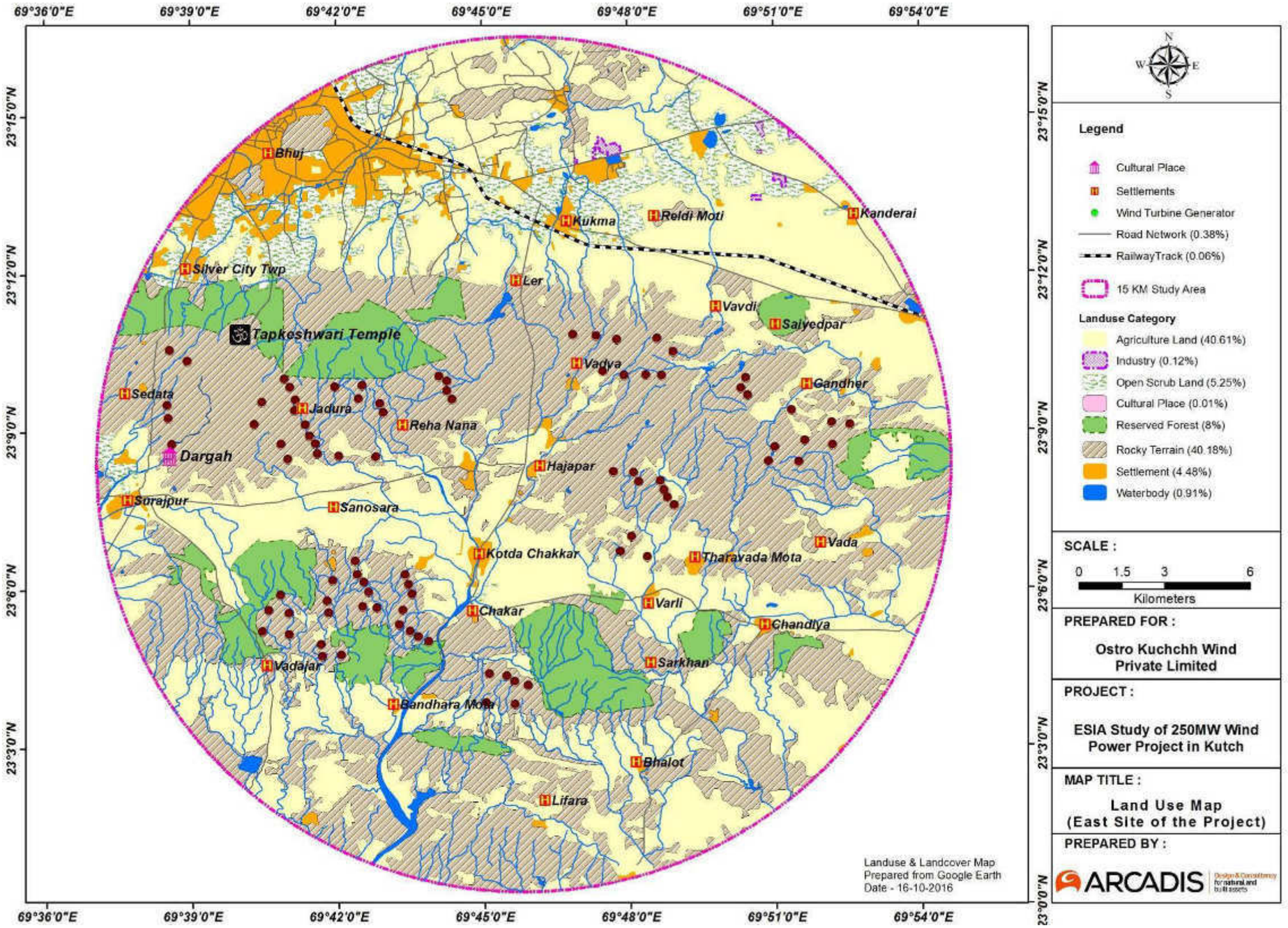
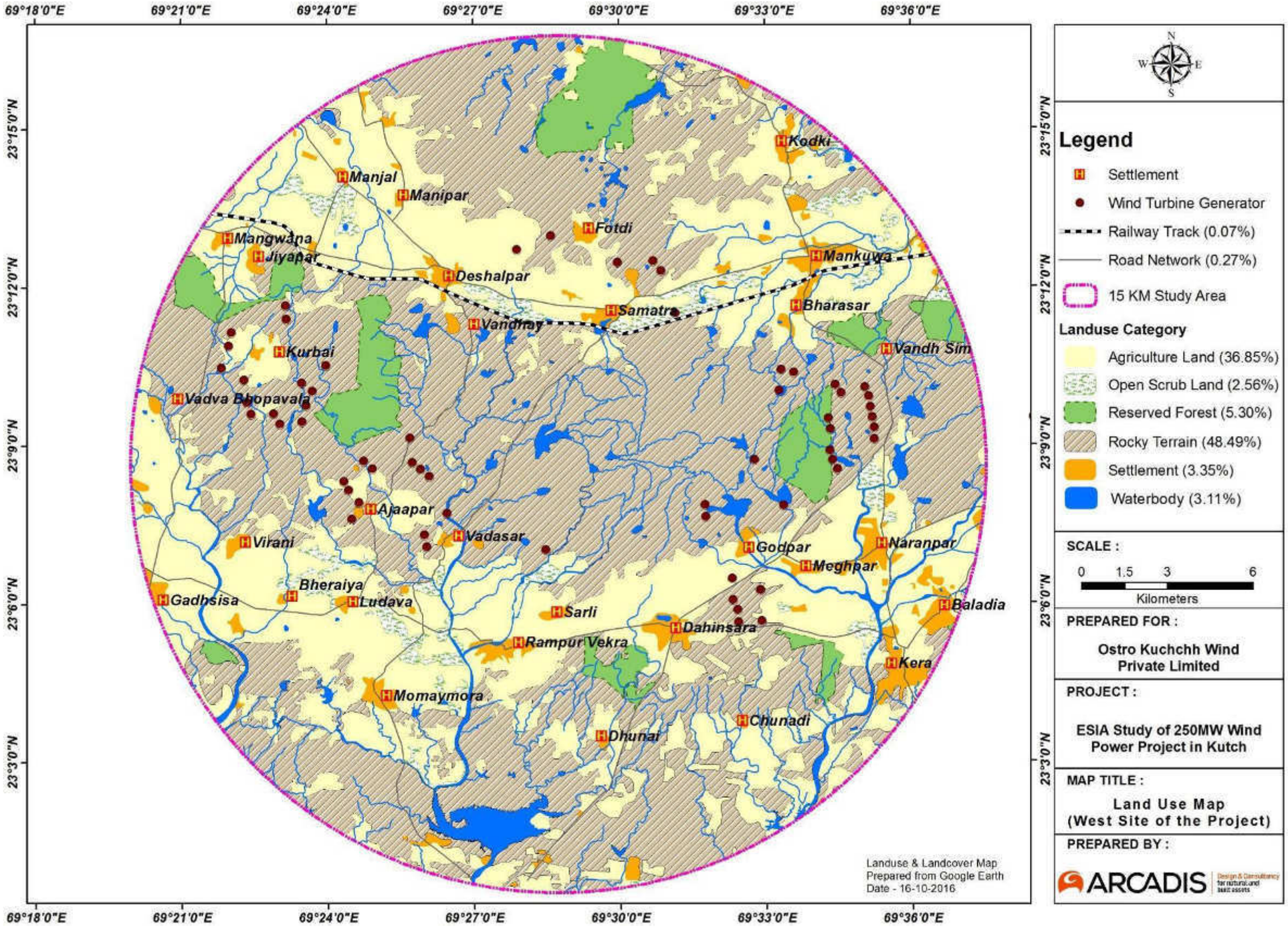


Figure 4-6 Land use map of the project area (West side)



4.4 Soil

The soils found in Kachchh district can broadly be grouped into four types, i.e., Shallow Black soils, Residual Sandy soils, Coastal Alluvial soils and Desert soils. The Shallow black soils are found in central and north-central parts of the Kachchh mainland and in Khadir and Bela Islands. The depth of soil ranges from a few cm to 30 cm. Broadly, these soils are poor in fertility.

Soil found in the region are reddish brown in colour with fine weak granular structure to poorly developed one. These soils are sandy to loamy sand in texture dominated by coarse sand. These are non-calcareous, neutral to alkaline in reaction with poor base saturation. They are affected due to salt accumulation. From fertility point of view, they are poorly supplied with plant nutrients and, as such, support the crops with short duration and less water requirement.

4.5 Drainage

Study area is interspersed with many perennial and seasonal water bodies. Major water bodies recorded from the study area are Vijay Sagar Dam, located about 8.4 km south east from the nearest WTG no. BHE-08; Ludva dam and Khengar sagar dam located about 4.5km south west of BHO 111. The study area is drained by a number of water channels originating from Rukmawati river, Rudrani river and Viraniwala river on the west side of the project area. The east side of the project side is drained by Bhukhi Nadi or Ganga river originating from Khenga sagar dam. However, during site observations, all these water channels were found dry.

However, there are some large water bodies which serve as habitat for avian faunal species viz. Jamora pond and Kurbai pond. A number of avifauna was sighted at these water bodies.

The major field crops grown in the district are Bajra, Greengram, Castor, Groundnut, Cotton, Wheat and Mothbean, except wheat all other crops are grown in kharif and are rainfed. SardarSarovar project envisages supply of after for drinking, irrigation and industrial use in Kachchh district.

Considering the vast spread of the proposed WTG farm across 55km, map preparation was undertaken by preparing a grid of the site area and taking a reference point on the eastern and western part to present a map with 15km radius so as to cover the entire site area of 150 WTG's. The aim is to provide a clear view of the drainage of the entire site area in two maps.

The drainage map of the project sites for 15 km surrounding is presented in **Fig 4.7 and Fig 4.8** showing the east and west side of the project region to cover the entire vast project area spread across 55-60km from west to east direction. .

Figure 4-7: Drainage map of the Study Area (East side)

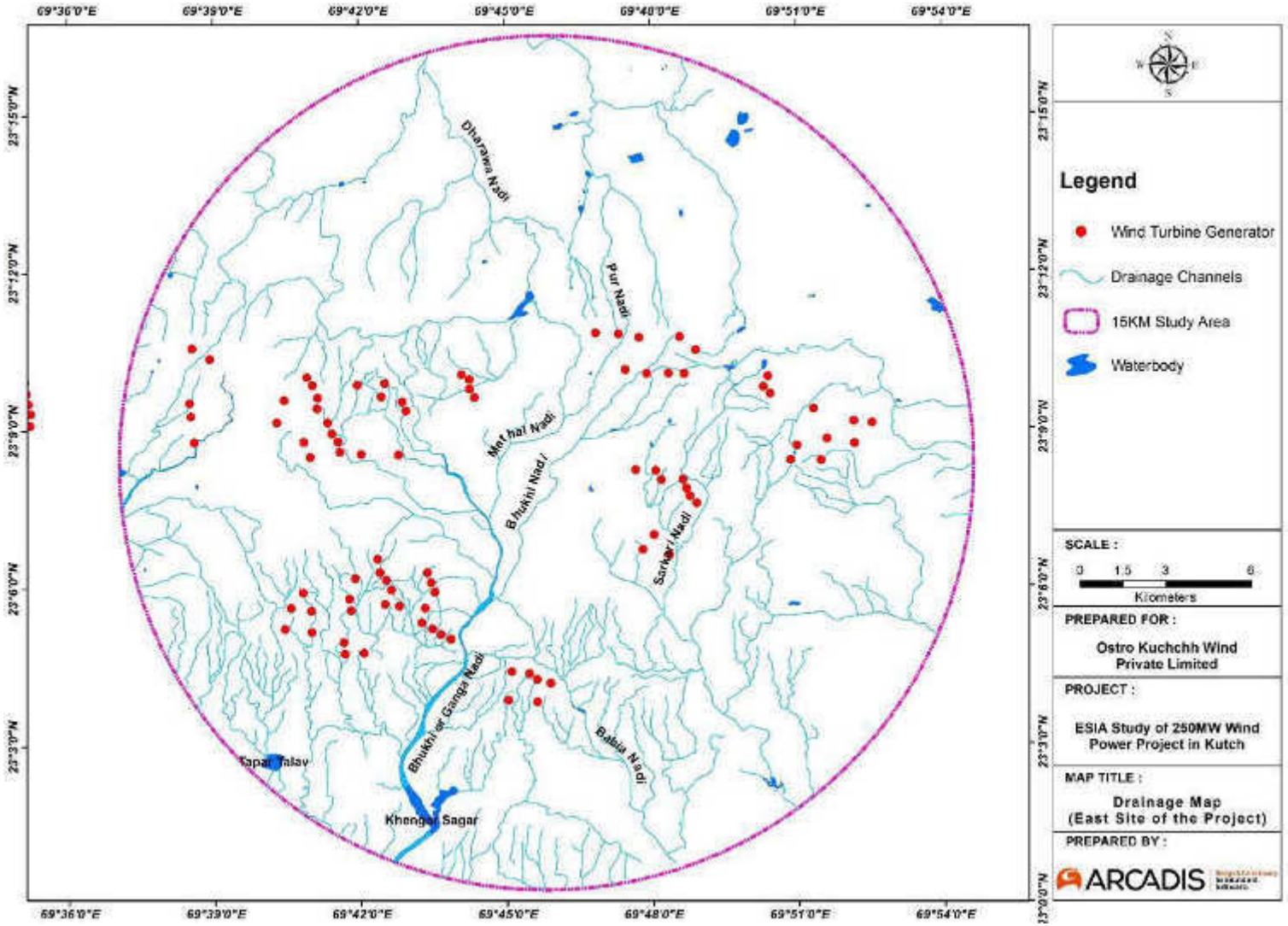
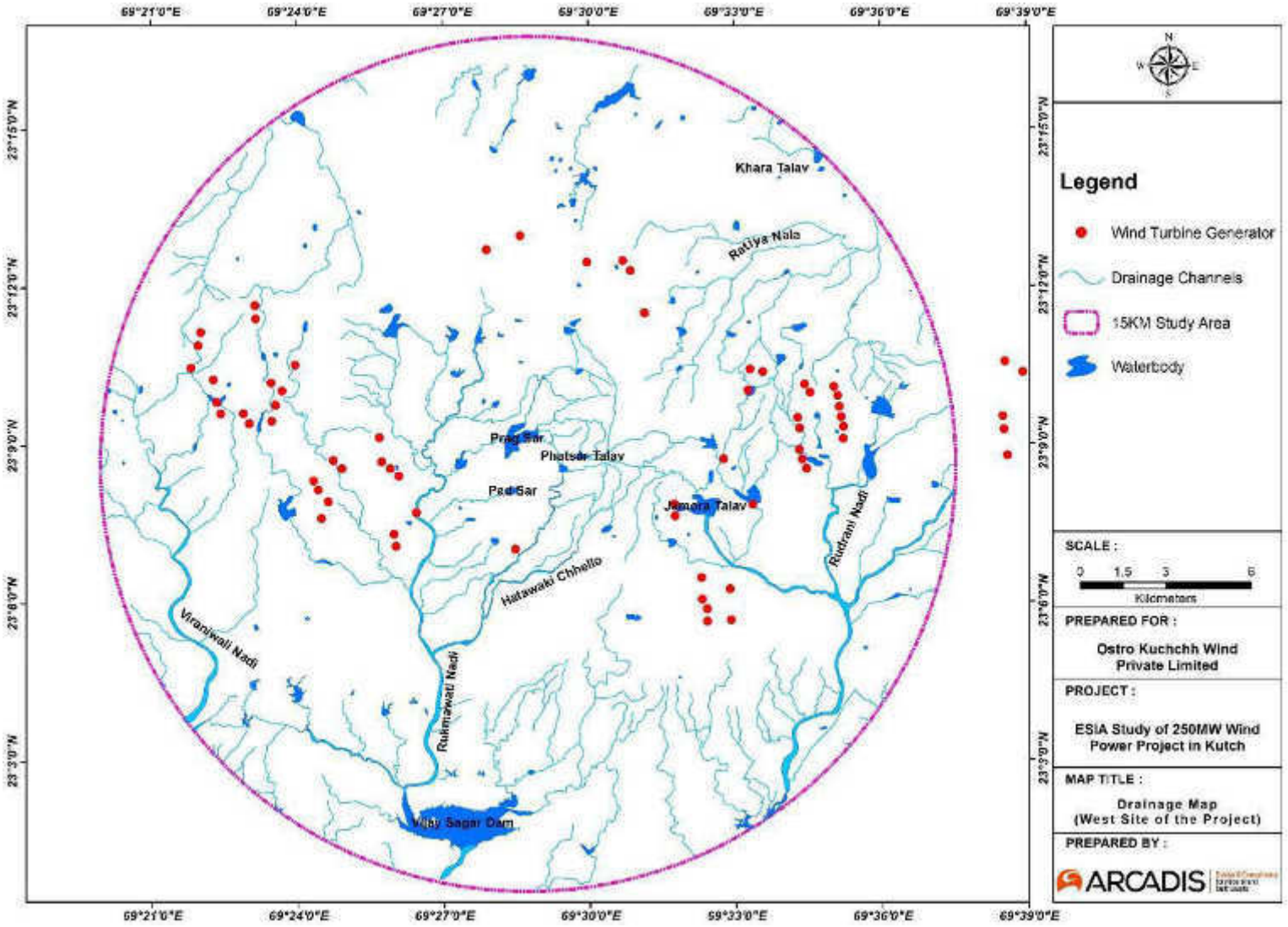


Figure 4-8: Drainage map of the Study Area (West side)



4.6 Hydrogeology

As per CGWB report 2013, major geological formation is of Mesozoic formation, Deccan Trap, Tertiary and Quaternary in the region. The aquifer system of the region is of both unconfined, semi to confined system.

The formations are grouped into the Bhuj (Umia) series, which forms the most prolific aquifer system in the district. This aquifer is extensively developed in central part of the Kutch district in a belt extends from Gadhuli-Dayapar-Lakhpat area in the west to Bhachau in the east. Lithologically the Bhuj Sandstone comprises of fine to coarse grained sandstone interbedded with siltstone and shale. The sandstone, which mainly forms the aquifer is soft, friable and highly porous/permeable.

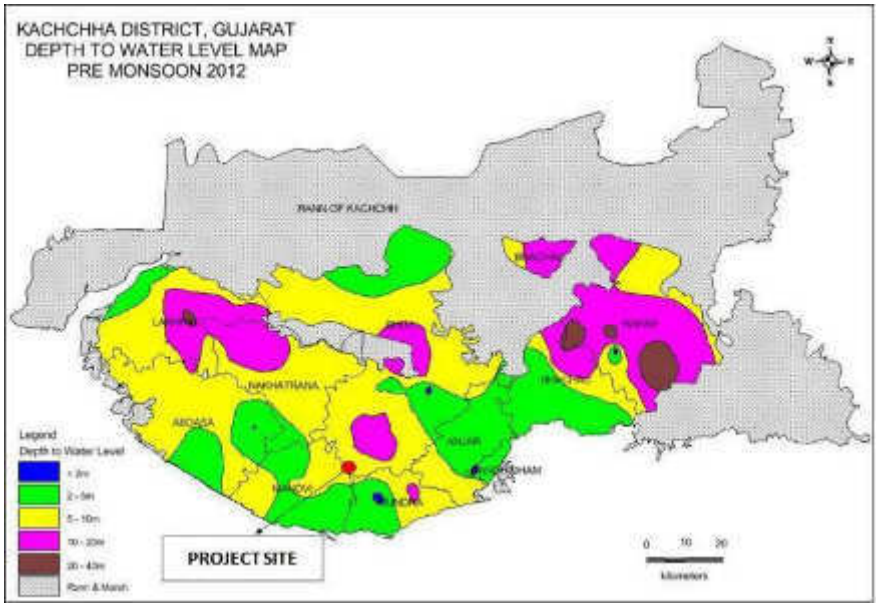
4.6.1 Ground Water Resources

Overall ground water development of the district is 79.34% and the district is categorized as semi-critical as per the groundwater development perspective. The net ground water availability of Kutch district is 796.20 mcm. The groundwater annual draft is 631.69mcm. The ground water development varies from as low as 24.40% in Lakhpat taluka to 107.98% in Bhachau taluka. The Bhuj taluka in which the project site is located is categorized as critical.

Name of Taluka	Annual Ground water Recharge in mcm / year	Existing Annual Ground Water Draft for all uses in mcm / year	Stage of Ground Water Development (%)	Category
Bhuj	191.67	171.93	94.42	Critical

Depth to water level map of pre-monsoon and post monsoon period and annual fluctuation of water level are prepared with data of NHS for year 2012. The water level map of the district of pre-monsoon 2012 (May) is as follows.

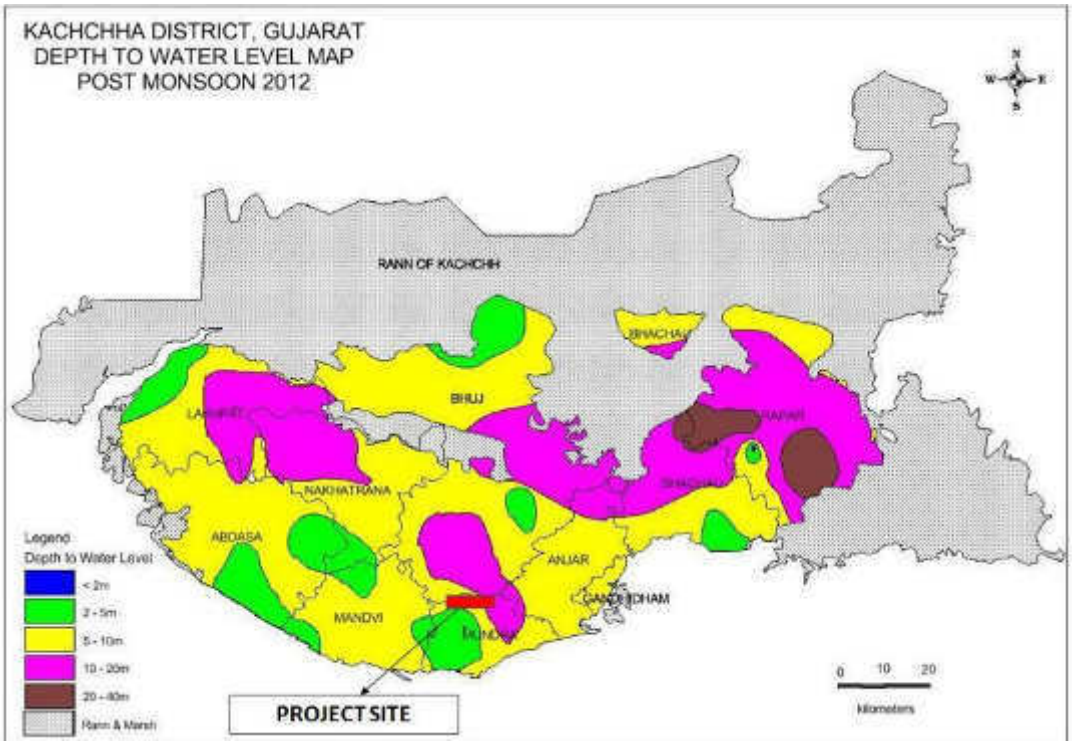
Figure 4-9: Pre- Monsoon Depth to Water Level Map for The Project Area



Source: Groundwater information booklet, CGWB, Kutch district, 2013

Depth to Water Level : As per CGWB, the depth to water level in general varies from 5 mbgl to 10mbgl in the area during the pre-monsoon period (May 2012) (Figure 4.6) and from 5 mbgl to 20mbgl during the post-monsoon period (Nov 2012) as shown in **Figure 4.10**

Figure 4-10 Post- Monsoon Depth to Water Level Map For The Project Area.



Source: Groundwater scenario of Kutch district, CGWB, 2013

4.6.2 Groundwater Quality

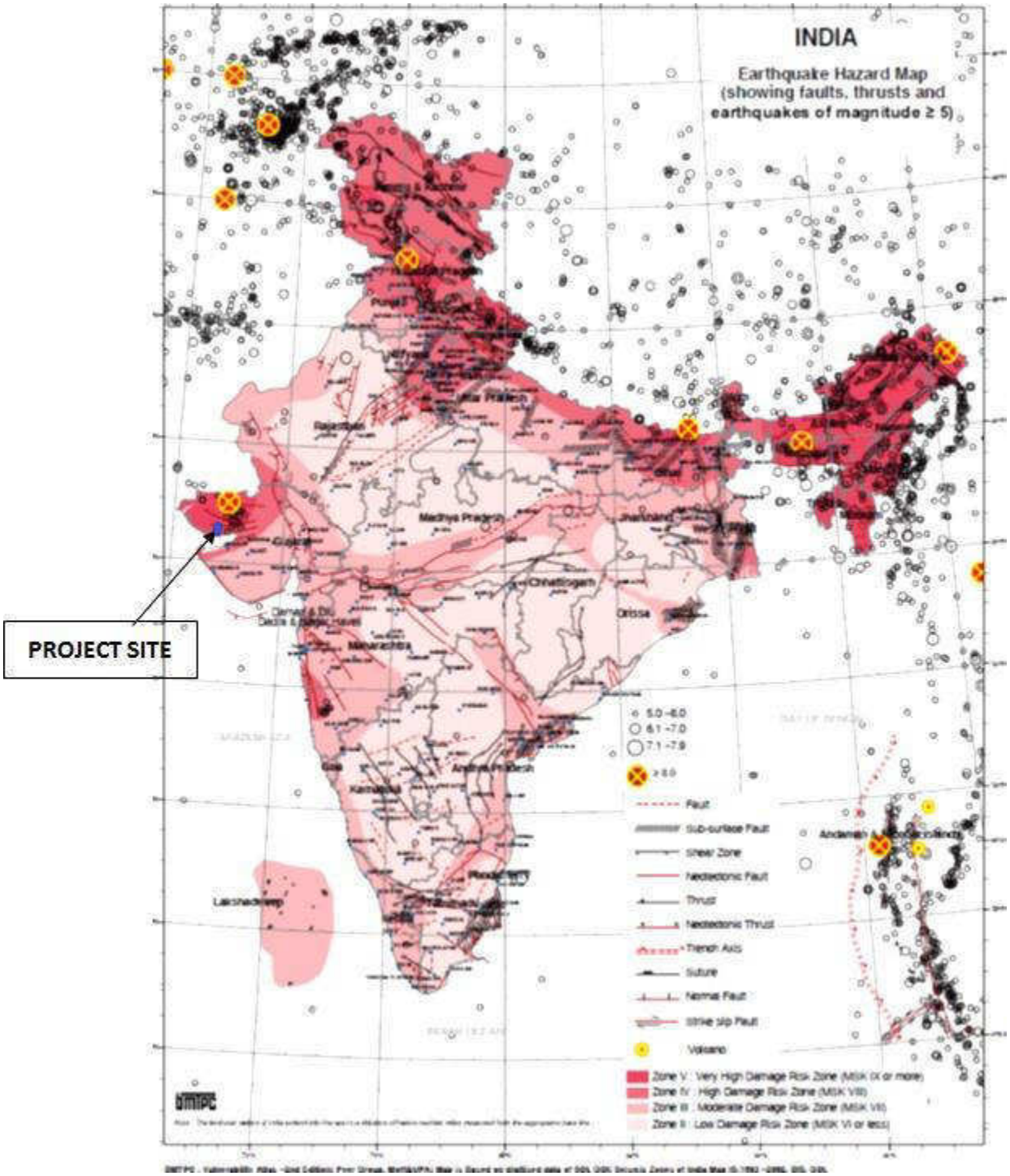
The quality of ground water in the district in general is highly variable and has complex character. In general, the areas underlain by marine sedimentary formations (Both Mesozoic and Tertiary), low lying areas in coastal parts and the Rann are characterized by inferior quality of groundwater. About 60% of the district contain native saline water. The ground water is generally good (EC < 2000 µS) in the area underlain by Bhuj series.

The most common problem is inherent Salinity of geological formations depositing under marine conditions. Water logging in Rann area etc are the other problems in Kachchh district. Frequent drought is another major problem. Kachchh district receives minimum rainfall in entire Gujarat because of erratic rainfall and exploitation the ground water level is declining. The continuous fall in water table has resulted into several problems like increasing salinity, problem of fluorides, reduction in bore yields and high failure rate of bores.

4.7 Seismic hazard

The proposed project is situated in ***Zone V Very high damage risk*** zone of getting affected due to earth quakes as per the Seismic Zones of India Map IS 1893 – 2002, BIS. As such the materials for construction of the wind power plant should have earthquake resistant properties to withstand and resist damage due to earthquakes which may lead to financial losses due to damage to the plant.

Figure 4-11 Seismic map



4.8 Environmental Monitoring

The existing baseline conditions serves as an index for assessing the pollution load and the assimilative capacity of any region and forms an important tool for planning project activities in the area. A detailed assessment of the existing environment was undertaken for the purpose mentioned above.

4.8.1 Ambient Air Quality

Ambient air monitoring was carried out at four locations for 24 hours (4-hourly sampling for gaseous pollutants (CO) and 8-hourly sampling for particulate matter) with a frequency of twice per week. The monitoring was conducted for one week during the period of May 2017. Monitoring stations were chosen on the basis of their proximity to settlements, topography and predominant wind direction.

The purpose of selecting the three monitoring locations was primarily to understand the baseline condition of the entire site area. Since the site has no industrial activity taking place so the only source of air pollution in the study area is the vehicular movement. In addition to this considering the fact that this is a "White" category industry and hence would not lead to any major air emissions or waste generation during the construction as well as operation phase. Hence, in selecting the locations, proper consideration was taken to cover the high traffic density areas as well as the sensitive receptors (settlements).The predominant wind direction is from south west to north east. The details of the monitoring locations are given below in **Table 4.2**

Table 4-2 Ambient Air Monitoring Locations

Station Code	Villages	Wind direction
AQ1	Ajaapar village	SW
AQ2	Ler village	NE
AQ3	Gandher village	E

Concentrations of all the ambient air quality parameters (PM_{10}, $PM_{2.5}$, SO_2, NOx and CO) at all four monitoring stations were observed to be well below the NAAQS. Overall the air quality of the project area is considered as good. The average Particulate matter (PM_{10}) monitored for the project site at three locations viz. Ajaapar village, Ler village and Gandher village was found in the range of 57.98 to 63.51 µg/m^3 i.e. well below the CPCB permissible limit of 100µg/m^3. Concentration of Particulate Matter ($PM_{2.5}$) monitored was in the range of 26.30 to 31.75 µg/m^3 i.e. below the CPCB permissible limit of 60 µg/m^3. Sulphur dioxide and Nitrogen Oxide too were recorded well below the CPCB permissible limit of 80µg/m^3. Carbon monoxide too was reported well below the permissible limit of 2mg/m^3. The results have been shown in **Appendix K**

4.8.2 Ambient Noise Quality

As per IFC EHS guidelines issued for wind sector to assess the background noise, it is understood that if noise criteria based on ambient noise are to be used, it is necessary to measure the background noise in the absence of any wind turbines. This should be done at one or more noise-sensitive receptors. The critical receptors identified are the once closest to the proposed location of the wind energy facility. However, in cases, when the nearest receptor is also close to other significant noise sources, alternative receptor has also been identified chosen.

The ambient noise monitoring was conducted at four locations viz. Jadura village, Ajaapar village, and Kurbai village. As per the site survey assessment some villages or single houses were observed in proximity to WTG's, such locations were considered for noise monitoring. In addition to this, a number of state highways (SH-42, SH-46, SH-47 and SH-48) pass within the site area, where vehicular traffic movement

occurs throughout the day, these have also been identified as the major noise generating source in the project site, as there are no other big industries. Road junction points connecting villages with State Highways as well as the was also considered as locations for monitoring. Hence, the noise monitoring network was established based on the understanding of the proposed project activities and professional judgment. Sound pressure level (SPL) measurements in dB (A) were recorded for every hour continuously for 24 hours for the aforesaid monitoring station and equivalent noise levels in the form of Leq day and Leq night were computed. The ambient noise was monitored at the selected locations over a series of 10-minute intervals.

Inference:

The average day time noise level ranges from 51.7 – 53.9 dB (A) and average night time noise level ranges between 40.8 – 42.5 dB (A). It is found that day time and night time noise levels are well within CPCB limits specified for Residential area as per **Noise Pollution (Regulation and Control) Rules, 2000.** The noise monitoring results have been shown in **Table 4.3**

Table 4-3 Noise level monitoring in the study area

Location Code	Location	Area Category	Daytime (L_{dn}) dB (A)		Night times (L_n) dB (A)	
			Results	Limits	Results	Limits
N1	Ajaapar village	Residential	51.7	**55**	40.8	**45**
N2	Jadura village near wind turbine no. BHO 154	Residential	53.6	**55**	42.5	**45**
N3	Kurbai village near Wind turbine number KUT49	Residential	53.9	**55**	42.1	**45**

4.8.3 Surface Water Quality

Two monitoring locations were selected to understand the surface water quality of the study area. The criterion for sampling location selection was distance from anthropogenic sources and use of the surface water body. The details of the locations have been given below in **Table 4.4** The physiochemical results of surface water is provided in **Appendix L**

Table 4-4 Surface Water Monitoring Location Details

Station Code	Sampling Location	Current Use
SW-1	Jamura pond (talab)	Washing/Bathing
SW-2	Ler village pond	Washing/Bathing

Two surface water locations were monitored for their physiochemical and bacteriological characteristics. The pH was observed in the range of 6.66 to 7.96. The surface water samples taken from Jamura pond and Ler village pond have Dissolved Oxygen (DO) levels as 5.2 and 4.8 mg/l respectively and Biological Oxygen demand (B.O.D) levels viz. 14.5 mg/l and 16 mg/l respectively. Concentration of Fluoride was found to be 1.34 and 1.42mg/l respectively. Moreover, the bacteriological examination of the surface water sample of Jamura pond show Total Coliform 170 MPN/100ml and 140 MPN/100ml was analyzed in Ler village pond.

Sample collected from these two surface water bodies complies to **Class D (Propagation of Wild life and Fisheries)** as per CPCB standard mentioned for best use classification of surface water. The pond water is not fit for drinking and is only used for washing.

4.8.4 Ground Water

Results of physical & chemical analysis of ground water samples from two locations were studied to have an idea of the quality of ground water in the study area. Sampling stations are presented in the **Table 4.5** given below:

Table 4-5 Ground water monitoring location details

Station Code	Sampling Location	Source	Current Use
GW-1	Naranpar village	Handpump	Drinking
GW-2	Jadura village	Handpump	Drinking

The criterion for sampling location selection was based on the distance from anthropogenic sources that can interfere with the monitoring results and present use of ground water sources. Results of physical and chemical analysis of the samples are presented in **Appendix M**. Physio-chemical analysis of groundwater samples show pH i.e.7.53 to 7.87 in both locations respectively. Both groundwater samples collected from Naranpar village and Jadura village showed Total Dissolved Solids (TDS) (335 mg/l and 415 mg/l respectively) i.e. below the BIS 10500 2012 acceptable limit of 500mg/l an also within the permissible limit of 2000 mg/l. Total Hardness concentration in Naranpar village & Jadura village (178.0 mg/l & 218 mg/l respectively) was found below the permissible limit of BIS 10500: 2012 of 600mg/l. Fluoride concentration in Naranpar village and Jadura village was found to be 0.03mg/l and 0.04mg/l i.e. below the BIS acceptable limit. **Figure 4.12** and **4.13** shows the monitoring locations for ambient air, surface water , noise level and groundwater quality monitoring conducted.

Figure 4-12 Monitoring location map (Project East Side)

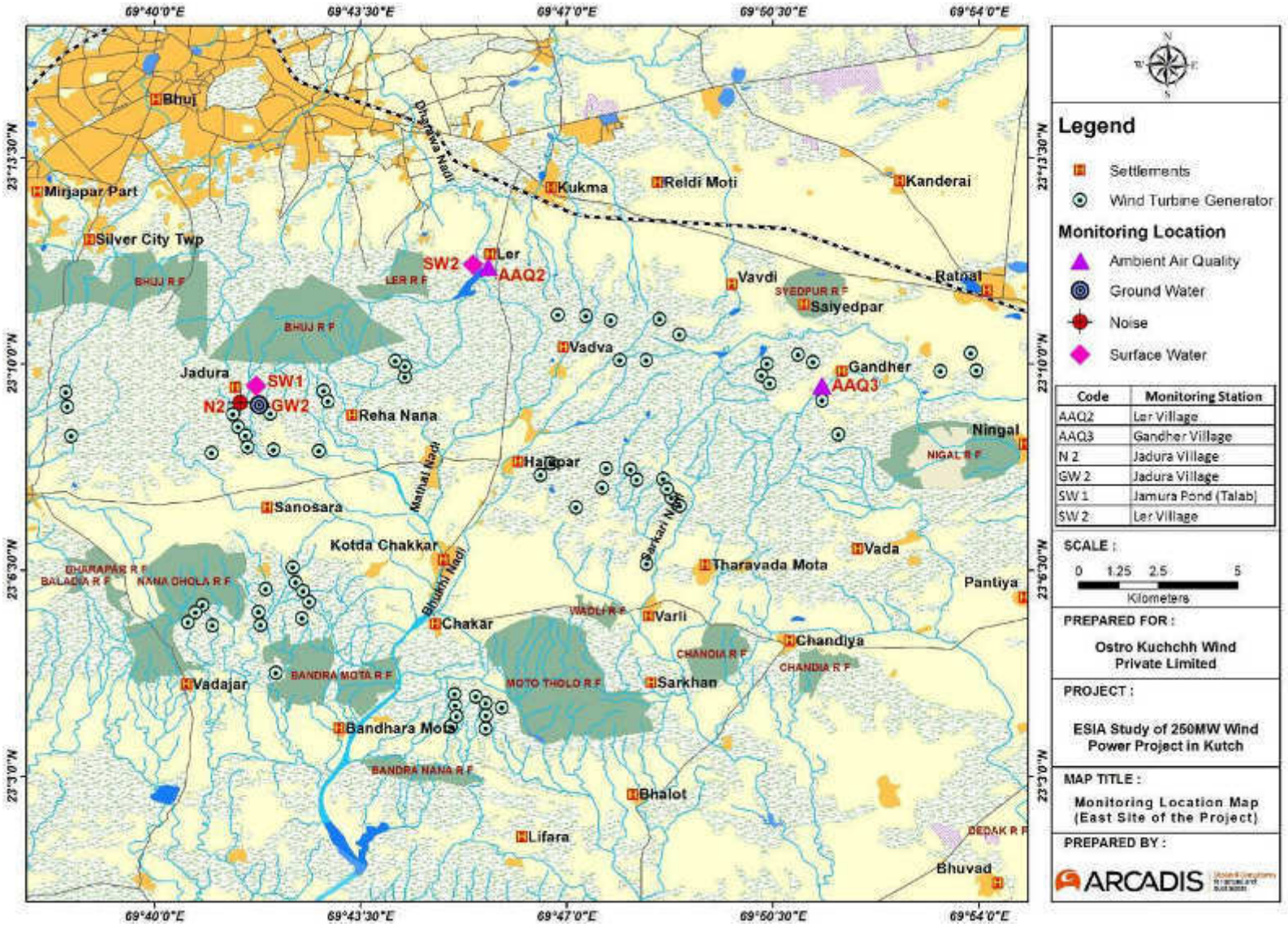
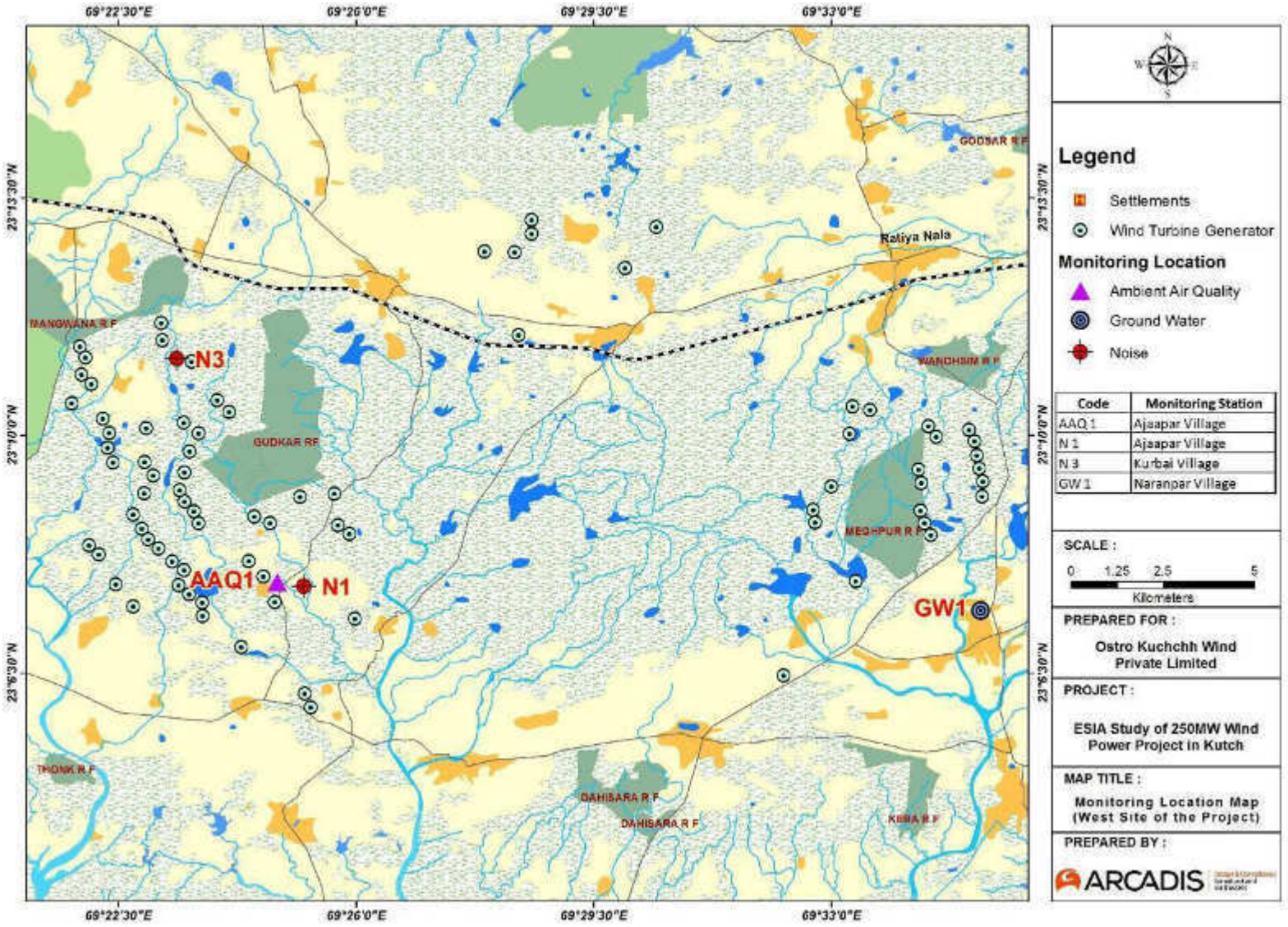


Figure 4-13 Monitoring location map (Project West Side)



4.9 Ecological Environment

Ecology & biodiversity study was carried out during last week of March 2017 with the aim to assess the existing ecological resources of the project site. The primary baseline survey was conducted to assess the nature of the existing habitat, phytosociological analysis of local flora; species composition, diversity index, existence of ecological sensitive areas; locations of wetlands/water bodies, land use pattern, cropping pattern etc. besides to draw a faunal profile of the project area including bird and bat through this assessment. Apart from that, published / unpublished secondary information (forest working plans) has also been collected and through dialogue with local residents and forest officials of the area. This information will further enable to gauge potential ecological impacts that can be generated from the project activities. Understanding of the significant risks and impacts is important to implement mitigation measures or suggest changes if the associated risks are alarming. Based upon the study, a practice mitigation measures would be recommended so that many impacts would be mitigated as well as managed properly. Main objectives for Ecological surveys:

Flora-

- Inventory of floral species which includes the list of rare, endangered as well as endemic species (if any), important habitats, forest type, vegetational composition of the study area;
- Listing of aquatic flora near the water bodies found in the study area;
- Identification of any notified area under international conventions, national or local legislation for their ecological, landscape, cultural or other related values within the study site.

Fauna-

- Inventory of fauna (terrestrial, aerial and aquatic) by direct sighting and through secondary means like, nests, roosts, pug marks, droppings, etc.
- Identification and classification of species recognized as critically endangered, endangered, threatened etc. as per IUCN Red list and scheduled species as per WPA (1972).
- Identification of areas important for breeding, foraging, nesting, resting or over wintering areas include migratory corridors/ avian migratory routes.
- Identification and assessment of aquatic fauna near the study area.

4.9.1 Methodologies for Ecological Surveys:

Desktop Review

A desktop review was conducted to determine the land use and land cover (Topo sheet, Satellite imagery), Forest type (Champion and Seth, 1962), Bio-geographic Provinces and Zones (Rodgers, Panwar and Mathur 2000) and floral & faunal assemblage in the study area from published documents/papers etc. To provide representative ecological status for the project, 5km radius surrounding the project site was considered as the study area for ecological survey.

Baseline Survey

Secondary data collection and primary on site survey were two components of the baseline survey. The primary baseline survey was carried out to determine the existing ecological conditions and was designed to fill any data gaps, and to facilitate an adequate assessment of the project impacts upon local ecology and the development of appropriate mitigation measures. As stated earlier, the baseline survey was conducted in last week of March between 22nd to 26th March, 2017. Prior to that secondary data regarding sensitive ecological habitat (National Park, Sanctuary, Ecological Sensitive Area, Migratory Corridor, habitat of endangered, vulnerable and range restricted species etc.), flora & fauna in the study area, forest cover was collected from Forest Department; and other published and unpublished documents. Stakeholder consultations (Forest Department, Local People etc.) were also

carried out to understand the major flora & fauna in the study area, pressure on forest resources, presence of any Schedule I species.

Flora Survey

Floral survey was conducted in four 10 m X 10 m (900sqm) plots. The main objective of the assessment was to qualitatively assess natural vegetation. Total five sampling locations were selected on plot of land within study area, having natural vegetation, i.e. areas without agricultural activity or plantation.

Species Diversity

Shannon Diversity Index has been used for estimating the diversity among the four sampling sites to highlight the most diverse site, calculate the Shannon Wiener diversity index of each site using the formula:

$$H = - \sum Pi. \ln Pi$$

Where, H' = Shannon index of diversity

$$Pi = \frac{\text{S= Number of individuals of one species}}{\text{N = Total number of all individuals in the sample}}$$

ln: is the logarithm to the base e

Faunal Survey

To assess the presence of fauna in the project site, a walk-through survey area was carried out. Each WTG locations were visited to find out the presence of faunal species near the project site. The faunal survey focused mainly on three groups viz. mammals, avifauna and herpeto fauna of the study area. Vantage point (VP) surveys was conducted at eight locations covering the entire site including the transmission routes in the early morning, afternoon and evening to keep a record on the bird species. The VP survey locations were selected upon the flight pattern of different birds, rich representation of bird species, conducive habitat of bird species and most importantly the potential to suffer significant impact from collision etc. The VP location map is shown in **Figure 4.11** and **4.12**. Data related to the other faunal species were also noted based on the direct sightings and from authentic secondary sources. Secondary sources like published books and reports, government departmental records, interviews with forest department and information from residents were further used to gather information and support primary observations. Time and Period of conducting study: An average of 20 minutes were spent at each vantage location to record birds. Location of vantage points are provided in **Figure 4.11** and **4.12**.

Methodology

To study the diversity of birds, transects were laid to survey sample plots. Besides, the vantage point survey was also carried out to quantifying flight activity of bird species that take place within the proposed wind farm envelope. Studies were carried out at site using binoculars and camera. A desk based study was done for further verification of collected field based data.

The scrublands, waterbodies and many agricultural fields have been selected for undertaking Line transect study. In case of scrubland habitats, which is mostly found in an open area with a very limited number of trees, short in height and sparsely distributed has been suitable for undertaking transect study. So, the visibility was found to be good and the field of vision remains uninterrupted. Survey was also done during the evening to estimate the population of nocturnal birds as well as bats. During the walkthrough survey, the roosting of bats was also searched and recorded.

Detailed Methodology- Line Transect Survey

Walkover Transect or Line Transect Method: This method involves recording different species of birds and bats as well as their respective number along a definite length of a habitat.

A single route that follows a natural path is the simplest and most convenient way to sample birds in the study area. But due to the patchy distribution of the representative habitat, single large transects were avoided. Instead small transects of about 100-200m were adapted to record birds,10m on both side of the transect line is considered as the study area for each transect. A total of about 15 line transects were randomly selected in the entire study area. Birds cited both the sides of the transect path were recorded and birds flying over the area were also noted. Instruments like binoculars and camera were used to identify the species.

Time and Period of conducting study: Ideally about 10-20 minutes was spent for conducting a line transect study of 100-200m.In case of point count method, on an average 20 minutes was spent in a single location to record birds and bat. Birds remain most active in the early hours of the day, so early morning hours were most preferred for conducting line transect. Apart from that, to record bats and nocturnal birds, some of these studies were done in the evening.

Vantage Point Study

Vantage point (VP) watches are a means of quantifying flight activity of bird species that take place within the wind farm envelope, with the principal aim of determining the likely collision risk. In this Vantage Point study, flight behaviour of birds and their movement pattern within the core study area and identify birds at collision risk. Again, survey was also performed in and around the water bodies located within the total study area, to estimate the bird diversity as well as bird flight pattern, and the way in which individual species is using the site.
During each session of study, two field observers were involved in collection of data. At each vantage point survey was carried out for 140 mins for 5 days.

Method of Data Collection: During each watch, two hierarchical recording methods are used to record data: focal animal sampling for target species and activity summaries for secondary species. These are as follows:

- Focal animal sampling- The area in view is scanned until a target species (flying in the collision risk zone) is detected at which point it is followed until it ceases flying or is lost from view. The time the target bird was detected and the flight duration are recorded.
- Activity summaries - Each species survey should be sub-divided into 5-minute periods, at the end of which the number and activity of that species is observed & recorded. Observation of target species takes priority over recording of secondary species.

Types of Data Collected: Data like species in flight, direction of flight, distance of bird from observer, direction of bird from observer, flying height of that particular bird from the ground, other activity and general description of flight were recorded.
Location of VP: A VP should provide an excellent and preferably an uninterrupted view of the study area. Being a huge project, the core study area is also vast, eight vantage points were selected for study, spread across the study area. To get an uninterrupted view, these vantage points were selected on relatively higher grounds/hillocks, near waterbodies and having little vegetation.

Table 4-6 Coordinates for Line Transect Survey

Line Transect	Latitude	Longitude
Line1	23°11'45.56"N	69°21'13.77"E
Line2	23°10'36.92"N	69°19'39.32"E

Line3	23° 7'54.80"N	69°23'59.26"E
Line4	23° 8'44.41"N	69°25'30.88"E
Line5	23° 9'12.51"N	69°28'42.17"E
Line6	23°11'29.89"N	69°26'57.34"E
Line7	23° 8'4.84"N	69°33'20.91"E
Line8	23° 9'39.05"N	69°36'40.11"E
Line9	23° 8'32.19"N	69°54'10.93"E
Line10	23° 3'55.66"N	69°46'37.96"E
Line11	23°11'20.04"N	69°45'27.32"E
Line12	23° 6'19.61"N	69°40'10.87"E
Line13	23° 9'39.53"N	69°40'17.56"E
Line14	23°12'25.03"N	69°30'34.70"E
Line15	23°12'48.57"N	69°29'44.23"E

Figure 4-14 Vantage Point Location Map & Probable Local Flight Paths (East side of project)

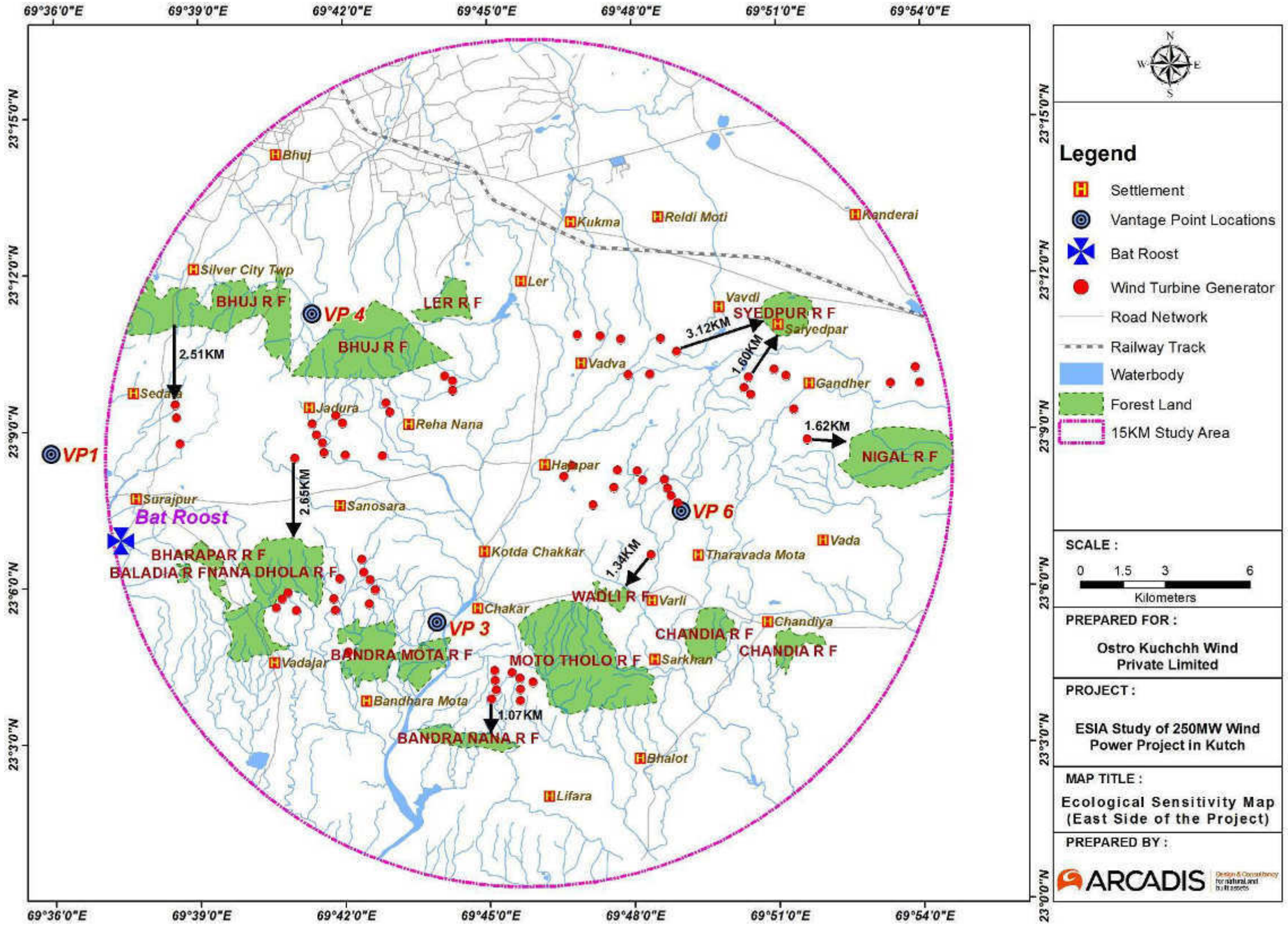
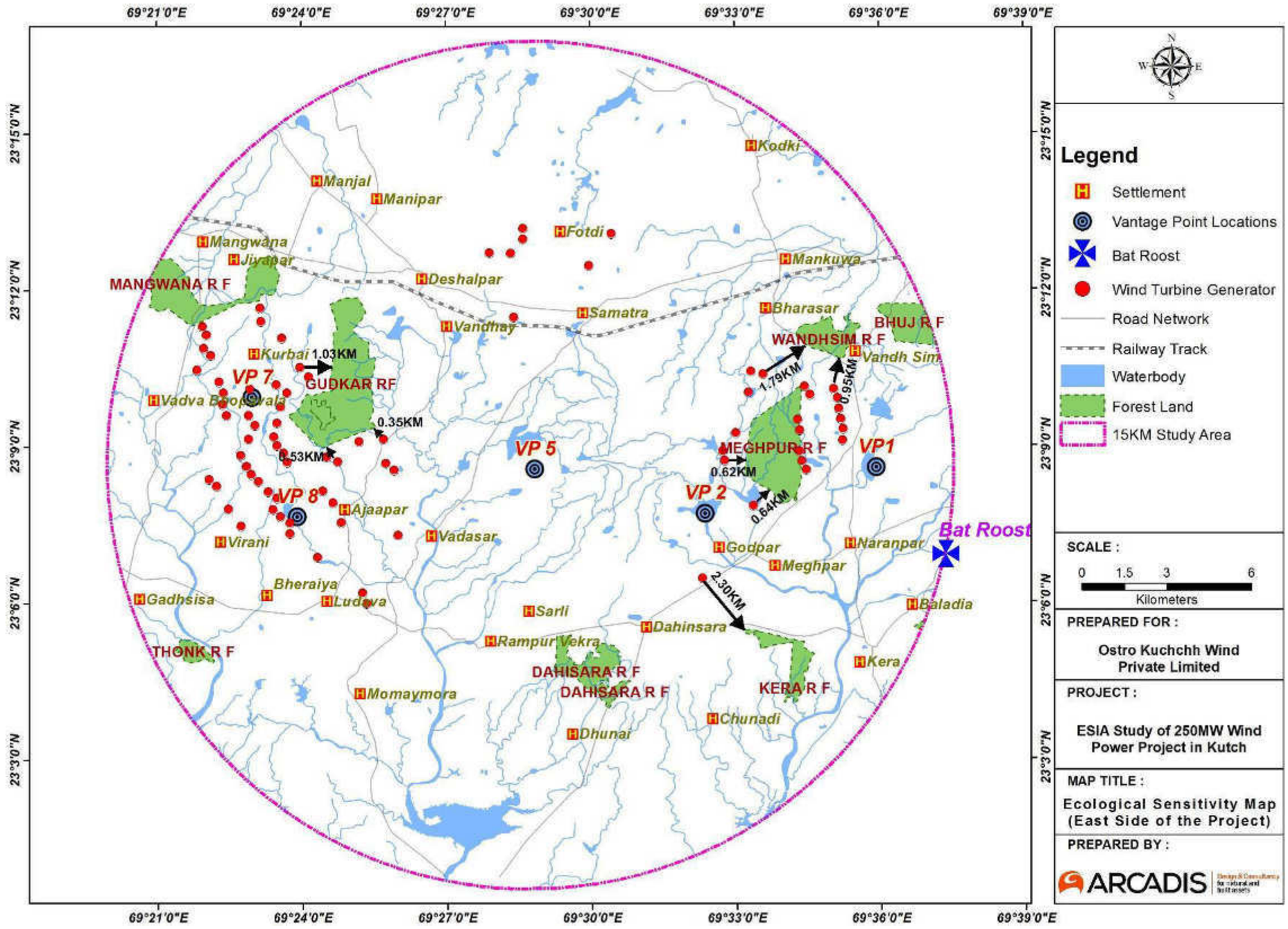


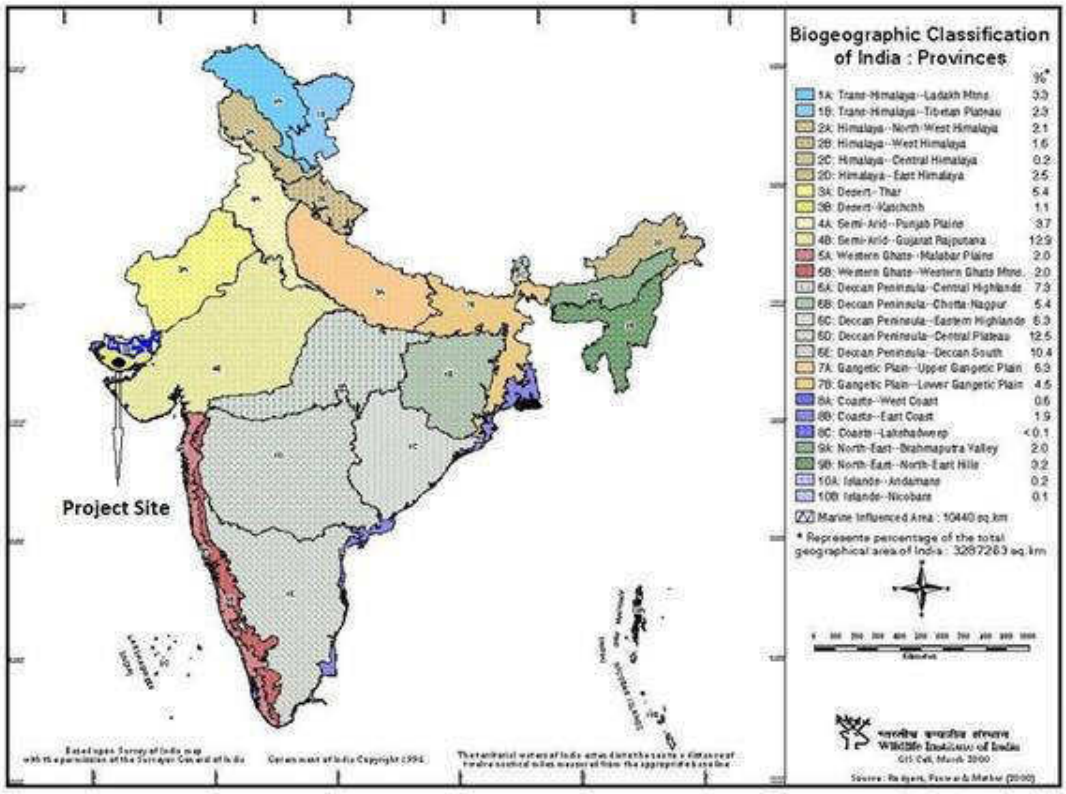
Figure 4-15 Vantage Point Location Map & Probable Local Flight Paths (West side of project)



4.9.2 Habitat Survey

According to the Biogeographic provinces of India published by Wildlife Institute of India (Rodgers, Panwar and Mathur, 2002), the project site falls under the Biogeographic Province – 3B-Desert Kutch (Figure 4-16). The site survey also included understanding of important habitats in the area. A "Habitat" according to IFC is defined as a terrestrial, freshwater or marine geographical unit or airway that supports assemblage of living organisms and their interactions with the non-living environment. As per IFC, habitats are divided into - Natural, Modified or Critical[15] the purpose of implementation of IFC Performance Standard-6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources). Critical habitats are subsets of Natural habitats. Mostly modified habitats were observed in the study area. Types of habitats are described in detail in this section below.

Figure 4-16 Biogeographic Zones of India



Types of Habitats in the Study area

Scrub Land: This type of vegetation is extensively found in non-cultivated lands, particularly revenue lands located within the study area. Big trees were generally absent or sparsely distributed. Hard wood thorny trees like *Acacia catechu, Prosopis juliflora, etc. are* commonly found in the natural scrublands. Natural vegetation in the study area is mostly classified as Type 6-B Northern Tropical Thorn Forests as per Champion & Seth 1968 (forests.gujarat.gov.in). These forests contain spare and stunted growth of species like Acacia and thorny bushes etc.

[15] Natural Habitats- These are the areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
Modified Habitats- These are the areas that may contain large proportion of plant and/or animal species of non-native origin and/or where human activity has substantially modified an area's primary ecological functions and species composition. It may include areas managed for agriculture, forest plantations, reclaimed coastal zones and reclaimed wetlands.
Critical Habitats- These are the areas with high biodiversity value, including (i) habitat of significant importance to critically endangered and/or endangered species; (ii) habitat of significant importance to endemic and/or restricted range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes. Critical habitat can be subset of Natural or Modified Habitat.

Plantation and Orchards: Small orchards and private plantation are spread through the study area. This plantation or orchards are mostly dedicated to one or two crop having commercial value. Commonly planted trees are Mango (*Mangifera indica*), Pomegranate (Punica granatum) and Coconut (*Cocos nucifera*).

Agricultural Field: Agricultural fields are mainly used for growing wheat, cotton, etc. Apart from these crops other agricultural products produced in the study area Bajra, Greengram, Castor, Groundnut, Cotton, Wheat, Mothbean etc. (CGWB Kachchh, 2013).

Road side Plantation: Trees planted along the major roads in the study area. Some important tree species are *Azadirachta indica*, *Acacia auriculiformis*, *Phyllanthus emblica*, *Ficus religiosa*, *Ficus benghalensis.*

Floral Diversity:

To estimate floral diversity, quadrat samplings were carried out at five plots, each of 10 x 10sqm in size. Sampling location were randomly selected on plots of land where agriculture was not practiced or orchard or plantation was not present. Biodiversity value following Shannon Diversity Index was found to be:

Table 4-7 Floral diversity

Sampling Location	Shannon Diversity Index Value
Quadrat A	1.11
Quadrat B	0.85
Quadrat C	1.28
Quadrat D	0.69
Quadrat E	1.13

The Shannon index increases as both the richness and the evenness of the community increase. Typical values are generally between 1.5 and 3.5 in most ecological studies. A value less than 1.5 indicates low floral diversity. Diversity was recorded as low as 0.69. Detailed data of the quadrat sampling is provided in **Appendix N**

Plant species recorded in the study area are listed in **Appendix O.** The picture of plant species recorded in study area provided in **Appendix P. The quadrate location map of the east and west side of the project site has been shown in Figure 4.17 and 4.18**

Figure 4-17 Quadrat Location Map (East side of project side)

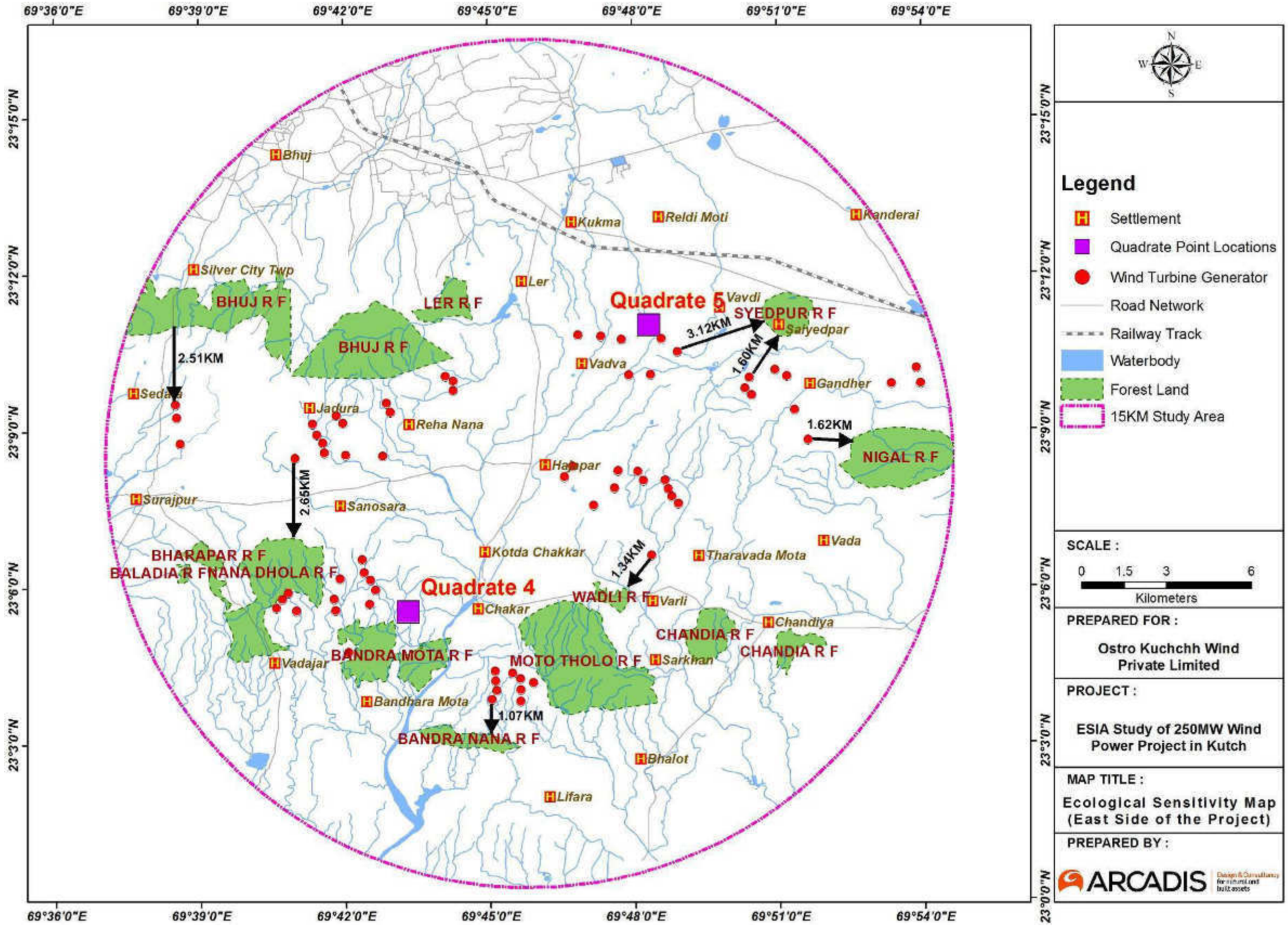
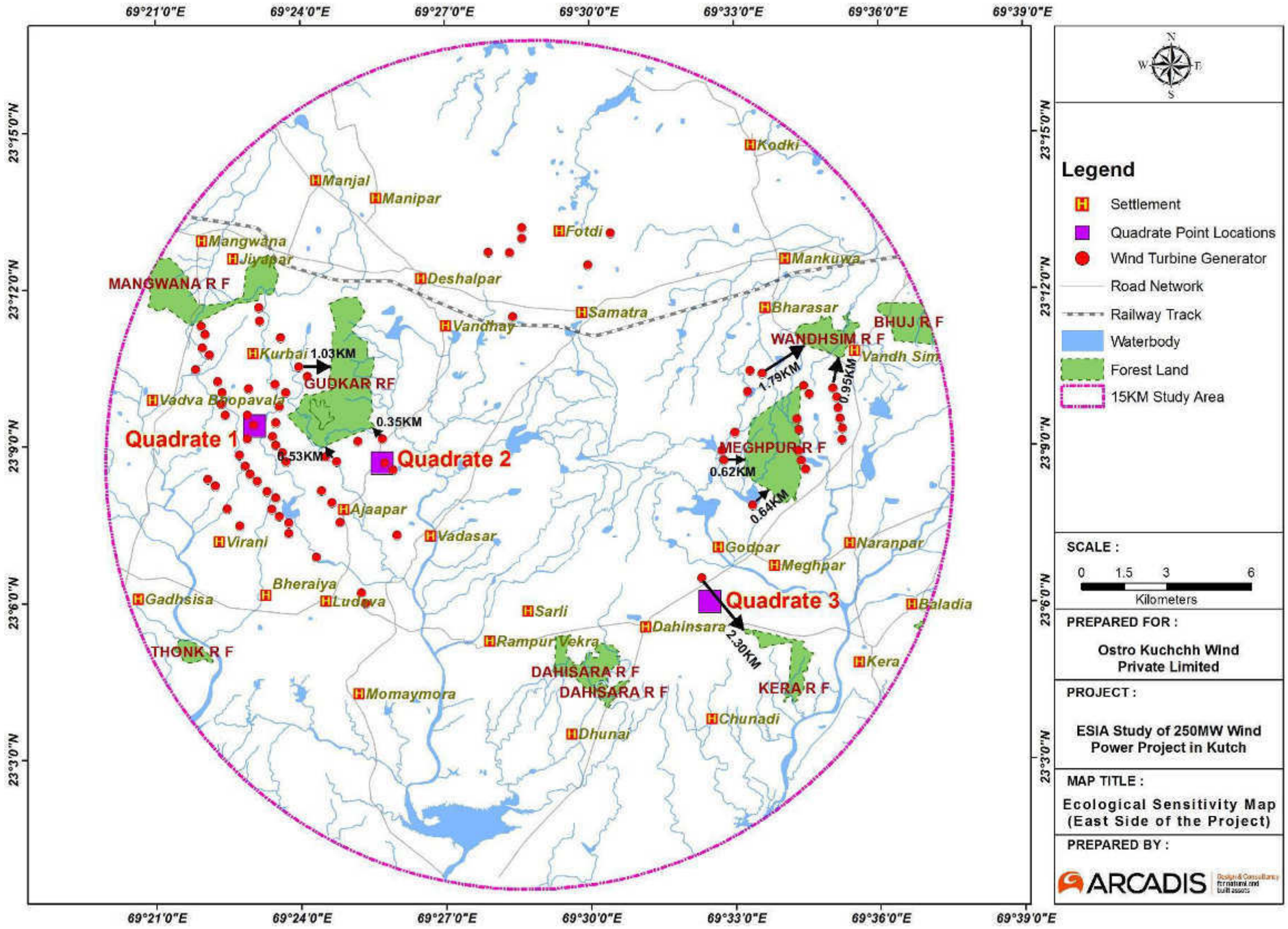


Figure 4-18 Quadrat Location Map (West side of project side)



Wildlife Habitat

Study area found to be predominately a rural setup with majority of the land covered by scrub or barren lands. Many seasonal and perennial waterbodies are in the study area. Water from these water bodies are reportedly used for irrigation by the local farmers. No perennial river flows in the study area.

During this study, an interview was conducted with a regional forest office in Bhuj. As per the information obtained from the forest office, project area does not serve as habitat for any mirgratory bird species with high conservation status. No Protected Area (PA) like National Park, Wildlife Sanctuary/Bird Sanctuary or not having an Important Bird Area (IBA) exist near the project area.

The different animal habitats observed at the study area are described below:

Consultation with local villagers and forest department officials revealed that, small mammals like fox, mongoose and jackals are reportedly found in the scrubs of this area. Agricultural fields, geomorphological features of the area and human settlements around the proposed WTG locations provide suitable habitats for rodents. Human settlements also generate food waste as well as carcasses of domestic animals, which can support scavengers like jackal and Indian fox that lives in that part of dry arid regions.

No hoofed animals like deer or antelopes are recorded from the study area. Consultation with local villagers confirmed the presence of hare in the scrublands. Apart from hare, wild boar and blue bull are also reported from the study area.

Agricultural fields and shade trees around the fields provide habitat for weaver birds, purple sunbird, green bee eater, common babbler, Indian robin, black drongo, common myna etc. The open grasslands and scrubs provides ideal habitat for grassland birds like red-wattled lapwing, bush lark, paddy field pipit. Water bodies within the study area provide excellent habitat for water birds like herons, river tern, ibis etc.

Faunal Diversity

Mammals: Mammalian species like Golden Jackal (*Canis aureus*), Indian Fox (*Vulpes benghalensis*), Indian Grey Mongoose (*Herpestes edwardii*), squirrel (*Funambulus palmarum*); rodents- *Bandicota indica*, *Mus musculus* and bats species (Indian Flying Fox) etc. are reported from this area.

Herpetofauna: Species like Northern House Gecko (Hemidactylus triedrus), common garden lizard (Calotes versicolor), spiny tailed lizard (Uromastyx hardwickii), Brahminy skink (Mabuya carinata), saw-scaled viper (Echis carrinatus), cobra (Naja naja) are reported from the study area. A list of faunal species observed/reported from the study area is given in table below.

Table 4-8 List of Faunal Species Recorded or Reported in the Study Area

Sn.	English Name	Scientific Name	Occurrence	WPA Schedule/ IUCN Status[16]	Reported or Recorded
1	Jackal	*Canis aureus*	Rare	II/LC	Reported
2	Common Fox	*Vulpes benghalensis*	Frequent	II/LC	Recorded
3	Grey Mongoose	*Herpestes edwardsii*	Frequent	II/LC	Recorded
4	Striped Squirrel	*Funambulus palmarum*	Common	IV/LC	Recorded
5	Bandicoot rat	*Bandicota indica*	Common	V/LC	Reported
6	House rat	*Mus musculus*	Common	-/LC	Reported

[16] Vulnerable; NT-Near Threatened, LC-Least Concern (IUCN Ver. 3.1), Schedule – I, IV, V (Indian Wildlife Protection Act - 1972)

7	Indian Flying Fox	*Pteropus giganteus*	Common	V/LC	Recorded
8	Indian Hare	*Lepus nigricollis*	Common	IV/LC	Reported

Photo 4-2: Mammals observed in the project site

Striped Squirrel

Indian Flying Fox

Bat roost sighted on a banyan tree in project site

Table 4-9 List of Reptilian Species of the Study Area

Sl. No.	English Name	Scientific Name	WPA 1972 Schedule
1	Northern House Gecko	Hemidactylus triedrus	-
2	Common garden lizard	Calotes versicolor	II/-
3	Spiny tailed lizard	Uromastyx hardwickii	-
4	Brahminy skink	Mabuya carinata	Not Listed/LC
5	Saw-scaled viper	Echis carrinatus	IV/-
6	Cobra	Naja naja	II/-

Photo 4-3: Reptiles observed in the project site

Brahminy Skink

Snake hole in the project site

Avifauna: During primary survey 80 bird species were identified and recorded from the primary survey. Out of these 80 birds, 31 birds were recorded flying or are able to fly more than 40m from the ground. Birds fly above 40m from the ground can be considered vulnerable to get hit by the wind turbines because of flying within the "Probable Collision Risk Zone" of a WTG. Birds like Long Legged Buzzard, Montagu's Harrier, Black Kite, Shikra Pallid Harrier, Oriental Honey Buzzard, Ashy-crowned Sparrow Lark, Indian Bushlark, Oriental Skylark, Ruddy Shelduck, Common Pochard, Garganey, Common Teal, Darter, Little Swift, Little Egret, Great Egret, Painted Stork, Grey Necked Bunting, Red Headed Bunting, Common Kestrel, Barn Swallow, Red-rumped Swallow, Yellow Wagtail, Little cormorant, Common Sandpiper, Wood Sandpiper, Rosy Starling, Glossy Ibis, Black Headed Ibis and Greater Flamingo found within the study area are normally fly or are able to fly above 40m.

Apart from these two birds, Eurasian Spoonbills and Indian Peafowl are listed as Scheduled I species, but these species generally do not fly above 40m. A list of species, recorded from the study area is given in Table below. Details of Bird Species with general flight behavior is provided in **Table 4.10** Picture of recorded bird species from the study area, is provided in **Appendix Q.**

Table 4-10 List of Avian Species Recorded in the Study Area

S. no.	Family	Common Name	Scientific Name	Migratory Status	IUCN status	WPA 1972 Sch.	Foraging Guide	Preferred Habitat	Flight Behaviour	Sighting of occurrence in study area
1.	Accipitridae (Hawk,Harrier, Kite, Eagle,	Long Legged Buzzard	*Buteo rufinus*	R	LC	Sch I (Part III)	C/I	Open scrub/Grass land	Flying and sailing in wide circles, average **30m**. Can fly as high as 400 m.	Rare
2.		Montagu's Harrier	*Circus pygargus*	WV (From Central Asia, Europe)	LC	Sch I (Part III)	C	Open scrub/Grassland/cultivation/ avoid woodland	Sails gracefully, with powerful and elegant wing beat, mostly around **2m** from the ground. During long range flight is capable of flying more than 50-60m above ground	Rare
3.		Black Kite	*Milvus migrans*	R	LC	Sch I (Part III)	C/S	Settlement /market place/dump	Soars within **20-30**m, highly maneuverable flight in urban space Capable of flying above 40m.	Frequent
4.		Pallid Harrier/Pale Harrier	*Circus macrourus*	WV (from Central Asia)	NT	Sch I (Part III)		Open scrub/Grassland/cultivation/ avoid woodland	Sails gracefully, with powerful and elegant wing beat, mostly around **2m** from the ground. During long range flight is capable of flying more than 50-60m above ground	Rare
5.		Indian Shikra	*Accipiter badius*	R	LC	Sch I (Part III)	I/C	Open Woodland	Rapid wing stroke, punctuated with glide. >50m.	Frequent
6.		Oriental Honey Buzzard	*Pernis ptilorhynchus*	R	LC	Sch I (Part III)	I	Open scrub/woodland	Average height of **30m**. Capable of flying above 40m.	Rare

7.	Alaudidae	Ashy Crowned Sparrow lark/Ashy crowned Finch-Lark	*Eremopterix griseus*	R	LC	Sch IV	I/G	Open Scrub/Agricultural land	Flight undulating near ground, with series of rapid wing beat punctuated by momentary pause. 40-50 m Male display consists of a song flight that involves soaring up to **30-40 m,** then diving with partly closed wings and then rising up in a glide.	Frequent
8.		Indian Bushlark	*Mirafra erythroptera*	R	LC	Sch IV	I	Open Scrub/Agricultural land	Flies close to the ground, Male display consists of a song flight that involves soaring up to **30-40 m,** then diving with partly closed wings and then rising up in a glide.	Frequent
9.		Rufous Tailed Lark	*Ammomanes phoenicura*	R	LC	Sch IV	I/G	Open Scrub/Agricultural land/stony outcrops	Flies close to the ground,	Frequent
10.		Oriental Skylark	*Alauda gulgula*	R	LC	Sch IV	I/G	Grassland/agricultural fields	Flight undulating near ground, with series of rapid wing beat punctuated by momentary pause. Male display consists of a song flight that involves soaring up to **30-40 m,** then diving with partly closed wings and then rising up in a glide.	Frequent

11.	Alcedinidae (Vol 4)	Common Kingfisher	*Alcedo atthis*	R	LC	Sch IV	P/C	Fresh water body in open country	Generally, flies around **5-10m** from ground, Can hover **2-3m** above water	Frequent
12.		Pied Kingfisher	*Ceryle rudis*	R	LC	Sch IV	P/I	Still Freshwater, slow-moving River	Hovers **8-10m** over the water surface for hunting opportunities, during regular flight rarely flies over **15m**.	Rare
13.		White Throated Kingfisher	*Halcyon smyrenensis*	R	LC	Sch IV	P/C	Cultivation/Forest Edges/Freshwater	Rarely flies over **10-15m**	Frequent
14.	Anatidae	Ruddy Shelduck	*Tadorna ferruginea*	WV (from Central Asia)	LC	Sch IV	P/C/I/G/H	Fresh Water Wetland	Can fly more than 40-50m above ground	Confined to Jamura pond
15.		Common Pochard	*Aythya ferina*	WV (from Central Asia, Europe)	LC	Sch IV	P/C/I/G/H	Large Open Water Body	Is capable of flying more than 40-50m above ground	Confined to Jamura pond
16.		Spot Billed Duck	*Anas poecilorhyncha*	R	LC	Sch IV	H/I	Freshwater wetland	Within 5m from water surface	Confined to Jamura pond
17.		Garganey	*Anas querquedula*	WV	LC	Sch IV		shallow freshwater lakes and marshes	fast twisting wader-like flight. Flight >40m during migration.	Confined to Jamura and Godkur pond

18.		Common teal	*Anas crecca*	WV (from Siberia, Central Asia)	LC		I/P/G	Freshwater wetland	Is capable of flying more than 40-50m above ground	Godkur Pond
19.		Lesser Whistling Duck	*Dendrocygna javanica*	R	LC		I/P/G	Freshwater wetland	-	Godkur Pond
20.	Anhingidae	Snake Bird/ Darter	*Anhinga melanogaster*	R	NT	Sch IV	P	Swamp/Water body	Near ground flight is associated with strong quick flaps of, punctuated with sailing. Can spiral up using thermals and soar on motionless wings, more than **80-100m** above ground	Frequent
21.	Apodidae	Little Swift	*Apus affinis*	R	LC		I	Settlement/rock face/cliff	Flight is very swift and very agile with rapid twist and turns in pursuit of areal insects. Flies within the range of **10-50m** height**.**	Common and Frequent
22.	Ardeidae	Cattle Egret	*Bubulcus ibis*	R	LC	Sch IV	I	Freshwater wetland/marshland/dumpsite/ agricultural field	Local flight is generally at low height, average **10-20m**. During long flight from one foraging ground to another or between foraging ground and roosting ground, may flu at altitude more than **40m**.	Frequent
23.		Little Egret	*Egretta garzetta*	R	LC	Sch IV	P/I	Freshwater wetland/marshland	During long flight, may fly at a altitude more than **40m**.	Frequent

24.		Pond Heron	*Ardeola grayii*	R	LC	Sch IV	I/P	Freshwater wetland	Flies approximately **at 20-30m**	Frequent
25.		Great Egret	*Casmerodius albus*	R	LC	Sch IV	P/I	Marshland/ wetlands	During long flight, may fly at an altitude more than **40m**.	Frequent
26.		Grey Heron	*Ardea cinerea*	R	LC	Sch IV	P	wetland/marshland	Flies approximately **at 20-30m**	Frequent
27.	Campephagidae	Small Minivet	*Pericrocotus cinnamomeus*	R	LC	Sch IV	I	Open Woodland	Average flight height is **5-10m**	Frequent
28.	Charadriidae	Red Wattled Lapwing	*Vanellus indicus*	R	LC	Sch IV	I	Wetland	Slow flight with deliberate flaps of wings, capable of speed and great agility when required, average flight height is **10-20m**	Frequent
29.		Green Sandpiper	*Tringa ochropus*	WV (from sub-arctic Europe & Asia)	LC	Sch IV	I	Freshwater Wetlands	-	Godkur Pond
30.		Painted Stork	*Mycteria leucocephala*	R	NT	Sch IV	P/C/I	Freshwater wetland/marshland	Soars on thermal in circular pattern with motionless wings, more than **40-50m** from ground	
31.	Cisticolidae	Plain Prinia	*Prinia inornata*	R	LC		I	Grassland Scrubs/ agriculture field with tall crop	Flies close to the ground, within **4-5m**	Frequent

32.	Columbidae	Laughing Dove Senegal Dove Indian Little Brown Dove	*Spilopelia senegalensis*	R	LC	Sch IV	G	Open scrub/ hills/ near village	flight is quick and direct with the regular beats and an occasional sharp flick of the wings which are characteristic of pigeons, Hardly flies above 30-40m.	Frequent
33.		Rock Pigeon	*Columba livia*	R	LC	Sch IV	G	Rock cliffs/old ruins/buildings/cityscape/palm groves	flight is quick and direct with the regular beats and an occasional sharp flick of the wings which are characteristic of pigeons, Hardly flies above 30-40m.	Frequent
34.		Eurasian Collared Dove Indian Ring Dove	*Streptopelia decaocto*	R	LC	Sch IV	G	Dry country with agriculture and village woodlot	flight is quick and direct with the regular beats and an occasional sharp flick of the wings which are characteristic of pigeons, Hardly flies above **30-40m**.	Frequent
35.	Coraciidae	Indian Roller	*Coracia sbenghalensis*	R	LC	Sch IV	I	Open Scrub/agricultural land	Steady flight with repeated beating of wings, hardy flies above **20m.**	Frequent
36.	Corvidae	House Crow	*Corvus splendens*	R	LC	Sch IV	O	Open Scrub/ Woodland/ Agricultural Land/settlement	Flight with unhurried shallow wing flaps, straight with tail closed. Average flight height **5-20m.**	Frequent
37.	Cuculidae	Southern Coucal	*Centropus sinensis parroti*	R	LC	Sch IV	O	Scrubland/Forest Edge/open woodland	Poor flier, makes short clumsy flight the nearest thicket, flies within **5m** of ground.	Rare

38.	Dicruridae	Black Drongo	*Dicrurus macrocercus*	R	LC	Sch IV	I	Open Scrub/ Agricultural land/ near settlement/ open woodland	Extremely agile and maneuverable flight, hardly above **15-20m**.	Frequent
39.	Emberizidae	Grey Necked Bunting	*Emberiza buchanani*	WV (from Caspian Sea & Altai mountain)	LC	Sch IV	G	Dry thorny Scrubs/ agricultural fields/open woodland	During migration can fly more than 50m altitude	Rare
40.		Red Headed Bunting	*Emberiza bruniceps*	WV (from Caspian Sea & Altai mountain)	LC	Sch IV	G	Dry thorny Scrubs/ agricultural fields/open woodland	During migration can fly more than 50m altitude	Frequent
41.	Estrildidae	Indian Siverbill	*Euodice malabarica/ Lonchura malabarica*	R	LC		G	Grassland/ Scrubs/ babool grove/ agricultural field	Flies with rapid wing beats, average flight height is **10-15m**.	Frequent
42.		Scaly Breasted Munia	*Lonchura punctulta*	R	LC	Sch IV	G	Scrubs/ open forest/ agricultural field	Flies with rapid wing beats, average flight height is **10-15m**.	Frequent
43.	Falconidae	Common Kestrel	*Falco tinnunculus*	WV	LC	Sch IV	C	Open Forest/ scruby grassland/ marshland	Soars high above 30-50m using thermal, sometimes hovers about 10-20m while hunting.	Rare
44.	Glareolidae	Indian Courser	*Cursorius coromandelicus*	R	LC	IV	C	Dry Grasslands	Flies fairly low, within **1-2m** from ground	Rare

45.	Hirundinidae	Barn Swallow	*Hirundo rustica*	WV (from Central Asia)	LC		I	Open country/ near water body/ settlement	Few rapid wing beats followed by a graceful glide, with agile turning, more or less flies within **20m** from ground, during migration can fly at an altitude more than 50m.	Frequent
46.		Wire-tailed Swallow	*Hirundo smithii*	R	LC		I	Open country/ near water body/ settlement	Few rapid wing beats followed by a graceful glide, with agile turning, more or less flies within **20m** from ground	Frequent
47.		Red Rumped Swallow	*Cecropis daurica*	R/WV Winter visitors migrates from temperate southern Europe and Asia	LC	Sch IV	I	Open country/ near water body/ settlement	Few rapid wing beats followed by a graceful glide, with agile turning, more or less flies within 20m from ground, during migration can fly at an altitude of 3000-4000m. (deduction from Migration)	Frequent
48.	Laniidae	Bay Backed Shrike	*Lanius vittatus*	R	LC		C	Open scrub/Dry open Grassland/ near cultivation	Steady flight with regular wing beating, flies at round **10m** from ground	Frequent
49.		Long Tailed Shrike	*Lanius schach*	R	LC		C	Open scrub/Dry open Grassland/ open woodland/ orchard	Steady flight with regular wing beating, flies at round **10m** from ground	Frequent
50.	Laridae	River Tern	*Sterna aurantia*	R	NT		P	Large Water body	Flies up and down deliberately over water body	Godkur Pond

									and rivers, generally flies within **5m** from the water surface.	
51.	Meropidae	Green Bee-Eater	*Merops orientalis*	R	LC	IV	I	Open scrub/Open woodland/ cultivation	Flight with few flaps of wings, followed by graceful glide on open motion less wings. Flies more or less **10-20m** from ground.	Frequent
52.	Motacillidae	Citrine Wagtail	*Motacilla citreola*	WV	LC	Sch IV	I	Near water body/ pool/river bank	Undulating flight, with rapid wing flapping, then few second pause.	Rare
53.		Yellow Wagtail	*Motacilla flava (vol9, pg282)*	WV (from Europe)	LC	Sch IV	I	Damp Grassland/ near water body	As a winter visitor is able to fly at great height above 40m. During migration flies over Himalayan passes above 3000m.	Frequent
54.		Paddy Field Pipit	*Anthus rufulus (vol9, pg258)*	R	LC	Sch IV	I	Open Scrub/Grassland	Undulating flight, with rapid wing flapping, then few second pause. Hardly flies above **20m**	Common and Frequent
55.		Tawny Pipit	*Anthus campestris*	WV	LC	Sch IV	I	Open Scrub/Grassland	It performs a quaint mating display, which consists of flying up to 30 metres while singing.	Frequent
56.	Muscicapidae	Pied Bushchat	*Saxicola caprata*		LC	Sch IV	I	Grassland/ Cultivation	Flies close to the ground	Frequent
57.		Common Stonechat	*Saxicola torquatus*	WV (from Himalaya)	LC	Sch IV	I	Scrub/ cultivation	Flies close to the ground	Frequent

58.	Nectariniidae	Purple Sunbird	*Cinnyris asiaticus*	R	LC	Sch IV	N/I	Bushes/ open woodland	Flies with a rapid wing biting, flies within **15m** from ground	Frequent
59.	Passeridae	House Sparrow	*Passer domesticus*	R	LC	IV	G	Open Scrub/Agricultural Land/habitation	Flies within **20m** from ground	Frequent
60.	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*	R	LC	Sch IV	P	Freshwater wetland	Can fly at height more than **40m** when traveling between two hunting ground (wetlands)	At waterbodies
61.	Phasianidae	Indian Peafowl	*Pavo cristatus*	R	LC	Sch I	G/I	Near Habitation	Mostly a ground bird, much effort is needed for flight, can hardly fly more than **10-15m** from ground	Rare
62.		Grey Francolin	*Francolinus pondicerianus*	R	LC	Sch IV	G/I	Open grassland/ agricultural field	Mostly ground bird, hardly flies above **5m** from ground	Frequent
63.	Ploceidae	Baya Weaver	*Ploceus philippinus*	R	LC	Sch IV	G/I/N	Grassland/agriculture dotted with trees and date palm	Generally flies within **20m** from ground	Frequent
64.	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	R	LC	Sch IV	P/I/C	Wetland	When properly airborne fly strongly and long distance at a height of **30-40m**	Frequent
65.	Psittacidae	Rose Ringed Parakeet	*Psittacula krameri*	R	LC	Sch IV	F	woodland/ Open scrub	Steady flight with regular wing flapping, flies on an average altitude of **15m**.	Rare
66.	Pycnonotidae	Red Vented Bulbul	*Pycnonotus cafer*	R	LC	Sch IV	O	Open Scrub/agricultural land/Dry Deciduous Forest	Flies within **10-15m** from ground	Frequent
67.	Rallidae	Common Coot/ Eurasian Coot	*Fulica atra*	R	LC	Sch IV	V	Fresh Water Body	When properly airborne fly strongly and long distance at a height of **30-40m**	At waterbodies

68.	Recurvirostridae	Black-winged stilt	*Himantopus himantopus*	R	LC	Sch IV	P/C	Wetlands	Flight feeble and flapping	At waterbodies
69.	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	WV (from Central Asia)	LC	Sch IV	I	Wetlands	Jerky vibrating flight is common in sandpipers, but is able to fly long distance at more than **40m** from ground	At waterbodies
70.		Wood sandpiper	*Tringa glareola*	WV (from Europe, North Asia)	LC		I	Wetlands	Jerky vibrating flight is common in sandpipers, but is able to fly long distance at more than **40m** from ground	At waterbodies
71.		Common Redshank	*Tringa totanus*	WV	LC	Sch IV	I	Wetlands		Frequent
72.	Strigidae	Spotted Owlet	*Athene brama*	R	LC	Sch IV	C	Around Habitation and Cultivation	Flies within **30m** from the ground	Rare
73.	Sturnidae	Common Myna	*Acridotheres tristis*	R	LC	Sch IV	O	Open scrub/woodland/near habitation	Flies within **20m** from ground	Frequent
74.		Rosy Starling	*Pastor roseus*	WV (from Himalaya, Central Asia)	LC	Sch IV	O	Open woodland	Capable of flying more than **100m** from the ground	Frequent
75.		IndianRobin	*Saxicoloides fulicatus*	R	LC	Sch IV	I	Open scrubland	Flies within **20m** from ground	Frequent
76.	Threskiornithidae	Glossy Ibis	*Plegadis falcinellus*	WV (from northern India	LC	Sch IV	P/I	Wetland	Flock fly in “V” formation and generally flies at an altitude more than **50m** above ground	Rare

				and Central Asia)						
77.		Black headed Ibis	*Threskiornis melanocephalus*	R	NT	Sch IV	P/I	Wetland	Generally, flies at an altitude more than 50m above ground	Rare
78.	Timaliidae	Common Babbler	*Turdoides caudata*	R	LC	Sch IV	I/G	Open dry scrub	Mostly flies within **15m** from ground	Frequent
79.	Phoenicopteridae	Greater Flamingo	*Phoenicopterus roseus*	WV	LC	Sch IV		Shallow water bodies, including saline lagoons, salt pans, estuaries, and large saline or alkaline lakes	During migration, fly at high altitudes more than 40 m.	Godkur Pond
80.	Threskiornithidae	Eurasian Spoonbills	*Platalea leucorodia*	Resident	LC	Sch I (Part III)		Extensive shallow, wetlands with muddy, clay or fine sandy beds	Short glides interspersed with fast, shallow wing-beats	Godkur pond

Migratory Status:
R – Resident; WV – Winter Visitor; PM – Passage Migrant; SV – Summer Visitor
IUCN Status:
VU – Vulnerable; NT – Near Threatened ; LC – Least Concern;

	:	Schedule I bird species
	:	Birds capable of flying within collision risk zone

4.9.3 Aquatic Ecosystem

The study area has many small and big waterbodies. The project site is also drained by small seasonal rivers. But no major drainage system can be found within the study area. In the study area, natural drainage is represented by few narrow and shallow canals, which remains dry for major time of the year. Apart from these, there are few water bodies within the study area, most of the water bodies are manmade structures. Seasonal fluctuation of water level is very evident for these water bodies and most of the water bodies dry up during peak summer season.

Aquatic Faunal Diversity

Amphibian species like common Pond frog, Skipper frog were sighted near the water bodies located in the study area.

Table 4-11 Amphibians Observed/Recorded from the Study Area

Sn	Common Name	Zoological Name	WPA Schedule / IUCN Status
1	Indian Skipper Frog	*Euphlyctis cyanophlyctis*	LC /Not Listed
2	Indian Pond Frog	*Euphlyctis hexadactylus*	-/LC

4.10 Socio economic profile of the study area

The socioeconomic condition in the study area has been detailed in this section, which provides a correlation of the village level socioeconomic conditions to that of tehsil and district level. The objective of analysis of information at village, tehsil and district level is to identify the existing facilities and gaps at village level which can be considered as need of the study area.

Site visit was undertaken along with primary and secondary data collection from various sources. Information and documents were collected from the Ostro Energy related to ESMS manual, project site location and land details. The assessment of socio-economic environment was carried out based on the primary survey with the help of framed questionnaire to conduct community consultation (as presented in **Appendix R**). Secondary data includes Census 2011, information available on the Kutch district official website, district statistical handbook, and other available data on official government websites.

4.10.1 Methodology

The social assessment is primarily based on the analysis of the secondary data obtained from the Census -2011, district portal website[17], community consultations and primary consultation with the help of framed sample questionnaire for village profiling. Considering the nature of the project, operations and understanding of the demographic characteristics of the area from the secondary data it is designed to capture occupational patterns, societal set up, access to basic amenities along with socio - economic profiling of villages and communities.

The following methodology was adopted:

- Consultations with Panchayat members
- Stakeholder consultation with Stakeholders e.g. Panchayat head, teachers, youth group, farmer, health worker, ICDS worker and religious leader.

4.10.2 Study Area

All the project area villages are located in Bhuj taluk of Kutch district in Gujarat. The project area villages for the 250 MW Wind Power Project are given in Table 4.11. At the time site visit in March 2017, there were a total of 25 villages falling in the project area and hence consultation and socio economic study

[17] https://kutch.gujarat.gov.in/

was carried out in 12 sample villages falling in study area i.e. Bandhara Mota, Bandara Nana, Chubdak, Gandher, Jaduara, Naranpar Pasayati, Reha Mota, Reha Nana, Sanosara, Sedata, Vadasar and Vadva in Bhuj Tehsil of Kutch district of Gujarat. In July, 2017, the villages falling in study area are a total of 30 villages viz. Sedata, Jadura, Reha Nana, Vadva, Harudi, Sakrai Timbo, Vavdi, Gandher, Chubdak, Reha Mota, Bandhara Nana, Sanosara, Vadajar, Bandhara Mota, Naranpar Ravli, Nagiyari, Samatra, Kurbai, Vadasar, Godpar, Meghpar, Godpar Sarli, Kanpar, Ludva, Virani, Nabhoi Moti, Filon, Deshalpar, Bharasar and Ajapar village.

Total twelve villages have been considered as the study area for socio economic profiling, which are located within 5-30 km of the proposed project sites. Bhuj is nearest town of the study area villages.

4.10.4 Demography

The demographic profile in terms of total population, number of households, household size and sex-ratio of the selected villages surveyed in study area are discussed in the section below. In study area villages the average house hold size is around 5. Of the study area villages, Naranpar Pasayati has the highest population (5307) while Bandhara Nana has the lowest population (320). The average gender ratio in the study area villages is 989.

4.10.5 Schedule Caste (SC) and Schedule Tribes (ST)

As per census 2011, only one village-Naranpar Pasayati has 0.49% of ST population out of study area villages. Regarding scheduled caste (SC) population, Reha Nana village has maximum share percentage i.e. 19.89% of the total village population.

4.10.7 Status of Women in Study area villages

As observed in the study area, women play a significant role in agriculture and allied activities including crop production, livestock production, horticulture, post-harvest operations, agro-forestry, fisheries, etc. Women contribute in enhancing quality of life especially through rural and agricultural economies in many ways. A notable part of the agricultural labour-force in the study area are women.

Animal husbandry is the second largest economic activity next to agriculture in study area villages. It provides employment and economic support to rural families. Many of the important tasks in animal husbandry are performed by women apart from their responsibilities as home makers.

Besides animal husbandry activities like bringing fodder from field, chaffing the fodder, preparing feed for animals, offering water to animals, protection of animals from ticks and lice, cleaning of animals and sheds, preparing of dung cakes, milking, ghee-making and marketing of produce are performed by women. Thus, involvement of women in farming activities is a common feature in the study area villages. As revealed during consultation with women in the study area, women get involved in the farming and animal husbandry activities as being part of family and remain unpaid.

According Census, 2011 among the study area villages out of total working population Gandher has the highest percentage (18.62%) of female. It is then followed by Naranpar Pasayati (11.23%) and Chubdak (9.49%).

4.10.8 Literacy

Study Areas Villages: Vadasar has the highest literacy percentage (over 89%). The lowest literacy rate is seen at Jadura village (around 37%). The female literacy is too low in comparison with their male counterpart. The highest female literacy is seen at Vadasar (74.22% of total female population) and the lowest being at Jadura (around 26%) village.

4.10.9 Economic Activity & Livelihood Pattern

The study area has partly red sandy and few area black soil suitable for cotton agriculture and horticulture crops. Main crops cultivated are wheat, isabgol, sugarcane, castor oil, cotton and groundnut etc. Quiet a notable percentage of the population are involved in cow/goat rearing in the project area villages. Majority of the population are either involved as agricultural – labourer and/ or animal rearing. Many people have animal husbandry as a source of livelihood. Milk selling, goat trading etc. is also a source of livelihood in the project area villages. No big industries were observed in the area. The agriculture is rain-fed and artificial irrigation facilities are not in use in most villages. But in many areas irrigation is noticed through pumps (ground water). Apart from agriculture, the other form of economic activities is tailoring, shop keeping and small trading in the local village markets.

4.10.10 Agriculture and Irrigation in the study area

As per Census, 2011 only about 30% of the total population of study area villages are dependent on agriculture as their main livelihood resource. During site observation, it was noticed that extremely low ground water level and minimum irrigational facility is available in the study area, which adds up to the rising cost of cultivation and hence agriculture is gradually declining

Photo 4-4: Plantations observed in the project site

Planovate Cultivation (Isabgol)

Castor Cultivation (Arendi)

Agriculture is majorly dependent on rain, bore wells are the only source of irrigation in the study area villages. Irrigation facility is inadequate in the study area. Limited number of farmers have their own bore wells and rest are dependent only on rainfall for cultivation. Villagers of Godpar village have own a community water storage reservoir meant for irrigation in the harvest seasons. Villagers have expressed their will to improve the condition and capacity of the reservoir.

4.10.13 Vulnerability

During consultation with panchayat member, it was observed that, some vulnerable group e.g. BPL families, landless family, physically handicapped, widow etc. are present in the study area villages as shown in following **Table 4.12**. Government provides pension to those who comes in vulnerable group especially for widow and physically handicapped persons.

Table 4-12: Village-wise vulnerable ggroup

Study Area Villages	Vulnerable Groups			
	BPL Family	Physically Handicapped (Person)	Landless Families (%)	Women Headed household
Bandhara Mota	10	02	25	05
Bandhara Nana	12	01	05	02
Chubdak	100	2	250	10
Gandher	50	03	80	03

Study Area Villages	Vulnerable Groups			
	BPL Family	Physically Handicapped (Person)	Landless Families (%)	Women Headed household
Jadura	100	05	50	02
Naranpar Pasayati	41	15	130	07
Reha Mota	14	06	65	02
Reha Nana	08	04	50	04
Sanosara	150	10	30	03
Sedata	200	10	90	05
Vadasar	30	02	60	02
Vadva	00	04	05	05

Source: Primary Data, collected through field visit and survey

The project proponent should identify vulnerable community members as above mentioned during private land procurement process. Project proponent should also avoid or minimize land purchase from the vulnerable groups especially women (widow)/ disabled persons headed house hold and marginal farmers. The project proponent may also be required to focus on providing employment opportunity to the vulnerable community members and also the implementation of programme under CSR activity for them.

4.10.15 Amenities and Infrastructure

Education

It is noted that all villages have access to primary education, though secondary are restricted to a few villages. Higher secondary schools and colleges for under graduate studies are not located within the village and students travel to Bhuj or Kera town for the same.

Photo 4.6 Govt. Primary and middle school in study area Village (Reha Nana)

Health

Access to health services is very limited. Out of 12 villages only Sedata have a community health centre (CHC). People normally rely on the local unregistered practitioners. In emergency cases, they go about 10 to 25 km away to Kotda and Bhuj government hospital.

No other study area villages have any kind of health facility and the populace depend on local practitioners. The nearest health facility is about 10 to 25 km away located in Kotda and Bhuj government hospital respectively. General diseases that is observed to be prevalent in the study area villages is cough & cold, diseases borne out of mosquito-bites like malaria etc.

Photo 4.7 Consultation with Nurse at Community Health Centre in Sedata Village

Drinking Water

It was informed by both Panchayat samiti and community that piped water supply system through reservoirs exists in all the villages. Water is supplied to individual households at a nominal charge of Rs. 60-100 per month/ household in most of the villages. The charges are variable across the villages. All the study area villages have RO water facilities in small units in the schools. As informed by the teacher, due to lack of maintenance most of the RO filters are not working. Some villages are facing serious water scarcity. Ground water depth is more than 500 ft. to 1000 ft. in the consulted area villages.

The only exception is Godpad village where a community RO Water Filter with a 1000 liter capacity above ground water storage tank has been constructed. This has been possible through a voluntarily contribution made by the villagers to the Gram Panchyat. At present the RO water filter is maintained by the panchayat. A nominal charge of Rs. 100/ household / year is charged for maintenance of the RO water filters.

Photo 4.8 Drinking water facility in the study area villages

Roof top tank at individual household toilet in Sanosara village

RO water filter at Godpad Village

Source of Fuel for Cooking

Most of the villagers in all the surveyed villages use fire wood, cow dung, and crop residue as fuel for cooking. Out of the study area villages Sanosara and Vadasar has the highest and lowest percentage of LPG users i.e. 25% and 5% respectively.

Electricity

Households of all study area villages were observed to have electricity connections in the proposed project area. It was told by the local people that electricity is available almost 24 hours. Tariffs are being charged for these connections.

Communication and Transportation

Transportation facilities are available at the district, tehsil and village level. Auto-rickshaw, jeeps and govt. buses are the major mode of transportation in the area. Self-owned motor cycles and bicycles are frequently used private transport for the villagers. Only a few villagers own either bicycle or motor cycle.

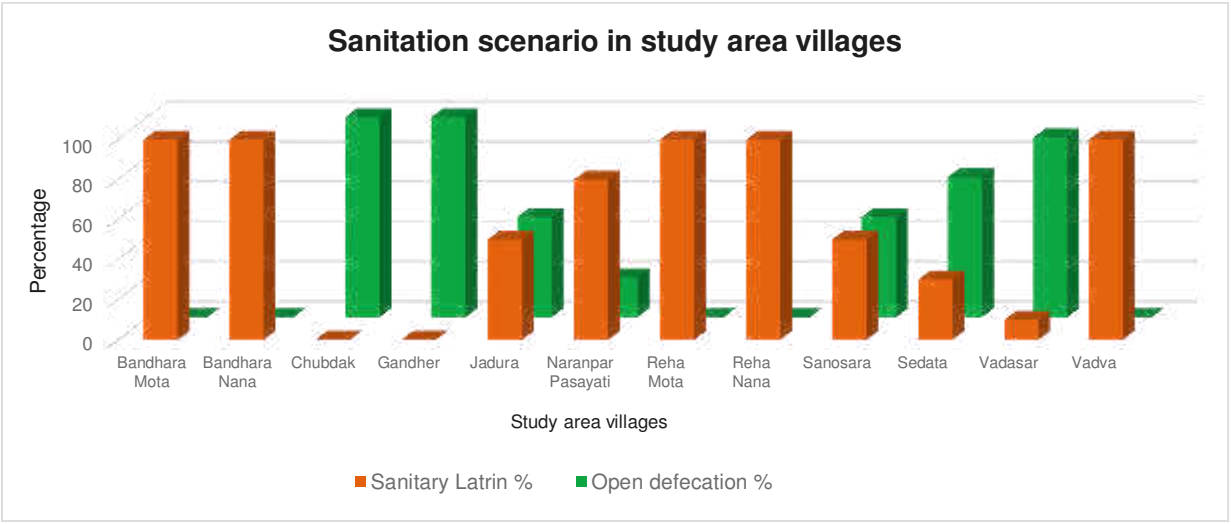
As observed during consultation Emergency No. 108/ Ambulance is not available locally in the study area, hence the local people face terrible situation during the time of emergencies.

Sanitation

Majority of households of the study area have their own sanitation facilities in form of pit latrines in the study area villages. Open defecation is practiced as well. Details of the sanitation scenario of the study area is given in **Figure 4.19**

Photo 4.9 **Transportation facilities in study area villages**

Figure 4-19 Sanitation scenario in the study area villages



Source: Primary Data, collected through Field Visit and Survey

4.10.16 Community Property Resources (CPR)

During consultation it was observed that, all the study area villages have community property. The list of community property resources in the study area is provided in **Table 4.13**

Table 4-13: Village Wise Common Property Resources

Study Area Villages	Common Property Resources (CPR)				
	Religious Place	Sacred place	Community Hall	Community Pond	Cremation Ground
Bandhara Mota	Y	N	Y	Y	Y
Bandhara Nana	Y	Y	Y	Y	Y
Chubdak	Y	Y	N	N	Y

Study Area Villages	Common Property Resources (CPR)				
	Religious Place	Sacred place	Community Hall	Community Pond	Cremation Ground
Gandher	Y	Y	N	N	Y
Jadura	Y	N	N	Y	Y
Naranpar Pasayati	Y	Y	Y	Y	Y
Reha Mota	Y	Y	Y	Y	Y
Reha Nana	Y	Y	Y	Y	Y
Sanosara	Y	N	Y	Y	Y
Sedata	Y	Y	N	N	Y
Vadasar	Y	Y	N	Y	Y
Vadva	Y	N	N	Y	Y

4.10.17 Archaeological Sites

As observed, there is no designated archaeological site present within 10 km radius of any proposed WTG locations. Though, some old temple and dargah structures was observed in a close proximity of some of the proposed locations, but none of the structures are listed as archaeological sites by Archaeological Survey of India. Details of such cultural and religious structures have been elaborated in the following chapter. A list of archaeologically and culturally important monuments is appended here in **Table 4.14**

However, care should be taken during construction activity, particularly during "earth moving" operations. World Bank's Chance find procedure must be followed, in case of any accidental find of structures or objects of probable archaeological importance. "Word Bank Chance Find Procedure" is provided in **Appendix S.**

Table 4-14 List of Archeological Monuments in Kutch District

Sl. No.	Name of Monument / Sites	Location
1	Ancient Site (Kotada)	Locality- Dholavira, Tehsil- Bhachau
2	Rao Lakha Chhatri	Bhuj
3	Siva temple	Kotai
4	Excavated Site	Surkotda

Source: http://asi.nic.in/asi_monu_alphalist_gujarat.asp

4.10.18 Cultural Heritage in Study Area

Study Area Village

Champa dala Dargah

An ancient dargah, namely Champa dala Dargah is located in Sedata village within 350 to 500 m distance from WTG No.-BHO-27. It is a more than 400 year old dargah. The area surrounding is very neatly covered by trees and stone. It was told by the community members, the dargah is abode of BB Maa, Kaiben and Champa dala. Main festival during August- September, more than 2000 pilgrim

expected during main festival. It was observed that the dargah is very popular and hold strong religious importance amongst local communities.

Photo 4.10 Champa dala Dargah at Sedata village

5.0 STAKEHOLDER CONSULTATION

Stakeholder engagement and identification of stakeholders for consultation associated with the project is an essential requirement of the ESIA study. It establishes a good relationship for successful management of environmental and social impact in project. The aim behind the consultations undertaken was to develop an understanding of the socio-economic status and culture of the community and the indigenous people.

Village profiling and community consultation has been carried out in eleven villages located in the proposed project area. Stakeholder consultation included discussion with village panchayats, Anganwadi, educational institute, Priest and community health centre etc. The list of stakeholders consulted for the proposed project is provided in **Table 5.1.** The minutes of meeting is provided in **Appendix T.**

Table 5.1 Consultation with Different Stakeholders

Stakeholder type	Name & Designation	Department/Address	Date
Panchayat Samity	Jainendra Singh	Bandara Mota	23/03/2017
	Lakha Bhai	Jadura	24/0032017
	Krishna Ben	Naranpar Pasayati	24/03/2017
	Gobin Teja	Reha Mota	23/03/2017
	Md. Kesar Ahmad Prah	Chubdak	23/03/2017
Muzawar (Priest)	Dargah, Head Priest	Champa dala dargah, Sedata	22/03/2017
Health Centre	Daya Ben, Staff Nurse	Sedata	24/03/2017
	Pramila Ben, Staff Nurse		
Primary School	R.J Vaghielu, Headmaster	Reha Nana	24/03/2017
	D.B Rathod, Teacher		
	Smt. B.L Soni. Teacher		
	G.J Parmar, Teacher		
	Smt. S.M Chaudhury, Teacher		
	Smt. U.N Mistri		
Anganwadi	Mrs. Mohan ba jee Soda Mrs. Yashwant ba Permar	Naranpar	25/03/2017
Community	Kasan Ramji Mauji Veghi Walgi mavji Patel Lal jee Vhimji Dhanji Arjan	Godpar	25/01/2017

Source: Primary consultation

Public consultation was held with the locals, anganwadi workers, public health center workers, teachers and panchayat members of various villages (Details given in **Appendix T**). Discussion was based on a set questionnaire including project specific negative and positive impacts, socio-economic resource,

demographic profile of the villages. Expectations of locals w.r.t the project development was also discussed.

During discussion, it was found that majority of stakeholder's consulted were aware about the upcoming wind power project. Locals were aware that project would involve majorly revenue land and some private land specifically for transmission line tower, access road, and pooling substation, which would be procured from the locals through a negotiation. The locals are also aware about the positive impact associated with the development of the project which would majorly bring a rise in direct and indirect job/economic opportunities. At the same time, locals were apprehensive on the health and safety risk associated with movement of heavy vehicles for transportation of WTG equipment's onsite and demanded proper health and safety plan.

Photo 5.1 View of the infrastructural facilities in the study area villages

Community pond at Godpar

Village Road (Kuchcha)

Drinking water facilities in Govt. Primary School

Sanitation structure in Govt. School

Photo 5.2 Village level consultations in the study area villages

Consultation with Sarpanch at Vadva Village

Community Consultation at Sedata Village

Meeting with School Headmaster, Reha Nana Village

Consultation with Community, Chubdak Village

Consultation with Administration (Panchayat Office)

Anganwadi worker with children at a ICDS Centre

In line with the CSR Regulations, Ostro Energy at its corporate level, has developed their own CSR Policy in alignment with its CSR vision, principles and values, for delineating its responsibility as a socially and environmentally responsible corporate citizen. The Policy lays down the areas of intervention, principles and mechanisms for undertaking various programs in accordance with Section 135 of the Companies Act 2013. The CSR Policy of Ostro is appended herewith in **Appendix U**

5.2 Grievance Redressal Mechanism (GRM)

As per the Performance Standards (PS) of IFC, the client should establish a grievance mechanism to receive and address specific concerns about compensation and relocation that are raised by displaced persons or members of host communities, including a recourse mechanism designed to resolve disputes in an impartial manner.

The grievance mechanism should be scaled to the risks and adverse impacts of the project. It should address concerns promptly, using an understandable and transparent process that is culturally appropriate and readily accessible to all segments of the affected communities, and at no cost and without retribution. The client will inform the affected communities about the mechanism during its community engagement process.

Community grievance must be recorded in specified “Community Grievance Register Format” of the project proponent (Ostro), as provided in **Appendix J**

6.0 ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

6.1 Approach & Methodology

Primary impacts are assessed for a radius of 500m around the project site and secondary impacts are assessed beyond this radius for the proposed project. Also, 100 m RoW along the transmission line route is also considered for impact assessment. The methodology adopted to assess the significance of impact associated with project activities during construction and operational has taken following criteria into consideration. Details of screening criteria are given in **Table 6-1**

Table 6-1 Screening Criteria for Environmental and Social Impact Assessment

Impact	Distribution of impact	Duration of Impact	Intensity
Low/ Short	Influence of impact within the project site boundary and ROW of Transmission line -**Site**	Limited for duration of less than 6 months	Limited local scale impact resulting in temporary disturbance/loss of environment/social components
Moderate/ Medium	Spread of impact within 2 km from the of the project site boundary – **Buffer**	Impact may extend up to 2 years	Local scale impact resulting in short term change and/or damage to the environment components.
High/ Long	Influence of impact between 2 km to 5km from the project site boundary – **Widespread**	impact extends beyond 2 years	Regional impact resulting in long term changes and/or damage to the environment components.

Significance Evaluation Matrix

Significance evaluation matrix as shown in **Table 6-2** has been used to evaluate the significance of identified potential environmental impacts. This matrix includes criteria as discussed above to analyse the significance of impact. Colour codes have been given to signify the impact intensity.

The environmental impacts associated with the project activities have been identified and analysed to evaluate their significance. Because of clean category projects, environmental impacts are very few with minor significance and can be controlled through mitigation measures.

Table 6-2 Impact Significance Matrix

Distribution	Duration	Intensity	Significance
Within Site	Short	Low	LOW
Within Site	Short	Moderate	
Within Site	Medium	Low	
Within Site	Medium	Moderate	
Within site	Long	Low	
Buffer area	Short	Low	
Widespread	Long	Low	
Within Site	Short	High	MODERATE
Within Site	Medium	High	
Within Site	Long	Moderate	
Within Site	Long	Low	

Buffer area	Short	Moderate	
Buffer area	Medium	Low	
Buffer area	Medium	Moderate	
Buffer area	Long	Low	
Buffer area	Long	Moderate	
Widespread	Short	Low	
Widespread	Short	Moderate	
Widespread	Medium	Low	
Widespread	Medium	Moderate	
Widespread	Long	Moderate	
Within Site	Long	High	
Buffer area	Short	High	
Buffer area	Long	High	
Widespread	Short	High	
Widespread	Medium	High	HIGH
Widespread	Long	Moderate	
Widespread	Short	Low	
Widespread	Short	High	
			NO IMPACT
			POSITIVE IMPACT

Key project related activities of Ostro Kutch Wind Power project during separate phases like Pre-construction phase, Construction phase, Operation & Maintenance phase (O & M) and Decommissioning phase has been listed in Table 6.3

Table 6-3 Project related activities in different phases of project

Pre-Construction Phase	Construction Phase	Operation & Maintenance Phase	Decommissioning Phase
Micro siting of WTG locations	Site clearance	Movement of Site vehicles for plant inspection	Dismantling and demolishing of structures
Planning related to power evacuation process	Hauling of earth materials within site	Inspection and operation check for all WTGs	Excavation, backfilling and restoring site to original conditions
Access road leading to WTG site planning	Movement of heavy vehicles carrying Construction material, machinery & its storage	O & M of ancillary facilities like yards and stores.	
Land purchase or lease process	Access road creation	Inspection and operation check of transmission lines	

Various approvals process from government	Setting up of labour camp	Storage of Hazardous material onsite	
Planning of ancillary facilities like yards, stores, etc.	Storage of waste from labour camp	Disposal of hazardous material	
	Waste generation from site	Waste disposal	
	Hazardous waste generation and storage onsite	Addressing the grievances of local people	
	Waste water generation from site and labour camp	Undertaking CSR activities in the project area	
	Erection of WTGs	Substation operation monitoring and power generation	
	Substation construction		
	Transformer yard construction		
	Pole laying and Transmission line erection		

Table 6.4 represents the overall Activity Impact Matrix for the project activities and related impacted resources or receptors. The cells that are coloured “red” denotes the likelihood to cause impact that is generated due to the interaction from project activities. It has a potential to cause significant effect on the resource or receptor and can alter the baseline conditions. All the other cells which are coloured “white” are ‘scoped out’ as these may or may not generate any impact on interaction. These impacts are not significant enough to cause any baseline alterations. Cells highlighted in ‘orange’ indicates moderate impact, cell highlighted in yellow show minimal impact and cells highlighted in green show positive impact.

Table 6-4 Impact Aspect Matrix for Construction and Operation Phase

		PHYSICAL ENVIRONMENT											BIOLOGICAL ENVIRONMENT						SOCIO-ECONOMIC ENVIRONMENT						
	Resources & Receptors	Visual Aesthetics	Topography	Air Quality	Noise Impact	Ground water Quality	Surface water quality	Top soil removal/ Soil	Land use	Ground water resources	Local Drainage and Physiography	Aviation Hazard	Terrestrial habitat	Ecological Sensitive Areas	Aquatic Habitat and resources	Agriculture	Domesticated Animals	Avifauna habitat	Loss of land	Common Property Usage Conflict	Community Health and Safety	Local Job and Economic Opportunity	Land based livelihoods	Cultural and behavioural Heritage	Occupational Health & Safety
Project Phase	**Activity**																								
Pre- Construction	Micro siting of WTG locations																								
	Planning related to power evacuation process																								
	Access road leading to WTG site planning																								
	Land purchase or lease process																					P	P		
	Various approvals process from government																								
	Planning of ancillary facilities like yards, stores, etc.																								
Construction	Sourcing and transportation of construction material etc.	**L**		**M**	**L**			**L**			**L**		**L**							**L**	**L**			**M**	**M**
	Storage and handling of raw material and debris	L		L		L		L	L												L				M
	Establishment of labour camp and hiring of labour.	L		L	L			L					L									P		L	
	Operation of DG sets			L	L																				
	Access road construction	M		L	L								M						L		L	P		L	L
	Site Clearance	M		L	L			L					M									P			L
	Foundation excavation	M		L	L						L		L									P			M
	Transportation of WTG components to site and storage	M		L	L								L								M	P			M
	Erection of WTG's	M	M	L	L				M	L												P			M
	Transformer yard construction	M		L	L					L			L									P			M
	Substation construction	M		L	L					L			L									P			M
	Laying of transmission lines	M		L	L								M						M		L	P	L		M
Operation & Maintenance	Physical Presence at site during routine inspection and operation of all WTG's																								
	Periodic maintenance of all WTG's at every location																							M	M

		PHYSICAL ENVIRONMENT											BIOLOGICAL ENVIRONMENT						SOCIO-ECONOMIC ENVIRONMENT						
	Resources & Receptors	Visual Aesthetics	Topography	Air Quality	Noise Impact	Ground water Quality	Surface water quality	Top soil removal/ Soil	Land use	Ground water resources	Local Drainage and Physiography	Aviation Hazard	Terrestrial habitat	Ecological Sensitive Areas	Aquatic Habitat and resources	Agriculture	Domesticated Animals	Avifauna habitat	Loss of land	Common Property Usage Conflict	Community Health and Safety	Local Job and Economic Opportunity	Land based livelihoods	Cultural and behavioural Heritage	Occupational Health & Safety
	Maintenance of ancillary facilities such as store, yard, site office, transmission lines																							M	M
	Security of WTG's in operation				L																M	P		M	M
	Operation of wind turbines		M		L							H						M			M	P			
Decommissioning	Dismantling and Demolishing of structures	L		L	L						L										L	P			M
	Excavation and Backfilling			L				L	L		L											P			M

6.2 Impacts on Physical Environment

6.2.1 Air Quality

The impact on ambient air quality is anticipated due to the various project activities. Analysis of project activities, significance of associated impact on ambient air quality and mitigation measures are described below:

Construction Phase

During construction phase, various project components such as transmission cable laying, switchgear, approach roads, internal road network and porta cabin construction require land clearing, levelling, excavation, grading activities, vehicle movement, DG set operation. This results in an increased level of dust and particulate matter emissions, which in turn will directly and temporarily impact ambient air quality. If improperly managed, there is a risk of nuisance and health effects to construction workers onsite and to a lesser extent to nearby receptors from windblown dust (on the village approach roads of the project site) due to transportation of raw materials. The baseline monitoring results show concentrations of all the ambient air quality parameters (PM_{10}, $PM_{2.5}$, SO_2, NOx and CO) at all three monitoring stations well below the NAAQS permissible limit.

However, most of these project activities are expected to be restricted within the project boundary. Further, the movement of vehicles carrying raw materials on unpaved area within the project site and on access road causes fugitive dust emission and may extend to surrounding of project site like nearest settlements. Hence, the distribution of impact can be considered widespread, duration of impact is short an intensity of the impact as medium, the impact can be termed as of ***Moderate*** significance. But, the impact is reversible, and temporary in nature, if the following mitigation measures are adopted.

Mitigation Measures:

- Vehicles speed to be restricted to 20-30 km/hr. on unpaved road.
- Raw material should be covered with tarpaulin sheet during transportation and in storage area
- Water sprinkling on unpaved area but ensure use of tanker water purchased form suitable authorised vendor only.
- All the project vehicles should have valid Pollution under Control (PUC) certificate. Ensure regular maintenance of project vehicles during construction and operational phase.
- Turn off the machineries when not in use.

Operational Phase:

During operational phase, there would be minimal vehicular movement about 2-3 project vehicles for commuting purpose. DG sets will be only be used as a backup during power supply failure. Considering the above facts as well as the distribution of impact as within site, duration as long and intensity as low, the impact on ambient air quality is considered of ***Low*** significance.

The positive impact of the project on air quality will be the benefit provided by the replacement of conventional power generation with renewable energy. Wind energy will replace fossil fuel power energy generation (primarily coal powered), therefore carbon dioxide emissions into the atmosphere will be reduced. Overall the project will have a beneficial impact on air quality due to the replacement of non-renewable energy generation.

OVERALL IMPACT ASSESSMENT

The overall assessment suggests that the proposed project will lead to minor impact on air quality during construction phase due to fugitive dust emissions due to movement of project vehicles through village roads. During operation phase the proposed will have access roads constructed for approaching the WTGs and 2-3 vehicles would be used for operation and maintenance. Hence, insignificant impact on air quality is anticipated.

Project Phase	Risk Assessed
Construction	**Moderate**
Operation	**Low**

6.2.2 Soil Quality

These impacts are associated with the project activities such as erection of WTG towers, construction of access roads and storage of diesel, spent oil or transformer oil.

Top Soil Loss and Soil Contamination
The environmental impact anticipated in the proposed project is top soil loss and potential soil contamination. These impacts are associated with the project activities such as tower foundations, road construction, storage of diesel, spent oil, generation of used oil from running of DG sets during construction period. Analysis of project activities, associated impacts, their significance in construction and operational phases and mitigation measures are described below:

Construction Phase:

The project has been proposed on open scrub government land. The soil of the region is reddish brown in colour and is poor in fertility. During construction phase, activities that cause land disturbance include installation of tower foundations, road preparation, excavation, etc. Excavation will be carried out to the minimum. The soil will be mainly excavated for laying foundation of towers, site levelling and road work. The soil structure of this area is rocky and loamy. This rocky excavated earth material be utilized on site for road soling and site levelling as per requirement.

Loose top soil is generated due to excavation on project site due to site levelling for erection of WTG towers and access roads. The impact anticipated here is loss of top soil because of inappropriate storage. However, these activities and associated impacts are limited to be within the project boundary and during construction phase only. In general, the topography of the site is undulating with rocky terrain and hence there would be requirement of levelling for the erection of WTG's. Considering the buffer area distribution, short duration of construction phase and low intensity, significance of impact is evaluated as ***Low***. Soil contamination may result due to accidental spillage and inappropriate storage of diesel or used oil during construction phase. However, distribution of impact within the site and short duration of construction phase makes impact of ***Low*** significance and can be controlled with the recommended mitigation measures:

Mitigation Measures:

- Provide appropriate storage of top soil in an isolated and covered area to prevent its loss in high wind and runoff.
- Allow only covered transportation of top soil within the project site.
- Use top soil at the time of plantation and it can be given to nearby agricultural field after taking consent with the landowners/farmers.
- Plantation activities should be undertaken by OKWPL to appease the chances of soil erosion.
- Store hazardous material like diesel and used oil in isolated room and on impervious surface to prevent seepage into project site soil.
- Filling and transfer of oil to and from the container should be on impervious surface

Operational Phase:

During operational phase, project activities such as excavation and usage of chemicals such as diesel and spent oil will be absent therefore impact associated with these activities such as top soil loss and soil contamination are not anticipated in operational phase of the project. Considering all above facts, as well as the distribution of impact within site, short duration and low intensity, the impact can be termed as ***Low*** significance.

Care should be taken with regard to possible changes in soil quality due to human activities, such as disposal of waste material and domestic effluents on soil of the surrounding area. Waste water holding tanks / septic tank will be located at more than 500 m away from bore wells or any other underground water holding tanks in surrounding areas. Very small quantity of solid waste will be generated by workers during project operation, and this material will be handled and disposed of in an approved manner; therefore, no soil contamination will result. Taking the distribution of impact as within, duration short and intensity as low, the impact due to water abstraction will be **"Low"**

Mitigation Measures:

- All the hazardous material like transformer waste oil, oil for DG sets should be properly stored in designated areas and timely disposed to the nearest Common Hazardous waste TSDF facility after obtaining due permissions.

OVERALL IMPACT ASSESSMENT

The overall assessment suggests that the proposed project will have minor impact due to construction phase and operation phase on soil loss and contamination of soil due to project activity.

Project Phase	Risk Assessed
Construction	**Low**
Operation	**Low**

6.2.3 Noise Level

Noise is mostly generated during construction and operation period. Activities like road excavation, WTG foundation, grading, concrete batching etc. and wind turbine operation, blade movement generate noise. It may have impact on nearby settlements depending on its distance. Further details and mitigation measure have been presented below.

Construction Phase:

(A) Impact on Communities

The construction activity will be mainly carried out during day time. Project construction involves activities such as road construction, grading, excavating and drilling of tower foundations, concrete batching, tower erection, construction of ancillary structures, and operation of diesel generators, concreting, material movement and site cleanup. The WTG locations are located in an area with no continuous noise generating sources in the vicinity. Noise levels generated by construction equipment vary significantly depending on the type and condition of equipment, operation methods and schedule, will generally be in the range of 84–109 dB(A).

INDICATIVE NOISE FROM CONSTRUCTION EQUIPMENTS AS PER WTG LOCATIONS IDENTIFIED

The table shows the noise generated from different type of vehicles during the construction phase and presents an analysis of the noise level impact on the receptors (identified during modelling) located within a range of 197m – 455m. The average noise impact generated due to construction equipment's located at maximum distance of 455m is 39.31Dba and the average noise generated impact generated due to construction equipment's located at minimum distance of 197m is 47.87dBA, which is above the CPCB prescribed noise standard limit set for Residential areas i.e. 45dBA. (**Refer Table 6.5**) based on the following noise propagation equation.

$$L_p = L_w - 10 \log_{10} (2\pi R^2) - \alpha R$$

Here, Lp = sound pressure level (dB) at a distance of R from a noise source radiating at a power level,

Lw = sound pressure level (dB) at source

R = distance of receptor from source

α = frequency dependent sound absorption coefficient.

The above given equation can be used with either broadband sound power levels and a broadband estimate of the sound absorption coefficient (α = 0.005dB(A)/meter).

Table 6.5 Indicative noise from different equipment's and vehicles as per WTG identified

S. N	Type of Vehicle	Description	Typical Sound Power	Receptor No. G(BHO156a) (distance-455m from BHO 156)	Receptor No. L(KUT 73a) (distance-197m from KUT73)
1	Passenger Vehicle	Passenger Vehicle	85	21.59	30.15
2	Trucks	10 ton capacity	95	31.59	40.15
3	Cranes	Overhead and mobile	109	45.59	54.15
4	Mobile Construction Vehicles	Front end loaders	100	36.59	45.15
5	Mobile Construction Vehicles	Excavators	108	44.59	53.15
6	Mobile Construction Vehicles	Bull Dozer	111	47.59	56.15
7	Mobile Construction Vehicles	Dump Truck	107	43.59	52.15
8	Mobile Construction Vehicles	Water Tanker	95	31.59	40.15
9	Stationary construction equipment	Concrete Mixer	110	46.59	55.15
10	Compressor	Air compressor	100	36.59	45.15
11	Compressor	Vibratory compactor	110	46.59	55.15

(B) Impact on Workers at Project Site

Workers in close proximity to machines are prone to exposure of high levels of noise of machinery. This will be taken care by proving personal protective equipment like ear plugs/muffs and works will be rotated in shifts to avoid long term noise exposure. However, considering the temporary nature and short-term duration of project activities minor significant impact is anticipated The ambient noise levels in the area were monitored

at three locations in nearby settlement (Jadura near wind turbine no. BHO 154, Ajaapur village, and Kurbai village near wind turbine KUT49). Monitored results for day & night were within the applicable CPCB standards for ambient noise set for residential area. Considering the short duration, localized distribution and low intensity, impact has been assessed as ***Low*** significance.

Mitigation measures

- Keep stationary source of noise such as DG sets (currently used only for back up) at farthest point from the settlements
- Restrict major noise generating activities during night time 10:00 pm to 6:00 am
- Provide personal protective equipment (PPE) to workers, wherever noise is generated due to machinery operation.
- Regular maintenance of project vehicles.

Operation Phase from Wind Turbines

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. Aerodynamic noise generation is very sensitive to the speed of translation at the very tip of the blade. To limit the generation of aerodynamic noise, modern wind turbines limit the rotor rotation speeds. Large variable wind turbines in general rotates at slower speeds in low winds and its rotational speeds increases with increase in wind speed until the limiting rotor speed reached. This results in much quieter operation in low winds than a comparable constant wind speed turbine. Recent improvement in mechanical design of wind turbines have resulted in significantly reduced mechanical noise from both broadband and pure tones. Thus, the noise emission from modern wind turbines is dominated by broadband aerodynamic noise (Fegeant, 1999). Blades moving through the air produce an aerodynamic noise. This noise is detectable when it is greater than the background noise, generally at wind speeds up to 8 meters per second.

Wind Turbines for the proposed project will be of Vestas make V110-2.0 MW. The model has aerodynamic design of the blade tip and mechanical components design minimize noise emissions. This operational mode and mechanical design improvement contributes considerably to the minimization of noise. Some of noise levels for different activities are as follow:

Table 6.6 Noise levels for different activities

Source/Activity	Indicative Noise Level dB (A)
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Car at 40mph at 100m	55
Busy general office	60
Truck at 30mph at 100m	65
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

Source: The Scottish Office, Environment Department, Planning Advice Note, PAN 45, Annex A: Wind Power, A.27. Renewable Energy Technologies, August 1994

Committee on Environmental Impacts of Wind Energy Projects, National Research Council (2007). Environmental Impacts of Wind-Energy Projects, p. 158-9.

Impact due to Wind Turbine Noise

The ability to hear wind turbines noise depends on the ambient noise level. When the background noise level and wind turbine noise are of the same magnitude, the wind turbine noise gets masked by the background noise. Therefore, wind turbine noise level of higher magnitude than background noise level can be considered as significant. However, this noise level can be reduced by the aerodynamic design of the V110 turbine. The assumptions made for modelling are:

- Noise modelling has been conducted assuming the 95% of WTG rated power,
- Wind speed considered is between 3.0 m/s - 20.0 m/s, step 1.0 m/s
- There is continual sunshine and permanently cloudless skies from sunrise to sunset.
- There is sufficient wind for continually rotating turbine blades.
- Rotor is perpendicular to the incident direction of the sunlight.
- Sun angles less than 3 degrees above the horizon level are disregarded (due to likelihood for vegetation and building screening).
- Distances between the rotor plane and the tower axis are negligible.
- Light refraction in the atmosphere is not considered.

CUMULATIVE NOISE MODELLING RESULTS OBTAINED AS PER WTG LOCATIONS IDENTIFIED

Noise Modelling results show **NONE** of the WTG locations will have noise generated above the CPCB standard set for day and night time i.e. 55dBA and 45dBA respectively for residential areas. The noise level modelled at range between 36.7 – 44.9dBA. However, on computing the cumulative noise, it has been found that cumulative noise level during day time is within CPCB day time standard i.e. 55dBA, whereas the cumulative noise level during night time was found to be slightly above the CPCB night time std. of 45dBA. The night time cumulative noise levels was found in the range of 45.3 – 47dBA.

Table 6.7 Noise modelling results detailing the Noise level received at the noise receptors w.r.t to the nearest WTG locations (day time)

Impacting WTG locations	Noise Receptor	Distance	Village	Receptor Coordinates		WTG noise level predicted dB(A)	Ambient noise level monitored at the nearest village dB(A)	Total Noise*	Incremental Noise
				Eqsting	Northing				
BHE-26	A(BHE26 N)	341m	Filon	537429	2559294	**40.5**	51.7 (Ajaapur)	**52**	0.3
BHE- 22	B(BHE 22N)	289m	Nabhoi Moti	540623	2559444	**42.5**	51.7 (Ajaapur)	**52.2**	0.5
BHE-29	C(BHE29 N)	392m	Virani	538485	2557127	**39.1**	51.7 (Ajaapur)	**51.9**	0.2
KUT-18	D(KUT18 N)	328m	Ajapar	542325	2558047	**41.5**	51.7 (Ajaapur)	**52.1**	0.4
BHO-199	E(BHO19 9N)	349m	Ajapar	542315	2557859	**41.6**	51.7 (Ajaapur)	**52.1**	0.4
BHE-08	F(BHE08 N)	425m	Ludva	543000	2554298	**38.3**	51.7 (Ajaapur)	**51.9**	0.2
OLD-19	G(OLD19 N)	277m	Meghpar	555264	2555794	**41.2**	51.7 (Ajaapur)	**52**	0.3
OLD-19	I(OLD 19N)	442m		555561	2555497	**36.7**	51.7 (Ajaapur)	**51.8**	0.1
KUT- 90	A(KUT 90N	321m	Kurbai	540591	2562840	**41.9**	53.9 (Kurbai)	**54.2**	0.3

BHO- 165	B(BHO 165aN)	255m		539986	2563951	**42.6**	53.9 (Kurbai)	**54.2**	0.3
BHO-165	C(BHO16 5bN)	417m		539810	2,564,061	**39.4**	53.9 (Kurbai)	**54**	0.1
BHO- 164	D(KUT 30N)	335m		537134	2564262	**42**	53.9 (Kurbai)	**54.2**	0.3
BHO- 164	E(BHO 164N)	244m		537200	2564329	**44**	53.9 (Kurbai)	**54.3**	0.4
BHO-189	F(BHO18 9aN)	403m	Samatra	548832	2564833	**37.8**	53.9 (Kurbai)	**54**	0.1
BHO-189	G(BHO18 9bN	248m		548601	2,564,962	**42.3**	53.9 (Kurbai)	**54.2**	0.3
BHO-189	H(BHO18 9cN)	398m		548491	2565174	**38**	53.9 (Kurbai)	**54**	0.1
BHO-193	J(BHO193 N)	416m	Kanpar	547995	2567286	**40.4**	53.9 (Kurbai)	**54.1**	0.2
KUT- 73	L(KUT 73 (a)N)	197m	Nagiyari	551270	2566516	**44.2**	53.9 (Kurbai)	**54.3**	0.4
KUT- 73	M(KUT 73 (b)N	279m		551302	2566422	**41.3**	53.9 (Kurbai)	**54.1**	0.2
BHO- 71	A(BHO 71N)	392m	Sakrai Timbo	581235	2557924	**39.6**	53.6 (Jadura)	**53.8**	0.2
BHO-114	B(BHO11 4N)	377m	Gandher	587673	2562181	**39.4**	53.6 (Jadura)	**53.8**	0.2

BHO-97	C(BHO97 b N)	229m	Chubdak	590787	2561961	**43**	53.6 (Jadura)	**53.9**	0.3
BHO-97	D(BHO97 aN	310m		590997	2562336	**40.8**	53.6 (Jadura)	**53.8**	0.2
BHO- 98	F(BHO 98N)	269m	Chubdak	592245	2561868	**41.8**	53.6 (Jadura)	**53.9**	0.3
BHO- 111	A(BHO 111 (a) N	294m	Bandhara Nana	576,975	2,550,548	**42.2**	53.6 (Jadura)	**53.9**	0.3
BHO- 111	C(BHO 111 (b)N)	294m		577,175	2,550,806	**44**	53.6 (Jadura)	**54**	0.4
BHO-113	B(BHO 113N)	434m	Bandhara Nana	577,525	2,550,549	**40.3**	53.6 (Jadura)	**53.8**	0.2
BHO-160	F(BHO16 0N)	225m	Reha Mota	573,224	2,559,349	**43.3**	53.6 (Jadura)	**54**	0.4
BHO- 35	G(BHO 35N)	455m	Jadura	571,583	2,559,019	**38.3**	53.6 (Jadura)	**53.7**	0.1
BHO-156	H(BHO15 6aN)	361m		571,490	2,561,194	**40.5**	53.6 (Jadura)	**53.8**	0.2
BHO-156	I(BHO156 -bN)	410m		571,048	2,561,109	**39.8**	53.6 (Jadura)	**53.8**	0.2
BHO-31	J(BHO31 N)	443m		570,379	2,560,981	**38.6**	53.6 (Jadura)	**53.7**	0.1
BHO- 27	K(BHO 27 N)	299m	Sedata	565,691	2,559,603	**40.6**	53.6 (Jadura)	**53.8**	0.2

Table 6.8 Noise modelling results detailing the Noise level received at the noise receptors w.r.t to the nearest WTG locations (night time)

Impacting WTG locations	Noise Receptor	Distance	Village	Receptor Coordinates		WTG noise level predicted dB(A)	Ambient noise level monitored at the nearest village dB(A)	Total Noise*	Incremental Noise
				EASTING	NORTHING				
BHE-26	A(BHE26N)	341m	Filon	537429	2559294	**40.5**	40.8 (Ajaapur)	**43.8**	3
BHE- 22	B(BHE 22N)	289m	Nabhoi Moti	540623	2559444	**42.5**	40.8 (Ajaapur)	**44.6**	3.8
BHE-29	C(BHE29N)	392m	Virani	538485	2557127	**39.1**	40.8 (Ajaapur)	**42.9**	2.1
KUT-18	D(KUT18N)	328m	Ajapar	542325	2558047	**41.5**	40.8 (Ajaapur)	**44**	3.2
BHO-199	E(BHO199N)	349m	Ajapar	542315	2557859	**41.6**	40.8 (Ajaapur)	**44.1**	3.3
BHE08	F(BHE08N)	425m	Ludva	543000	2554298	**38.3**	40.8 (Ajaapur)	**42.6**	1.8
OLD-19	G(OLD19N)	277m	Meghpar	555264	2555794	**41.2**	40.8 (Ajaapur)	**44.2**	3.4
OLD-19	I(OLD 19N)	442m		555561	2555497	**36.7**	40.8 (Ajaapur)	**42.3**	1.5
KUT- 90	A(KUT 90N	321m	Kurbai	540591	2562840	**41.9**	42.1 (Kurbai)	**44.9**	2.8

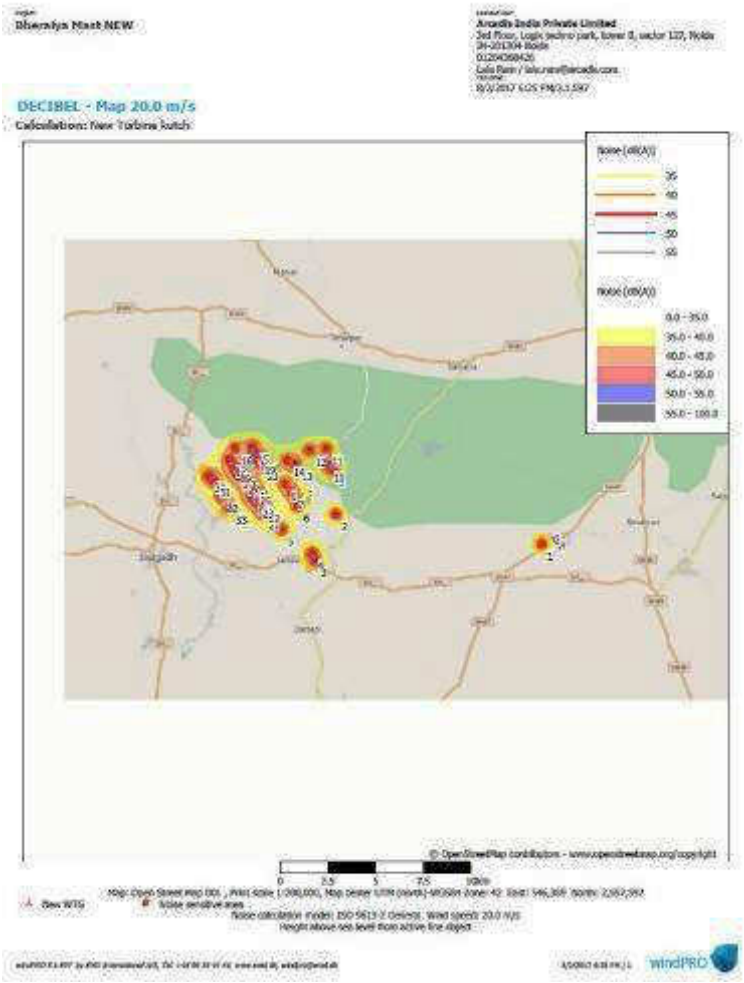
BHO- 165	B(BHO 165aN)	255m		539986	2563951	**42.6**	42.1 (Kurbai)	**44.6**	2.5
BHO-165	C(BHO16 5bN)	417m		539810	2,564,061	**39.4**	42.1 (Kurbai)	**43.9**	1.8
BHO- 164	D(KUT 30N)	335m		537134	2564262	**42**	42.1 (Kurbai)	**45.1**	3
BHO- 164	E(BHO 164N)	244m		537200	2564329	**44**	42.1 (Kurbai)	**46.1**	4
BHO-189	F(BHO18 9aN)	403m	Samatra	548832	2564833	**37.8**	42.1 (Kurbai)	**43.6**	1.5
BHO-189	G(BHO18 9bN	248m		548601	2,564,962	**42.3**	42.1 (Kurbai)	**45.3**	3.2
BHO-189	H(BHO18 9cN)	398m		548491	2565174	**38**	42.1 (Kurbai)	**43.6**	1.5
BHO-193	J(BHO193 N)	416m	Kanpar	547995	2567286	**40.4**	42.1 (Kurbai)	**44.2**	2.1
KUT- 73	L(KUT 73 (a)N)	197m	Nagiyari	551270	2566516	**44.2**	42.1 (Kurbai)	**46.3**	4.2
KUT- 73	M(KUT 73 (b)N	279m		551302	2566422	**41.3**	42.1 (Kurbai)	**44.6**	2.5
BHO- 71	A(BHO 71N)	392m	Sakrai Timbo	581235	2557924	**39.6**	42.5 (Jadura)	**44.3**	1.8
BHO-114	B(BHO11 4N)	377m	Gandher	587673	2562181	**39.4**	42.5 (Jadura)	**44.3**	1.8

BHO-97	C(BHO97 b N)	229m	Chubdak	590787	2561961	**43**	42.5 (Jadura)	**45.5**	3
BHO-97	D(BHO97 aN	310m		590997	2562336	**40.8**	42.5 (Jadura)	**44.6**	2.1
BHO- 98	F(BHO 98N)	269m	Chubdak	592245	2561868	**41.8**	42.5 (Jadura)	**45**	2.5
BHO- 111	A(BHO 111 (a) N	294m	Bandhara Nana	576,975	2,550,548	**42.2**	42.5 (Jadura)	**45.5**	3
BHO- 111	C(BHO 111 (b)N)	294m		577,175	2,550,806	**44**	42.5 (Jadura)	**46.1**	3.6
BHO-113	B(BHO 113N)	434m	Bandhara Nana	577,525	2,550,549	**40.3**	42.5 (Jadura)	**44.6**	2.1
BHO-160	F(BHO16 0N)	225m	Reha Mota	573,224	2,559,349	**43.3**	42.5 (Jadura)	**45.8**	3.3
BHO- 35	G(BHO 35N)	455m	Jadura	571,583	2,559,019	**38.3**	42.5 (Jadura)	**44**	1.5
BHO-156	H(BHO15 6aN)	361m		571,490	2,561,194	**40.5**	42.5 (Jadura)	**44.6**	2.1
BHO-156	I(BHO156 -bN)	410m		571,048	2,561,109	**39.8**	42.5 (Jadura)	**44.3**	1.8
BHO-31	J(BHO31 N)	443m		570,379	2,560,981	**38.6**	42.5 (Jadura)	**44**	1.5
BHO- 27	K(BHO 27 N)	299m	Sedata	565,691	2,559,603	**40.6**	42.5 (Jadura)	**44.6**	2.1

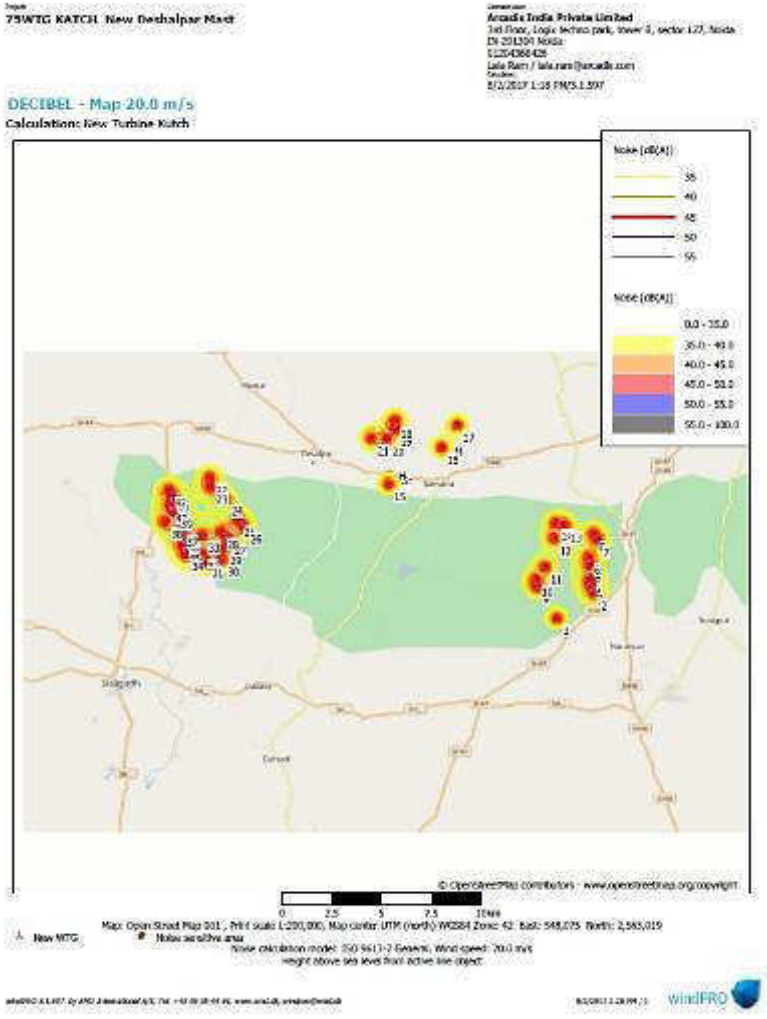
Cumulative total noise has been computed considering the Casella USA training information on decibel addition and subtraction. A table of correction noise correction has been used, based on which the incremental noise has been computed by adding the noise correction to the higher noise level value. However, this noise level can be reduced by the aerodynamic design of the V110 turbine**.** The noise modelling map has been shown below in **Figure 6.1**

Figure 6.1 Noise modelling map

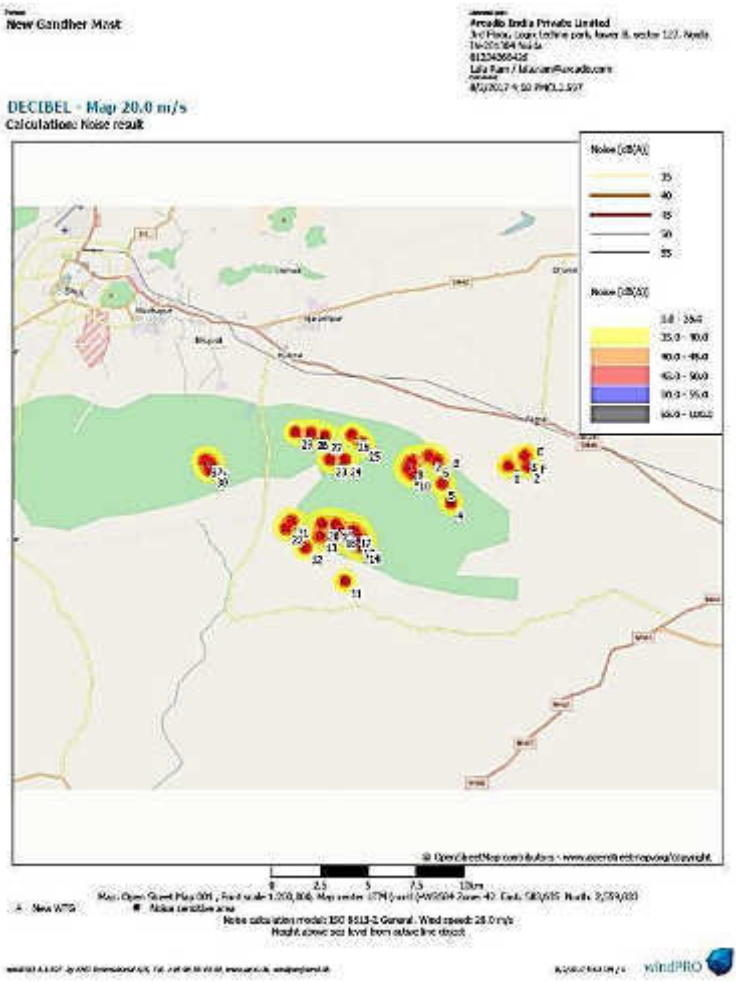
Bheraiya mast



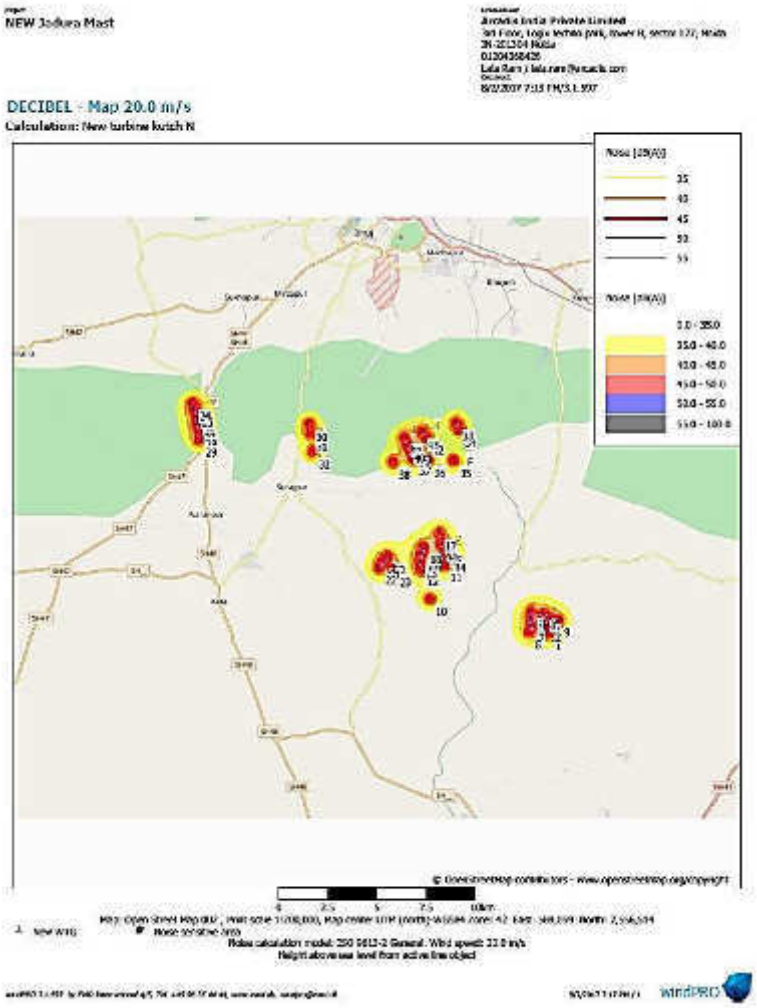
Deshalpar mast



Gandher mast



Jadura mast



From the noise modeling analysis (through windpro software) it was found that about 6 WTGs will be impacting 7 receptors in terms of the night time noise level (NAQQS) prescribed by Ministry of Environemnt, Forests and Climate Change (Govt of India). The WTGs are BHO-164, BHO-189, KUT-73, BHO-97, BHO-111 and, BHO-160. The level of noise estimated at those receptors will be between 45.3 to 46.3 d(B)A, which slightly exceed the NAQQS standards (45 d(B)A) for night time noise. Hence, the level of impact from operational turbines cannot be considered as any issue.

Overall Impact Assessment

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No impact**

Impact Due to Transmission Line

The proposed 220 kV transmission line is of 62 km (approximately). A total of 190 towers of DA+DB+DC+DD+DDE type have been planned for power evacuation, which will cross eighteen villages. The approach route identified for the transmission line was based on a criterion to reduce the environmental and socioeconomic footprint of the transmission line. Based on the observation made pertaining to the proposed transmission line and the information provided by Ostro, it was observed that the line route does not fall under any habitations and thick vegetation/forest cover. No households or community structures are in the route of the transmission line. There are no environmentally sensitive sites, archaeologically significant sites, areas of ecological and cultural significance present on the proposed transmission line route. The transmission lines will cover mostly along the scrub lands or abandoned waste lands. Therefore, the impact due to proposed transmission line is considered to be low.

Overall Impact Assessment

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No impact**

6.2.4 Drainage and Physiography

Although, topography of almost all WTG's have undulating land. Levelling or filling is expected to cause change in terms of natural drainage pattern due to alteration in contour level.

Construction Phase:

Levelling would be required for almost all WTG locations falling on undulating rocky terrain. Besides, the construction of access road involves levelling of land. This might bring in some minor changes in the contour level and natural drainage pattern in the project area. The levelling required may involve alternation in smaller drainage channels. However, it should also be ensured that levelling of project site will not cause accumulation of surface runoff in adjacent surrounding areas. Considering the limited distribution of impact (within the site),

short duration of activities and flat topography of site as well as low, the significance of impact is assessed as **Low**.

Mitigation Measures:

- Designing of contour level with minimum alteration to be considered for the project site.
- Provide alternatives to collect surface runoff from the project site during the monsoon period.
- Don't allow exit of runoff from the project site in the adjacent surrounding land area.

Operational Phase:

In operational phase, project activities causing the alteration of natural drainage pattern do not exist therefore associated impact is not anticipated and can be termed as **No Impact.**

OVERALL IMPACT ASSESSMENT

The overall assessment suggests that the proposed project will have low impact on drainage pattern during construction phase and no impact during operation phase

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No Impact**

6.2.5 Water Resource

Water is required for various project activities, fulfilment of this water requirement through ground water may have impact in terms of ground water depletion. However, severity of impact depends on the ground water potential.

Construction Phase:

In the construction phase, water requirement for civil work per WTG would be 60.0KL, which works out to be 7500KL for construction of 125 WTG's.During peak construction phase, about 600-700 construction workers will be employed. Hence, the total domestic water requirement purpose is 31.5KLD. In operational phase, there will be over 35-40 staff available onsite including security guards. Water requirement will be only for drinking, which will be met by packaged drinking water.

As discussed in Chapter 4, studies undertaken by CGWB have categorized Bhuj taluk as "Critical" area as per groundwater development perspective. Taking the distribution of impact as buffer area, duration short and intensity as low, the impact due to water abstraction will be **"Low"**

Mitigation Measures:

- The water for construction should only be sourced from authorized sources.

Operation Phase:

Very low quantity of water would be required during the operation phase. The only requirement during the operation phase would be domestic water requirement, which will be met by packaged drinking water. Hence, the impact on groundwater can be considered as Negligible and will have "**No impact**" on water resources of the region.

OVERALL IMPACT ASSESSMENT

The overall assessment suggests that the proposed project will have low impact on ground water/surface water used will be of short duration in the construction phase. During operation phase the proposed project is anticipated to have negligible impact as only about 1.8KLD of water would be required for 15-20 technical personnel and also 20 security guards onsite.

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No Impact**

6.2.6 Water Quality

Waste water discharge from labour camps and site office and civil works.

Construction Phase:

During the construction works, there is a possibility of contaminated runoff from the site as the activities involve the installation of wind turbine foundation, underground cables, soil compaction, increased run off and sedimentation of surface waters. During site visit, large to medium sized village ponds were observed in two villages namely Jamora pond ~0.91 km east from OLD-15 and OLD-16 and Kurbai pond is about 0.41 km North from KUT-41.

A labour camp will be reportedly set up for onsite migrant labours. These camps will discharge domestic wastewater due to bathing, washing and cooking. Septic tanks and soak pits shall be provided for disposal of the same. Functional and well maintained toilets for the labours in good condition should be provided to the labourers. Besides, construction processes include fabrication of concrete and related water usage. Wastewater from construction activities would mostly contain suspended impurities. Taking the distribution of impact as within site, duration short and intensity as low, the impact due to water abstraction will be **"Low"**

Operation Phase

Groundwater contamination can occur if chemicals are not properly handled or are incorrectly disposed of and leach into the water table or if wastewater from plant activities is not properly disposed. Very small volume of waste will be produced from the operation of the wind farm (e.g., used oil, paint cans), which will be disposed to authorized vendors. Minor volumes of sewage will be generated from toilet facilities at the site office. This will be disposed to septic tank; thus no significant impact is anticipated to surface or groundwater. The impact on groundwater quality during operation phase will have **No impact.**

Besides, there is no impact due to storm water anticipated as the rainfall in the region is erratic and scanty. But, OKWPL should ensure construction of storm water drainage structures along the length of the roads to rule out future weather uncertainties Small dried water channels were observed during the site visit. Taking the erratic rainfall and distribution of impact as buffer area, duration short and intensity as low, the impact is considered to have **Low Impact.**

Mitigation measures

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

- Temporary paved areas should be constructed to be used while refueling the machineries;
- Machinery and vehicles should be thoroughly checked for the presence of leaks if any;
- Drip pans should be provided with vehicles with leaks to prevent soil contamination; and
- Storage of oil should be undertaken on paved impervious surface and secondary containment should be provided for fuel storage tanks.
- Proper storm water drainage channels to collect surface runoff (due to monsoon) from the project site.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**Low**

Operation	**No Impact**

6.2.7 Solid/ Hazardous waste

Construction Phase:

Solid waste during the construction phase consists primarily of scrapped building materials, excess concrete and cement, excavated material, rejected components and materials, packing materials (pallets, crates, plastics etc.) and human waste. However, taking the undulating terrain of the site, considerable levelling would be required. Taking the distribution of impact as within site, duration short and intensity as low, the impact due to water abstraction will be **"Low"**

Mitigation Measures

- The excavated material generated will be reused for site filling and levelling operation to the maximum extent possible.
- Food waste and recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers while food waste will be disposed through waste handling agency.
- Hazardous waste viz. waste oil etc. will be collected and stored in paved and enclosed area and subsequently sold to authorized recyclers.

Operation phase:

There will not be any substantial generation of solid waste, other than insignificant domestic waste. The impact is considered to have "**No Impact"**

Mitigation measures

- Food waste and recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No Impact**

6.2.8 Impact on landuse

The range of potential project impacts on land include land disturbance (creating erosion and sedimentation), disposal of excess soil, and soil contamination.

Construction Phase

Activities that cause land disturbance include installation of tower foundations, road preparation, excavation, etc. Excavation will be carried out to the minimum. The soil will be mainly excavated for laying foundation of towers, site leveling and road work.

This excavated earth material be utilized on site for site leveling as per requirement. The top soil excavated during construction, will be stock pilled and will be used for plantation. The roads will not be paved and only soling will be done with excavated earth & rock material, so land disturbance will be minimized. The cranes used for construction activities will be placed on hard, flat surface area and if required, ground leveling will be

done. Taking the distribution of impact as within site, duration short and intensity as low, the impact during the construction phase can be predicted to be **"Low"**

Mitigation measures

- After construction phase, the areas acquired by labour colonies should be reverted back similar to preconstruction stage.

Operation Phase

No impact on land use is envisaged during the operation phase.

Mitigation Measures:

- Any hazardous waste like waste oil, paint containers will be disposed to authorized vendors after due permission of concerned authority/body.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No Impact**

6.2.9 Aviation Hazard

Operation Phase

As per the guidelines of Airport authority of India, "No objection" for height clearance is required from Airport Authority of India (AAI) if the height of the structure is above 150m above ground level[18]. In addition to this, structure located within 20km as per Visual Flight Rules, also requires NOC. The hub height of Vestas model V110-2.200 is 110m to which the rotor blade length will also be added. Besides, the project site is located at a distance of 12.5km south; hence NOC for height clearance is required from AAI and Ministry of Defence19.

Since the project site is located 12.5km from AAI with probable low-flying areas, the wind energy facility (including anemometer mast) may impact aircraft safety directly through potential collision or alteration of flight paths.

Prevention and control measures to address these impacts include the following:

- Consult with the relevant aviation authorities before installation, in accordance with air traffic safety regulations.
- When feasible, avoid siting wind energy facilities close to airports and within known low-flying areas or flight paths. Cumulative impacts associated with the number of existing wind energy facilities within, or in close proximity to, low-flying areas or flight paths should be a consideration in siting turbines.
- Use anti-collision lighting and marking systems on towers and/or blades and consult with the relevant aviation authorities to determine appropriate lighting and marking requirements in line with national standards. In the absence of national standards, refer to good practice guidance.

Aviation Radar: In addition to this, the proposed wind energy facility if located near radar may also impact the operation of aviation radar by causing signal distortion, which may cause loss of signal, masking real targets

[18] http://nocas2.aai.aero/nocas/#

[19] http://nocas2.aai.aero/nocas/AAI_Links/FAQ_1st_April_2015.pdf

and/or erroneous signals on the radar screen, creating flight safety issues. These effects are caused by the physical structures of the tower/turbine and the rotating blades. Proximity to existing energy facilities should also be considered in relation to cumulative impacts on radar. Considering the impact to be long term the risk is termed as **"High" impact**

Prevention and control measures to address these impacts include the following:

- Consider wind energy facility design options, including geometric layout, location of turbines, and changes to air traffic routes.
- Consider radar design alterations, including relocation of the affected radar, radar blanking of the affected area, or use of alternative radar systems to cover the affected area.
- Consultation should be undertaken with the relevant aviation authorities to determine prevention and control measures.

6.2.10 Impact due to Climate Change Variability

ADB screening tool has been designed to take into account climate induced risks and natural hazards of geophysical origin. This screening tool helps to expand the ADB's risk assessment capacity within its policy framework and project life cycle operations. ADB has developed this risk screening tool to rapidly assess impacts and associated risk at the project preparation stage. The checklist presents a set of questions, answers to questions in the risk screening tool, when totaled generate a risk value of High, Medium or Low.

Table 6.9 Climate and disaster risk screening

General Project Identification			
Date	**:**	**August 2017**	
Country and Project Title	**:**	**India : ESIA study for 250MW wind power project in Kutch district**	
Lending or financing Modality	**:**	**ADB**	
Risk Assessment Category	**Risk Value**	**Total**	**Remarks**
Pre-determined impacts and risk factors			
• Which physical environment best describes the project area	Using **Appendix V**, add the score for the physical environment which best describes the project location. 1+1	2	The region falls under arid/semi-arid and desert environment. The region experiences low erratic rainfall with an average annual rainfall of 378mm as per IMD Bhuj. The project would be established on very degraded, rocky terrain with land not suitable for agriculture. The area falls in Zone V Very high damage risk zone of getting affected due to earth quakes.
• Categorise sectoral risk of project (See **Appendix W**: Risk by sector)	Add risk value from 0-3	2	Energy
• List individual hazards that may impact project	Add risk value of 1 for each natural hazard (up to a maximum of 4).If hazards unknown use 3 as a risk value 1+1+1	3	The area falls in ***Zone V Very high damage risk*** zone of getting affected due to earth quakes as per the Seismic Zones of India Map IS 1893 – 2002, BIS. The area experiences very hot weather conditions and the rainfall in Bhuj is very scanty and erratic
• Estimate the number of people in the project area "exposed" to risk after the project is completed.	For <100 score = 0, 100-1000 score = 1, 1000-10,000 score 2; >10,000 score = 3 Less than 100	0	The only impact on population would be during operation phase due to exposure to shadow flickering effect. The number of receptors due to same would be less than 100.
Stakeholder engagement and risk knowledge			
• Do the project proponents have the institutional capacity to	Yes/No (If good capacity then add 0; if poor capacity add 1 risk value: if very poor capacity add 2 risk values)	1	The major risk related to project would be a natural disaster -earthquake and hence Ostro team onsite should make coordinated efforts

successfully incorporate, manage and deliver risk management measures to the project			with district disaster risk management authority to take control of the situation, when in time of need.
• Will potential hazard impacts on communities, gender, indigenous people or the social dimension of risk be considered in the concept paper.	Yes/No (If No, add 1 risk value). If Unsure, add 1 risk value	1	Impacts on gender and community has been considered from the hazard perspective (flood, earthquake and landslide).
• Are there any demographic or socio economic variables (i.e. population increase, settlement patterns, bio-physical/environmental conditions) that may increase exposure to hazard impacts	Yes/No (If yes, add 1 risk value). If Unsure, add 1 risk value	1	There may be some rural sprawl of population in the next ten years from now, which might be impacted by WTG's as per their proximity, but the same is unsure as the project terrain is very difficult and inaccessible for any establishment of village settlement.
• Is it likely that Executing Agency stakeholder(s) has some practical knowledge of risk reduction measures for the project?	Yes/No (if No, add 1 risk value). If Unsure, add 1 risk value	1	Yes, Ostro team has capacity of risk management at the stage of project development stage.
• Will the project reduce, leave unaltered, or increase the risk to project beneficiaries?	Reduce risk, score = 0, Leave risk unaltered, score = 1, Increase risk, score = 2.	1	OKWPL will have no control on reducing the natural disasters , hence the risk related to natural disasters will remain altered.
• Will the project reduce, leave unaltered, or increase the risk to the localized environment/project dependent ecosystem?	Reduce risk, score = 0, Leave risk unaltered, score = 1, Increase risk, score = 2.	1	
• Do country/institutional policies or environmental laws	Yes/No (If No, add 1 risk value). If Unsure, add 1 risk value	1	Yes, the country institutional policies and environment laws significantly promote risk management measures.

significantly promote risk management measures?			
• **Does the Project require a risk expert to introduce risk reduction measures in project design, implementation, or operations and maintenance?**	Score = 0 for No. Score either 1 or 2 for Yes (based on your assessment of the level of risk).	1	
Total Risk Value (Range 0 to 25)	**High Risk:** between 17-25 **Moderate Risk:** between 8-16 **Low Risk:** between 0-7	**15**	**Moderate Risk**

Low Risk (0-7): This range indicates the Project proposal has considered risk management measures to minimize hazard impacts and associated risks, and that the Project may therefore have a potentially higher threshold against current and anticipated risks.

Moderate Risk (8-16): Project exposure to Risk is **likely**. It is **recommended** that risk reduction measures be incorporated into project design and activities.
High Risk (17-25): Project exposure and vulnerability to potential Risks is **very likely**. It is **highly recommended** that risk reduction measures be incorporated into project design and activities, and that a further review of the Project proposal be undertaken.

6.3 Socioeconomic Impact

6.3.1 Impact on Land and Livelihood

Construction phase:

(A) Land procurement

The internal path ways and the access roads route survey and planning is underway. Such a development will improve the accessibility in the area and would hence add to the social and economic development of the area. The project site has been proposed on government land. Micro siting of the WTG's has been undertaken, no erection of the same has been undertaken as per the site visit observations.

Land requirement for each wind turbine generator (WTG) is 3acres. The land for access road needs to be finalised. Besides, the land required for transmission line tower construction on ROW basis (~8m x 8m) also needs to be identified. It is any issues related to ROW if faced should be deeply investigated, properly compensated so that further issues are not raised in future.

In the proposed wind power project, revenue land will be acquired and does not involve involuntary acquisition of land. Land team of OKWPL has identified land parcels to setup the proposed project.

(B) Livelihood Impact

The land parcels identified for the proposed project is majorly fallow revenue land. Rearing of cattle is noticed in some of the land tracks. Though, no economic activity is observed during ESIA study, acquisition of such land may impact on livelihood of the local people. However, this can be ascertained only after finalization of lands and verifying the existing scenario.

Consultation with the villagers revealed that agriculture is one of the source of livelihood in the area. Other sources of income include cattle rearing, working as labourers in nearby towns and dairy. Considering the following factors adverse socioeconomic impact on land owners and cultivators due to land selling is anticipated to be minor. To mitigate the minor impact, the following mitigation measures are suggested:

- Local employment should be encouraged both during construction and operation.
- Stakeholder engagement plan and Community Development Plan should be implemented during construction and operation phase.

(C) Engagement of Local and Migrant Labour

The social impact associated with the engagement of local and migrant labour in the proposed project is potential of conflict between labour and contractor or developer which in turn may result in suspension of project and may cause reputational risk to project developer. Also chances of conflict between local & migrant labour on the use of common resources may arise. Considering the project in designing phase and construction phase yet to be started, indicators have been discussed to provide sense of what should not be done with respect to labour engagement. The issues discussed here in the form of indicators IFC PS 2 and Indian Labour Act.

Indicators in Labour Engagement:

Abolition of child and forced labour: Engagement of child and forced labour by contractor or developer in any form for the proposed project will be unfair with the children's right & the law.

Gender equity and non-discrimination: Discrimination and imbalance in gender equity in employment and opportunity may lead to conflicts between contractor and labour.

Freedom of association and right to collective bargaining: Not giving freedom to labour to express their views and form association may cause conflicts between labour and contractor but this is not applicable for wind power plant as the labour requirement is of short duration restricted to construction phase only and number of labour employed is not very large for the same phase.

Impact Significance: Considering the sensitiveness associated with the engagement of child, forced labour & NOT maintaining gender equity, the impact considered will be of **moderate** significance. OSTRO has laid down policies through which it demonstrates compliance to all of the above factors. Its contractors should be made aware of all its policies for labour requirements and incorporated in their contracts prior to the starting of the project. OSTRO need to monitor the implementation of the policies on regular basis.

OSTRO needs to adopt the following measures:

- OSTRO should include clause or provisions related with non-engagement of forced and child labour, gender equity, non-discrimination on employment in contractor's agreement and HR policy.
- OSTRO through its contractors should inform the labour about the grievance redressal mechanism by which they can inform about any grievances
- Grievances related with non-fulfilment of labour welfare measures shall be monitored by the contractor employed by OSTRO.
- It will be the responsibility of principal employer to get it ensure through its contractors. OSTRO is not going to employ labours directly for the project activity.
- OSTRO needs to ensure that labour is being adequately paid by contractors. The contractor should ensure that wages is being paid as per the requirement of minimum wages act.
- OSTRO needs to ensure the compliance of labour law and availability of facilities mentioned there by reviewing muster roll, wages register, attendance register through its contractors.
- OSTRO shall conduct internal audits to monitor the performance of contractor.
- OSTRO through its contractor should ensure that labour receives training on health and safety issues during the construction and operation of the project

Mitigation measures:

- It should be ensured that proper public disclosure is undertaken for the project activities at the community level.
- Proper compensation amount should be paid to the land owners to rule out conflict in future in case of land procurement for access/approach road and transmission tower construction.
- Stakeholder engagement plan and Community development plan should be implemented.
- It should be ensured that maximum employment is given to the locals w.r.t their capacity and skills.
- Grievance Redressal mechanism should be followed onsite. Complaints from the locals should be timely registered, investigated and resolved.

Operation phase:
There would be **no impact** on land during operation phase. There would be a requirement of security guards for WTG's hence local employment opportunity would be generated, this would be a positive impact of the project as it would enhance the economic opportunities of the locals.

Mitigation measures:

- The project proponent is suggested to provide an open access for grazing without any restrictions.
- Based on need assessment, CSR initiatives should be implemented in the project affected villages.
- OKWPL should undertake a formal consultation with all landowners from whom right of way is to be obtained for construction of transmission towers and make them aware of the project details;
- OKWPL should ensure that all agreements have been executed properly;
- Community development plan should be implemented.
- It should be ensured that maximum employment is given to the locals w.r.t their capacity and skills.
- Grievance Redressal mechanism should be followed onsite. Complaints from the locals should be timely registered, investigated and resolved.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No Impact**

6.3.2 Occupational Health & Safety Impact

Construction Phase:

(A) Occupational Health & Safety Hazards for workers

Occupational Health and safety hazard associated with project activities (during construction and operational phase) in wind power plant are identified as follows:

- ***Working at height:*** The maintenance activities for the turbines such as turbine service and repair will involve working at heights (≥ 2m). The workers engaged in such activities may fall or slip from the scaffolding or ladders which may result in minor injuries such as muscle sprain or major ones such as ligament tear, fractures, haemorrhage depending on the height at which they are working.
- ***Electrical/ Fire Hazards:*** Turbine maintenance activities like motor/wire repairing will involve electrical work. The workers involved in such activities are susceptible to risks viz., electrical shocks, electrical burns, and fire and/or explosion hazards. Some of the risks are identified below:
  - **Eye injuries:** Retina damage due to flash or sparks emanating from the welding arc
  - **Electrical shocks**: Such incidents can occur when the fixing equipment in operation by the workers come in contact with live power lines etc. In some cases, it may lead to electrocution of the worker(s) involved in such works.
  - **Electrical burns:** They occur when the skin comes in contact with live power lines etc. The severity of the burn depends on voltage, current, time of contact etc. The burns can be classified as low voltage, high voltage, flash, flame, arc and oral burns depending on the factors.
  - **Fire and/or explosion hazard:** These can occur due to short-circuiting of power lines. The injuries can range from burns to death of the workers involved in the work.

Facilities like drinking water, separate kitchen, fans, beds, toilets and power supply has been provided to the workers/labours in the labour camp set up in the project site.

Housing space: Adequate housing space for labours has been provided. As per International Labour Organisation (ILO) standards, the floor area of workers' sleeping rooms should not be less than 7.5 square metres in rooms accommodating two persons, if a room accommodates more than four persons, the floor area should be at least 3.6 square metres per person. It is found that the labour camp complies to the standard given by ILO for labour accommodation.

Sanitation facilities for contract labourers: Proper functional toilets have been provided in the labour camp. The disposal of waste water is managed by the septic tanks and soak pits constructed in the camp.

(B) Other Hazards

The workers involved in activities such as loading and unloading of turbine components (spare components or discarded ones), crane operation (to move damaged components), storage and placing of turbine components etc. are susceptible to risks viz., physical injuries and trip/ fall hazards.

- ***Physical injuries:*** These can occur when workers involved in loading/unloading activities don't adhere to proper ergonomics discipline. Injuries like muscle strain, ligament tear, slip disc can occur which may prove to be fatal.

- ***Trip and fall hazards:*** The injuries are similar to those discussed under working at height. They occur when workers trip over/fall when debris etc. lies in the walkway/ passages.
- ***Accident/ injury due to vehicle collision/ slip along terrain:*** Such incidents can occur during transportation of damaged or spare turbine components.
- ***Electromagnetic field impact on workers:*** Magnetic fields result from the flow of electric current and increase in strength as the current increases, this can occur during laying of transmission lines.

Considering the distribution of impact as within site, short duration and moderate intensity, the impact can be termed as **Low** during construction phase.

Mitigation Measures:

- Provide and ensure wearing of personal protective equipment's such as gloves, helmets, ear plug, and safety belt.
- Ensure effective work permit system for critical activities such as electrical work and civil work.
- Prepare emergency communication system and emergency preparedness plan
- Ensure proper sanitation facilities
- All work at height to be undertaken during daytime with sufficient sunlight; Work permit system should be implemented for working at height (typically when working over 2 m above) and for hot jobs;
- Safety nets or airbags can be used to minimize the consequences of a fall. Proper training should be given to workers working on heights. Personal protective gears should also be provided to the workers.
- Prior to undertaking work, integrity of structures should be inspected; Fixtures should 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 should be engaged for work at height;
- Safety incidents should be recorded and monitored.
- Wind turbines should be equipped with earthing system;
- The substation should be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire
- Access to areas containing exposed electrical equipment should be enclosed and posted with warning signs

Ostro Energy at its corporate level has formulated Emergency Preparedness plan to deal with health and safety issues during project life cycle of a wind farm.

Emergency Preparedness and Plan for On-Site Emergencies: the plan has defined nature of emergencies that can be encountered during operation of a wind farm. Requirements of an Emergency Control Centre (ECC), firefighting facilities and medical facilities has also been detailed out. Roles and Responsibilities of personnel at site, communication channel to be followed, and procedures for different emergencies have also been detailed. OKWPL should ensure that all its hired contractors should abide by the requirements of plan formulated like undertaking mock drills, identification of first aiders and fire fighters, display of emergency numbers onsite etc.

(C) Labour Accommodation

The social impact associated with the labour accommodation or setting up labour camp (onsite) is anticipated in the form of conflict between labours and contractors /community.

Absence of basic amenities or facilities

In case, absence of basic amenities such as kitchen, good quality drinking water, clean and inadequate sanitation facilities, rest room and crèches for children at the labour camp during construction phase, may cause dissatisfaction between labours which in turn result in conflict with contractors.

Interaction with Local Community

In case of significant migrant labour influx, may cause conflict with community due to different cultural behaviour and sharing of local resources. Local resources which are presently being used by the community people are expected to be shared by migrant labour and it may cause strain on community.

Mitigation Measures:

- Setup onsite labour camp away from villages to restrict the interaction of migrant labour with local community that may lead to direct conflict.
- Ensure availability of all the basic amenities such as kitchen, drinking water, crèches, rest room and adequate toilets.

Operation Phase:

Occupational health and safety can be affected only during routine maintenance of the WTG's, which require working at height and might have possibility of electrocution if proper mitigation measures are not taken. Impacts due to electromagnetic field while working during operation and maintenance of transmission lines is also an impact envisaged. Taking the distribution of impact as within site, duration long and intensity moderate, the impact on occupational health and safety during project operation is expected to be **Moderate**.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**Low**
Operation	**Moderate**

6.3.3 Community health & safety

During Construction phase:

During construction phase, various project components such as transmission cable laying, switchgear, approach roads, internal road network and porta cabin construction require land clearing, levelling, excavation, grading activities, vehicle movement, DG set operation will take place. This will result in an increased level of dust and particulate matter emissions, as well as high traffic load, which in turn will directly and temporarily impact the local community. If improperly managed, there is a risk of nuisance and health effects. Taking the distribution of impact as within site, duration as short and intensity as low, the impact can be considered as "**Low"**

Operation Phase

According to IFC EHS guidelines, community health and safety hazards specific to wind energy facilities primarily include the following during the operation phase:

- Shadow flicker;
- Blade throw;
- Electromagnetic interference and radiation; and
- Public access

Shadow Flicker:

Shadow flicker refers to the shadows that a wind turbine casts over structures and observers at times of the day, when the sun is directly behind the turbine rotor from an observer's position. The shadow flicker effects usually during periods after sunrise and before sunset. During intervals of sunshine, wind turbine generators will cast a shadow on surrounding areas as the rotor blades pass in front of the sun, causing a flickering effect while the rotor is in motion. The light effect caused when the sun is positioned behind a rotating wind turbine has been described as shadow flicker. With the sun in the background, large moving shadows can be produced which

some people may find distasteful. The **Table 6.10** below shows the approximate sensitivity to shadow flicker at different RPM for three blade turbines, according to Stankovik et al.

Table 6.10 Shadow Flicker Sensitivity

Flicker Rate (Hertz)	Human Perception	Equivalent RPM Rate for a 3-Bladed Turbine
< 2.5	Negligible Effect	<50
2.5 - 3	May Affect 0.25% of the Population	50-60
3 - 10	Effect is Perceptible	<200
10 - 25	Greatest Sensitivity	200-500
>50	Continuous Light Source	1000

Source: Stankovik et al., 2009,

Larger turbines generally operate between 18 and 45 RPM, while smaller turbines generally operate below 150 RPM (Stankovik et al., 2009, p.96). The present design of wind turbines for this project is designed with speed of 19.0 RPM. So, the effect is expected to be negligible.

It has been stated that "*Flicker effects have been proven to occur only within ten rotor diameters of a turbine*". The greater the distance between the turbines and the observer the less noticeable the shadow flicker will be (Office of the Deputy Prime Minister, 2004, p.177)[20].

Modelling was undertaken using Wind Pro, for shadow flickering using real case scenario. The sensitive WTG locations resulted from the analysis of worst case scenario outcome will then be used as input in real scenario approach. The outcome of real scenario approach will be in the form of expected hours of shadow flickering on identified receptors. To run the real case scenario for shadow flickering following data have been used in software:

- Annual operational hours estimated for WTGs
- Sunshine hours of project site/nearby location

The real case scenario result will be then analysed with respect to cumulative impacted receptors and sensitive locations of WTGs. The maximum no. of hours (more than 30 hrs/year[21]) of shadow flickering occurrence in real scenario will be considered as **significant cumulative impact on the receptors**. The locations of WTGs contributing the significant cumulative impact will be identified and mitigation measures will be delineated for such locations.

SHADOW FLICKERING MODELLING RESULTS

From the "worst case scenario" analysis the shadow flickering modelling results shown that 3 WTGs (BHO-193, BHO-189 and BHO-99) will be impacting three receptors (a group of 3-4 houses, a single house and a big farm house) at Samatra, kanpar and deshalpar villages resepctively.The shadow impact at these receptors was found in the range of 68.22 – 91.58hr/year. In general, in "Real Case Scenario", the shadow flickering impact comes substantially lower than the result shown in "Worst Case Scenario". Anyways, suitable mitigation measures will be adopted.

20 The Real Truth about Wind Energy, A Literature Review on Wind Turbines in Ontario, June 10, 2011, SIERRA Club Canada.

[21] Dutch standards of 30 hrs/year was used in analysis of significant impact. In, India shadow flickering standards are not available

The modelling results has been given in **Table 6.11.** The modelling map is shown below in **Figure 6.2**

Table 6.11 Shadow Flickering modelling results detailing the shadow hours received at the sensitive receptors wrt to the nearest WTG locations

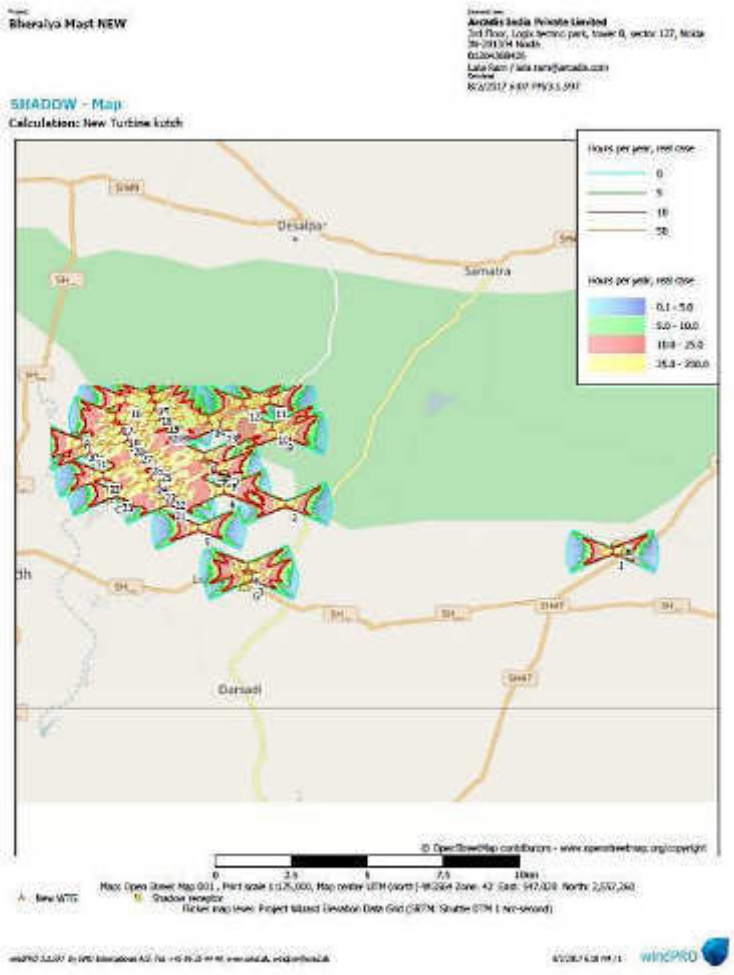
S.N	Impacting WTG locations	Receptor	Distance	Village	Coordinates		Shadow Hours /year	Shadow Minutes/day	Type of structure
					Easting	Northing			
1	BHO-189	G (BHO-189Rb)	248m	Samatra Village	548601	2564962	68:48	68.48	3-4 Houses
2	BHO-193	J (KUT-59 (b)R)	462m	Kanpar	547926	2567264	91:58	91.58	Single house
3	BHO-193	K (BHO-193R)	416m	Kanpar	547995	2567286	68:22	68.22	Big farm house named as Narmada Nirali Bagh
4	KUT-59		486m	Deshal par				68.22	

From the table 6.11, there are 3 WTG locations which may have shadow flicker effect of more than 30 hours per year, however, there are no WTG locations which can cause shadow flicker impact of more than 30 minutes per day. Further, the WTG locations with potential shadow flicker impact of more than 30 hrs per year are located at a safe set back distance from the impacted receptors as detailed in table 6.11 above. flicker issues are likely to be more important in higher latitudes, where the sun is lower in the sky and therefore casts longer shadows. The project area (Bhuj) is located at lower latitudes and therefore it is unlikely to have a significant shadow flicker impact. However, in case of significant shadow flicker impacts adequate mitigatary measures such as providing blind screens to the impacted receptor will be implemented.

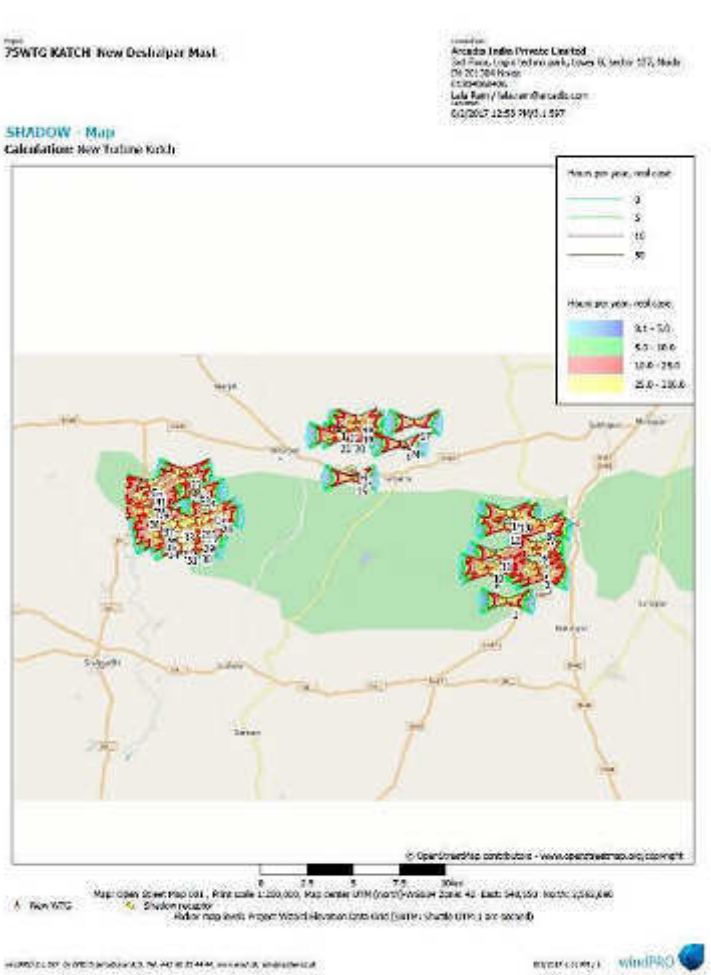
The graphical presentation of cumulative shadow flickering impact (contour line) on these two significant impacted receptors is presented as **Appendix X**

Figure 6.2 Shadow flickering map

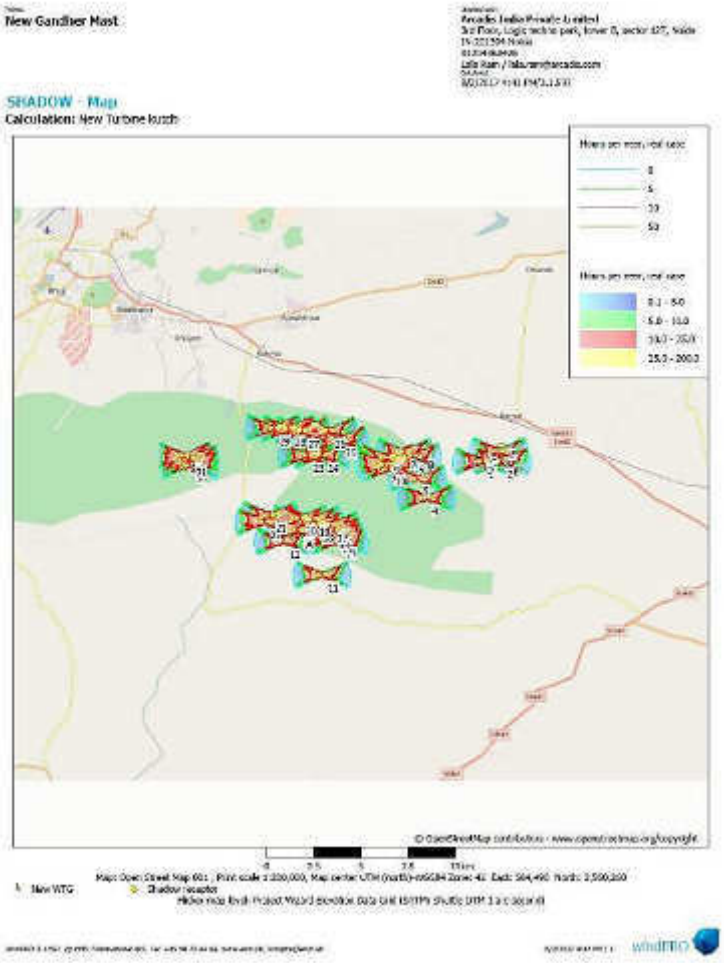
Bheraiya mast



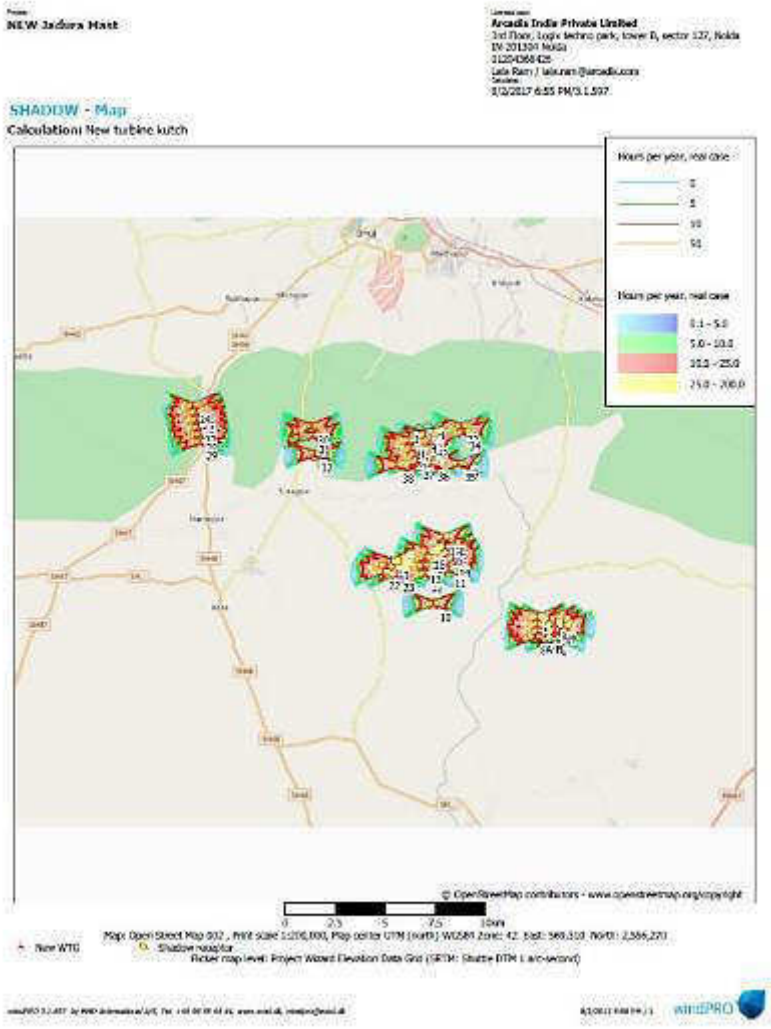
Deshalpar mast



Gandher Mast



Jadura Mast



Mitigation Measures

- It is recommended that OKWPL should 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. OKWPL will ensure that appropriate and timely action is taken in case of receipt of such complaints.
- Provide curtain and blinds in households with open roof, and windows, doors facing WTGs.
- Undertake plantation to hide shadow flicker near receptors (households) identified with significant impact.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**No Impact**
Operation	**Low**

Electromagnetic Fields:

All electronic devices, power lines, and generating stations produce EMFs. Wind turbines convert wind energy into electricity. The electricity is carried from the turbine by a cable, either underground or overhead, to the main electricity transmission grid for distribution, creating a small magnetic field. When a charged object, such as an animal, crosses the path of this magnetic field, a very small, momentary electric field may be created. There are four potential sources of electric and magnetic fields associated with the wind farm project. These are:

- Transmission line
- Wind turbine generator
- Generator transformer, and
- Underground cable

Though wind power produces EMFs like any other source of power and power transmission there are two major benefits to wind power in respect to safety. Wind turbines are ~110 meters above the ground and therefore the EMF[22] created by the production of energy is generally well above any people who may be in the area.

The electromagnetic fields produced by the generation and export of electricity from a wind farm do not pose a threat to public health. Grid connection is normally made at no more than 132 kilovolts (kV)[23], similar to the voltages used by utilities in existing residential distribution networks. In addition, project developers would design the entire electrical system to adhere to applicable state guidelines and industry standards to minimize EMF exposure from any new overhead transmission lines.

The grid connection lines are similar to other power lines and generate low levels of EMF, comparable to those generated by household appliances. Thus, it can be concluded that the electromagnetic fields produced by the generation and export of electricity from a wind farm do not pose a threat to public health.[24] The impact due to EMF can be termed as having **No Impact.**

22 Rideout, Karen & Constance Bos. January 2010. Wind Turbines and Health. National Collaborating Centre for Environmental Health. Vancouver, Canada & Sustainable Energy Australia (SEA) Pty. Ltd. The electromagnetic compatibility and electromagnetic field implications for wind farming in Australia. Melbourne and Canberra: Australian Greenhouse Office & Australian Wind Energy Association; 2004 [cited 2009 July 21].

23 The Real Truth about Wind Energy, An Analysis of the Potential Impacts of Wind Turbine Development in Ontario. Sierra Club Canada, June 2010

24 Evidence Review Wind Turbines and Health: A Rapid Review of the Evidence, National Health & Medical Research Council, Govt. of Australia

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**No impact**
Operation	

Blade Throw:

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.

The overall risk of blade throw is considered to be low as occurrence of dust storms in the project area is occasional.

Mitigation Measures

Mandatory safety standards in turbine design, manufacturing, and installation as well as more frequent maintenance have made the occurrence of blade throw a rare phenomenon. Wind turbines can also 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

The impact due to potential blade throw is expected to be of local spread, long duration and low intensity with mitigation measures and the overall impact is assessed to be insignificant.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**No impact**
Operation	**Low**

Public Access:

OKWPL should ensure that the entire wind farm area is not fenced/ barb wired and should provide access to the movement of livestock in the area for grazing purposes.

The impact on community/ social issues is expected to be of within site, short duration and low intensity with mitigation measures and the overall impact is assessed to be **Low.**

Mitigation Measures:

- The project proponent must ensure that the 400-year-old dargah structure should not get impacted by project activity.
- During the time of festival project proponent should plan to switch off the turbines.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No Impact**

6.3.4 Traffic Load

State Highway 42 and 46 will be used for movement of trailer trucks carrying WTG parts and other heavy vehicles for the project activity. Village and village roads originating from this road will be utilized during construction and operation phase for vehicular movement and movement of labors and other project materials.

Construction Phase

The vehicular movement in construction phase will be more compared to operation phase. The village roads are well developed but proper access roads need to be constructed to reach every WTG location. Also, as the number of vehicles increases the noise in the surrounding area will increase and generation of dust will also slightly increase in the area. The risk of accidents increases as the construction phase will see movement of vehicles and local people using the same village roads. Although low movement of population in surrounding area. Low traffic is observed due to lack of large scale industrial areas and commercial activities, but some small-scale factories like alumina refinery, perfoclay manufacturing units along with some stone quarry units exists. Movement of public buses and two wheelers were observed. Addition of construction vehicles on local villagers is going to be of **low impact** due to distribution of impact as within site, short duration and low intensity. Adequate preventive measures should be taken to mitigate the risks of accidents.

Mitigation Measures:

- During the development of roads and site preparation all the drainage courses should be properly channelized to maintain the drainage pattern of the area.
- If the widths of roads are found to be inadequate for the transport requirements of turbine blades and other large construction equipment's, permission should be taken from the respective authorities for required widening.
- Signage should be erected to identify site access routes and to inform motorists that local roads will be accommodating construction traffic.
- Signage warning for the site access junction locations and an advisory speed restriction of 30 km/hr should be erected.
- Widening and strengthening of the carriageway should be undertaken where necessary, to accommodate the turbine delivery vehicle wheel tracks.
- When practicable, construction traffic movements (equipment and materials) should be scheduled to avoid the peak traffic periods at the beginning and end of each day and other sensitive periods, in order to minimize any potential disturbance to local traffic.
- Telegraph poles and overhead cables may be relocated where necessary.
- If any bottlenecks are identified appropriate measures will be taken to avoid congestion due to the project.
- Alternative access routes for the transport of project construction equipment's and wind turbine parts to project site should be identified whenever necessary.

Operational Phase

In operational phase, very few (2-3 nos.) of vehicles will be required for commuting from home to site office therefore impact associated with movement of project vehicles is not anticipated. Vehicular movement in operation phase is negligible. Only maintenance staff and their vehicles are present and hence **No Impact** is envisaged.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No Impact**

6.3.5 Communal harmony and Stakeholder Engagement

This probable impact is applicable throughout the project life. The project influenced area is home to communities from various castes, religions and Schedule Tribes.

At any stage of the project, preference and bias towards certain communities over others for labour, business or CSR initiatives could result in communal disharmony. Grievance Redress Mechanism for the site should be developed to effectively deal with the communities' concerns, grievances and keep them adequately informed about the project. In case of an absence of an efficient information disclosure mechanism and grievance redressal mechanism, the stakeholder engagement process is likely to get hindered, consequently, preventing a healthy relationship between the company and local community.

Mitigation Measures

- To ensure an open and effective communication between the local populations, Vestas and OKWPL, a documented grievance redress mechanism developed at Ostro Energy 's corporate level must be followed at the site level for external stakeholders such as the local community.
- Furthermore, the local community must be kept informed of the project and its relevant details, with information disclosure meetings being necessary prior to every major stage of the project.

During construction phase, the distribution of impact is buffer area, duration short and intensity moderate, the impact significance can be termed as **Moderate.** During operation phase, the distribution of impact is buffer area, duration long and intensity low, the impact significance can be termed as **Moderate.**

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**Moderate**
Operation	**Moderate**

Impact on Cultural/ Archaeological Site

The site does not contain any archaeological monuments or sites as per the Archaeological Survey of India. Chance find procedure is required to be planned and implemented in case of accidental discovery of artefacts during construction activities.

An ancient dargah, namely Champa dala Dargah is located in Sedata village within 350 to 500 m distance from WTG No.-BHU-27. It is a more than 400-year-old dargah. The area surrounding is very neatly covered by trees and stone. It is of high cultural importance in the local area and may get impacted due to project activities. During the main festival, every year (March), more than 2000 pilgrims normally visits the area.

During construction phase, care should be taken that the access way to the Dargah is not disturbed. However, in case the same is not taken into consideration, the impact would be Low and during operation phase, if the access road to the dargah is used, the impact would be moderate.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No IMAPCT**

Associated social impacts related with the project has been assessed through the social indicators which has been identified and analyzed. Such analysis will also yield the nature of impacts as discussed in Table 6.4. Since the project is a clean energy project, absence of pollutant emission and limited social impacts are anticipated that can be controlled through mitigation measures as suggested in the following section.

Table 6-12 Social impacts Indicators and Analysis

S.N	Project Activities	Indicators	Social Impact	Nature of Impact	IFC Ps	Applicability
Pre-Construction Phase						
1	Land procurement	Physical and economic displacement	No physical and economical displacement as per current scenario	Low	PS-5: Land Acquisition and Involuntary Resettlement	May be applicable (In case of private land procurement for access road and erection of transmission towers
Construction Phase						
2	Engagement of local and migrant labour	• Abolition of child labours. • forced or • compulsory labour • Gender equity, non-discrimination and equal opportunity • Freedom of association and right to collective bargaining	Lead to conflict between contractor and labour as well as conflict between local and migrant labours	Moderate	PS-2: Labour working condition	Applicable
3	Labour Accommodation (Onsite)	• Non-availability of adequate facilities like drinking water, kitchen, etc. • Local community interaction	Conflicts between labour and contractors as well as conflict between labours and local community	Low	PS-2: Labour working condition	Applicable
4	Access to Common Property Resources	• Restriction on free movement or approach to common property resources	Conflict between Project developer and community	Low		May be applicable
5	Dislocation or damage of	• Existence of ASI declared cultural resources	Community protest	Low	PS-8 Cultural Heritage	Applicable

physical cultural resources	• Existence of physical resources with historical, religious, aesthetics, paleontological and any other cultural significance

6.4 Impact on Biological Environment

6.4.1 Impact due to site clearance

Construction Phase

Project construction involves land clearance, excavation, filling and levelling, causing the loss of vegetation. The clearance of vegetation will be restricted along a radius of 50 m around each wind turbine site and the entire area procured for each wind turbine may not be cleared. Most of the locations identified for the establishment of wind turbine generators do not comprise any trees or permanent vegetation at site or its immediate vicinity. Clearing of vegetation will also be done for access route/road and erecting transmission lines.

The footprint of a WTG is small and the clearance of ground vegetation also seemed to be less. In the event of loss of ground cover for development of WTG may be fully compensated due to the presence of undisturbed areas in the vicinity which could buffer for the displaced areas/habitat for small fauna. Moreover, absence of site boundary and fencing in the wind project (excluding transformers) would not pose any restrictions on movement of animals.

The soil compaction will also affect the regeneration of understory vegetation due to heavy equipment usage after construction phase. The livestock of the area mostly graze on grasses and other ephemeral herbaceous species and the loss of this ground cover will have a minimal impact for a very short period and the impact is reversible. Hence, impact on ecological environment due to vegetation clearance during construction phase is considered to be **"Low"** from the project activities.

In terms of faunal population, fox, jackal, mongoose, hare, reptiles etc. are reported to be present in the study area. As the construction phase of wind turbines will involve the movement of heavy and light vehicles, influx of workers within the project site and noise from the project activities during construction local wildlife may get impacted in following ways:

- Injury and death due to collision with project vehicles
- Injury and death may result by falling in pits dug at project site
- Hunting
- Electrocution if get contacted with electric cables

Although the construction activity is of very short duration, activities are limited and confined but the area spread of the project site is huge, thus the impact on these mammalian species from construction related activities be termed as **Moderate.**

Habitat Loss, Disturbance and Modification

Habitat loss due to wind turbines and associated infrastructures viz., turbine bases, substation and access roads is anticipated from such type of project. As the land requirement to setup the wind turbines are relatively low but the project expanse is huge, therefore medium risk is anticipated due to habitat loss. But large quantities of earth will be excavated for the purpose of making roads, etc. and vegetation clearance will result in habitat modification in the study area. Moreover, project area is not a designated or qualifying site of national and international importance for biodiversity. Hence, from this aspect, the impact is considered to be "**Low".**

Mitigation Measures

The following measures should be considered in the project design to mitigate the faunal impact due to the project:

- Temporary barriers be installed around the excavated areas so that the wildlife and livestock is not trapped in pits.
- Shepherd be informed through sign boards written in vernacular language to avoid the construction area for grazing their livestock.

- Plantation wherever done should be planted with locally occurring native plant species under the guidance of Forest Department.
- Signage near the Reserved Forests should be in place indicating the presence of wild animals.
- Trapping, hunting and injuring wildlife should be strictly prohibited.
- Labourers should be asked to stay within the project footprint area.
- Use of fuelwood should be strictly prohibited at labour camps and labour camps should be provided alternative energy/fuel for heating and cooking purposes.
- Minimal possible number of routes should be authorized for use during construction by the labourers and staff.
- Awareness programme regarding the significance of conserving wildlife and the penalty associated with killing wild animals should be conducted for the laborers and sub-contractors.

Operation Phase

No site clearance would be undertaken during operation phase, hence no impact anticipated.

OVERALL IMPACT ASSESSMENT

Project Phase	Risk Assessed
Construction	**Low**
Operation	**No impact**

6.4.2 Impact on bird and bat habitat

Construction phase

Wind turbine operation has few direct and indirect impact on bird and bat communities. Bird and bat mortalities has been reported from various operational wind farms across the country. The impacts during operation phase of wind farm is discussed in the sections below. The impacts of wind farm on the birds and bats identified the main potential hazards as:

- Disturbance & displacement
- Collision mortality
- Loss of habitats resulting from wind turbines and associated infrastructure

Disturbance & displacement
According to Birdlife International's report on effect of wind farm impacts on birds, these effects are variable and species, season and site specific. Disturbance can lead to displacement and exclusion from areas. Human activity during the installation of wind turbine such as movement on access roads may also lead to disturbance.

Operation phase

Noise generating from turbines affect birds and bats from using an area close to these. The effect of birds altering their migration flyways or local flight paths to avoid wind farm is another type of displacement. This effect depends on species, type of bird's movement, flight height, distance to turbines, wind force and wind direction etc. This can be highly variable ranging from a slight check in flight direction, height or speed to significant diversions which may reduce the number of birds using areas beyond wind farm. Some study

indicates alteration of flight line whereas some other studies says birds will fly between turbines rows (Christensen et al. 2004, Kahlert et al. 2004a).

The wind turbines are arbitrary located with a minimum distance of 250 m-300 m between consecutive turbines due to which cumulative barrier effect on local flight path is slightly envisaged in the area. Moreover, absence of any established migratory flyways in the area lowers the impacts like disturbance and displacement of migratory birds. The great Rann of Kutch is an important flyway stop for various important avifaunal species which is located at a distance of 55 km from the project site. Also, Important Bird Area (IBA) like Flamingo City, Naliya Grassland, Banni Grassland are located at a distance of 94 km N, 71 km W and 54 km NW respectively from the project profile area. Also, Kutch is popularly known for breeding and wintering areas for Greater Flamingos. No ground birds of high conservational value were sighted from the project site. A detailed bird and bat study to gather more concrete information on bird species, their abundance diversity, local migrating flying path, nesting & breeding areas, flying height and flying duration, should be conducted during migratory season during operational phase to ascertain if there is any impact on any endangered migratory species due to operating wind turbines.

Collision Mortality

The collision mortality is another impact due to wind power project, especially in area of more bird usage i.e. Important Bird Area (IBA). Direct mortality or lethal injury of birds can result from collision with rotor, towers, nacelles and associated infrastructure such as guy cables, power lines and meteorological masts. Although majority of studies indicates low mortality level from wind turbines (Painter et al. 1999, Erickson et al. 2001). Collision risk depends on a range of factors related to bird species, numbers and behaviour, weather condition, topography and scale of wind farm.

Vantage point study was conducted at 8 locations around the project site in the last week of March 2017 for 5 days to assess the bird and bat presence in the area, flying height, using a local flying path of birds and identified location with large usage of birds on and around the project site. A total of 80 bird species were identified from the primary survey. Out of the total 80 species observed, twenty-two bird species were migratory. Eight Schedule-I species, five Near Threatened species of birds were observed within the study area. Thus, effect of wind turbines on local birds cannot be ruled out. The list of these species has been shown in the **Table 6.13**

Table 6.13: List of Schedule I and Near Threatened Species Observed

S. N.	Common Name	Scientific Name	Migratory Status	IUCN status	WPA 1972 Sch.
1	Long Legged Buzzard	*Buteo rufinus*	R	LC	Sch I (Part III)
2	Montagu's Harrier	*Circus pygargus*	WV (From Central Asia, Europe)	LC	Sch I (Part III)
3	Black Kite	*Milvus migrans*	R	LC	Sch I (Part III)
4	Pallid Harrier/Pale Harrier	*Circus macrourus*	WV (from Central Asia)	NT	Sch I (Part III)
5	Indian Shikra	*Accipiter badius*	R	LC	Sch I (Part III)
6	Oriental Honey Buzzard	*Pernis ptilorhynchus*	R	LC	Sch I (Part III)
7	Snake Bird/ Darter	*Anhinga melanogaster*	R	NT	Sch IV

8	Painted Stork	*Mycteria leucocephala*	R	NT	Sch IV
9	River Tern	*Sterna aurantia*	R	NT	
10	Indian Peafowl	*Pavo cristatus*	R	LC	Sch I
11	Black headed Ibis	*Threskiornis melanocephalus*	R	NT	Sch IV
12	Eurasian Spoonbills	*Platalea leucorodia*	Resident	LC	Sch I (Part III)

Visit to Forest Office in Bhuj: During this study, an interview was conducted with a regional forest office in Bhuj. As per the information obtained from the forest office, project area does not serve as habitat for any mirgratory bird species with high conservation status.

Given the absence of any Protected Area (PA) like National Park, Wildlife Sanctuary/Bird Sanctuary or not having an Important Bird Area (IBA) near the project area, the potential impact on avaifauna due to mortality of any endangered bird species during operational phase is considered to be low. However, impact on other abundant bird species cannot be entirely ruled out.

The collision risk of birds and bats near to a WTG ranges between a radius of about 40m to 120 m. As per table 7.10 the species having general flight height >40m can be considered to be at risk of collision with the blades of operating WTG. Thirty-one (31) birds were recorded flying or are able to fly more than 40m from the ground. Birds like Long Legged Buzzard, Montagu's Harrier, Black Kite, Pallid Harrier, Oriental Honey Buzzard, Ashy-crowned Sparrow Lark, Indian Bushlark, Oriental Skylark, Ruddy Shelduck, Common Pochard, Garganey, Common Teal, Darter, Little Swift, Little Egret, Great Egret, Painted Stork, Grey Necked Bunting, Red Headed Bunting, Common Kestrel, Barn Swallow, Red-rumped Swallow, Yellow Wagtail, Little cormorant, Common Sandpiper, Wood Sandpiper, Rosy Starling, Glossy Ibis, Black Headed Ibis and Greater Flamingo found within the study area were found to fly or are able to fly above 40m. **The possible collision impact on birds from operational WTGs is assumed to be Low.**

None of the species observed are endemic to the project area. Also, Important Bird Area (IBA) in Kutch district[25] are Banni Grassland & Chhari hand at a distance of 54 km from the project site as well as Naliya Grassland 71 km W from the project site. Also, no wildlife sanctuary or bird sanctuary and National Park are present within 50 kms from the proposed project site.

During the site visit, a roost of Indian Flying Fox (also known as Fruit bat) was spotted and also have been reported to occur in the project site by local villagers. Based on the study, the overall conclusions drawn are as follows:

- The baseline status of the birds and bats clearly suggests that twenty-two bird species were migratory. Eight Schedule-I species, five Near Threatened species of birds were observed within the study area.
- The sensitive receptors such as important habitats of Birds & Bats i.e. National Park/Grassland, Important Bird Area do not fall in and around the project area and they are located more than 10 km away. Roosting sites of bats were observed in the project area and are also reported to occur in the project area.
- Literature survey suggested that Gujarat falls on Central Asian Flyway which is broadly defined flyway for several migratory birds and there is no other specific migratory bird route that passes only through the Kutch region.

The overall impact on birds and bats due to the project activity during the operational phase is "Low". As mentioned above, the impact from the operational turbines on local bird species can not be entirely

[25] http://www.birdlife.org/

ruled out. Basing upon the primary survey and professional judgement, we recommend a detailed bird and bat study to gather more concrete information on bird species, their abundance diversity, local migrating flying path, nesting & breeding areas, flying height and flying duration, should be conducted in migratory season during operational phase to ascertain if there is any impact on any endangered migratory species due to operating wind turbines.

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Mitigation Measures

The following measures should be considered in the project design to mitigate the bird and bat impact due to the project:

- Above ground wiring, if any should be provided with markers to avoid chances of perching of birds and avoid electrocution;
- Daytime visual markers shall be provided on any guy wires used to support towers to enhance visibility of towers for bird. Visibility enhancement objects such as marker balls, bird deterrents, or diverters shall also be installed along the transmission line to avoid avian collision;
- The tip of blades of WTGs should be painted to increase visibility and avoid collision. This is also done for established aircraft navigation path.
- Bird guards will be used on 3 kV line poles to avoid bird sitting on poles.
- Any dead animals/carcass shall be removed in time from the site so that it does not attract movement of raptors near to the WTGs
- Training of local staff and security guards for spotting of bird carcass and reporting the same. This will help to ensure the strategic actions, when the species are spotted in the region.
- Towers be regularly checked to avoid any nesting in any suitable gaps or platforms.
- Flash lamps on the WTGs should be installed to reduce the collision risks during nights.

Overall Impact Assessment

The overall assessment suggests that the proposed project will not lead to displacement of habitat for birds. Also, loss of habitat is not anticipated for mammals and other avifauna. Based on above discussion, the impact on birds during operation phase of the project is envisaged to be moderate.

Phase Of the Project	Risk Assessed
Construction	**Low**
Operation	**Low**

6.4.3 Impact due to natural disaster

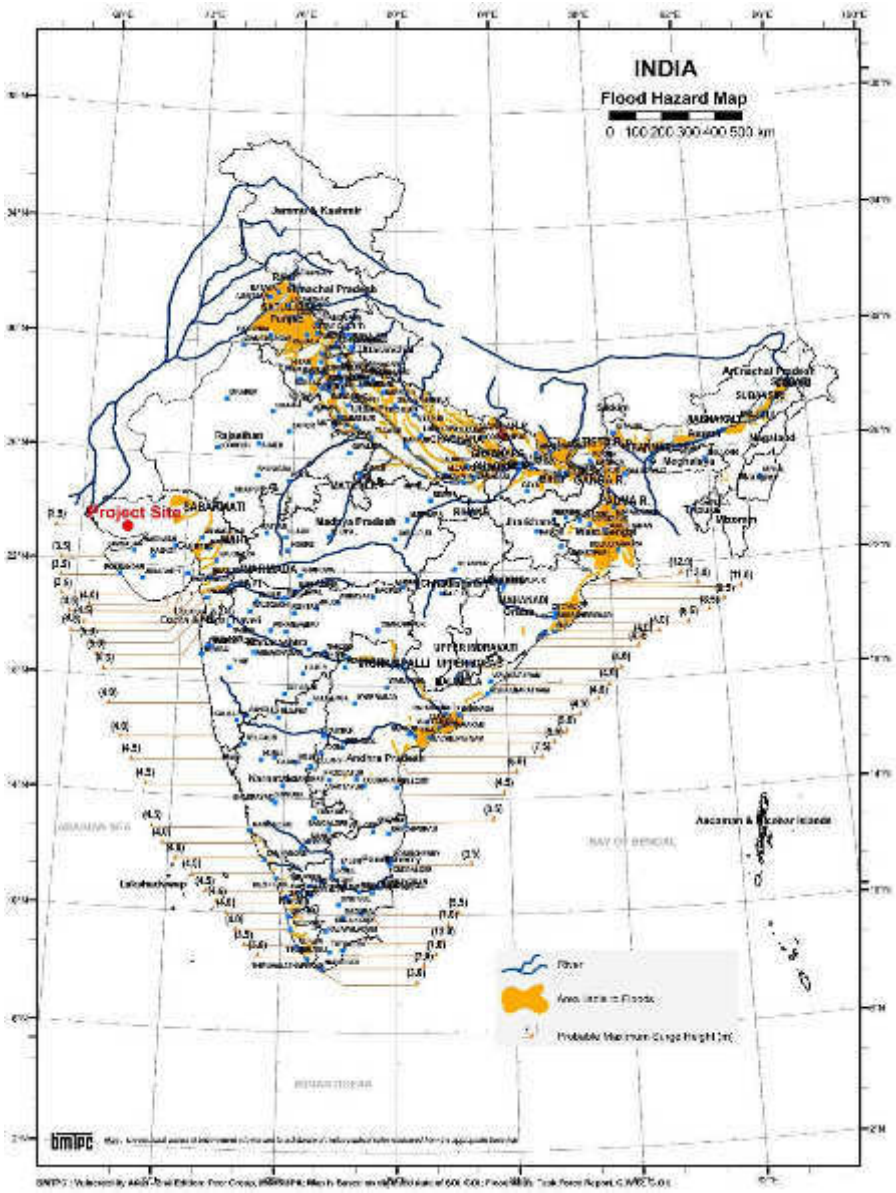
The site is located in a very high risk zone V and hence prone to earthquake. Considering the massive earthquake in 2001 which hit Bhuj. The earthquake killed thousands of people and destroyed about 400,000 homes. The intraplate earthquake reached 7.7 on the moment magnitude scale and had a maximum felt intensity of X (Extreme) on the Mercalli intensity scale. The impact can be termed as high during both construction and operation phase.

6.4.4 Impact Due to Flooding

The landscape of the project area is largely undulating with some parts of flat terrain. The elevation range of the study area lies between 400 and 850 feet. As per readily available flood hazad map of India, published by Building Materials and Technology Promotion Council, Ministry of Housing & Urban affairs, Government of India (BMTPC), Bhuj district does not fall into area vulnerable to floods. Also, there have been no reports of

flood in the project area as learnt from community consultations. Therefore, any impact due to flooding, particularly to proposed pooling substation is considered to be unlikely.

Figure 6-3 Rain Hazard Map of India



6.4.5 Visual Impact

The impact of windfarm development on landscape depends on:

- the distance between individual WTG
- the distance from which they are visible
- the siting and design of the windfarms and
- the way in which the landscape is experienced

The physical dimensions of WTG such as height, rotor diameter, appearance of WTG etc is uniform which gives a uniform landscape character to such as an extent that they create a different landscape character type and have become representative examples for the area. The settlements in the region are located at a sufficient distance from the WTGs. Further, this change is not adverse and local community had no negative perceptions about this change. Hnece, the visual impact from the development of WTG in the project area is a non-issue.

6.4.6 Cumulative Impacts

There are no renewable energy projects located near the proposed project site. Besides, no large industry is also observed in the area, though some small-scale factories like Alumina refinery, Perfoclay manufacturing units along with some stone quarry units are operational in the study area.

Considering the availability of land and good wind potential in the district, establishment of some other wind power project in near future cannot be ruled out. As the proposed wind power project do not involve forceful acquisition of land and the settlements are located far away (Approx. 1 km) as such no resettlement issues are there. However, some single houses were observed within 300m radius from the WTG locations.

Hence, no cumulative impact is envisaged due to the proposed project.

OVERALL IMPACT ASSESSMENT

Phase of the Project	Risk Assessed
Construction	No impact
Operation	No impact

Table 6.14: Overall Project Risk Assessment

Environment and Social Parameters	Impact During Construction Phase	Impact during Operation Phase
Establishment of Labour Camp	Low	No impact
Livelihood	Low	No impact
Laying of Transmission Lines	Moderate	No impact
Employment generation	High	Moderate
Air Quality	Moderate	No impact
Noise Quality	Low	Low
Ground Water Quality	Low	No impact
Surface Water Quality	Low	No impact
Soil Contamination	Low	Low
Top Soil Loss	Low	No impact
Shadow Flicker Analysis	No impact	Moderate impact
Impact on Wildlife other than avifauna	Low impact	No impact

Impact on avifauna	Low impact	Moderate impact
Visual Effects	Low impact	No impact
Aviation Hazard	No impact	Moderate Impact
Rainfall	No impact	No impact
Occupational Health and Safety	Low impact	Moderate Impact
Unnatural Events like Earthquake, floods etc.	High impact	High Impact

Conclusion:

The proposed wind power project will have minor as well as short term impact during construction phase. Moderate impact due to ground water utilization during construction phase is anticipated. Minor impact due to generation of dust and fugitive emissions are expected during construction phase only. Minor impact is expected on resource utilization like land and socio economic conditions of project area villages. There may be impact on cultural resources like Dargah and some temples located within the project site. Land for the proposed project is government land which is being transferred and the application for the same has been submitted in the Revenue department. Impact analysis reveals that minor impact is anticipated on livelihood of local community. Overall impact anticipated due to generation of noise and shadow flicker from the operating WTGs is anticipated as Low and moderate respectively. High impact on avifauna is also anticipated due to collision risk with the operating WTGs. Rest of the impacts on environment and social parameters is assessed to be minor during operation phase of the proposed project.

The project also has a positive impact in terms of employment generation for the local people during entire project lifecycle. The impacts identified both during construction and operation phase can be minimized and mitigated by adopting suitable mitigation measures as suggested in the ESIA report. Based on the conclusion drawn from the ESIA study the proposed project can be categorized as Category B (as per IFCs categorization of projects), which specifies that this project is expected to have limited adverse environment and social impacts which can be mitigated by adopting suitable mitigating measures.

7.0 ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

The Environment and Social Management Plan specifies measures for addressing the limited negative risks and impacts and for enhancing the beneficial impacts. In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

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. OKWPL 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. The outcomes of the Environmental and Social Impact Assessment of the proposed project have been used to formulate a Social and Environmental Management & Monitoring Plan for the project, presented in **Table 7.3**. The Plan specifies measures for addressing the limited negative risks and impacts and for enhancing the beneficial impacts. In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

7.1 Organisational Structure and Responsibilities

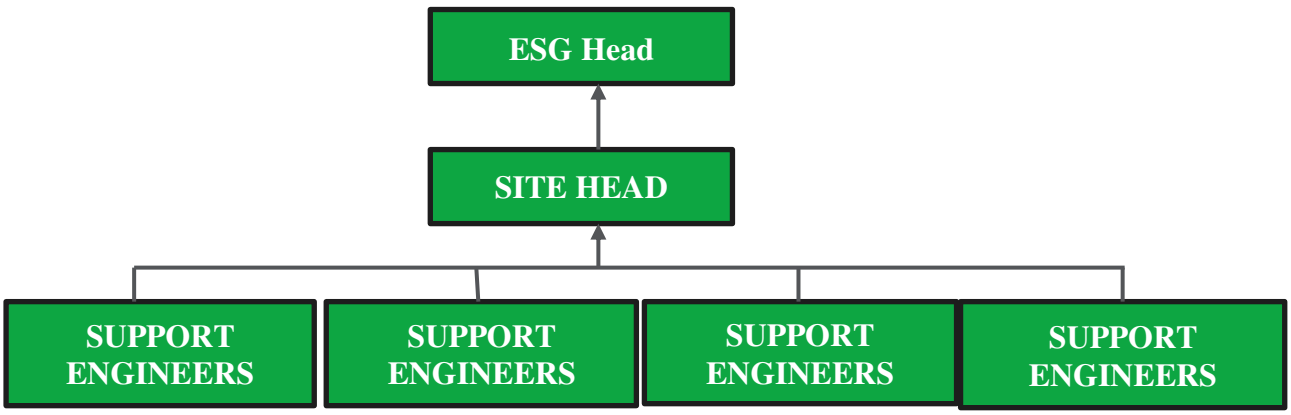
The overall management and coordination of the Project will be managed by COO & CEO (OSTRO), who shall be supported by the Head (Construction) & Head ESG. The Construction Head is supported by site head, site engineers, civil, electrical and mechanical personnel, while the ESG head will be supported by the HSE personnel of Vestas. The contractors shall work in co-ordination with the Site-In-Charge cum EHS Supervisor and be part of the Project management team. The construction contractor shall have an Environment Health and Safety (EHS) supervisor in their team.

Given the footprint of the project will be limited to the turbine sites and their immediate vicinity and the range of stakeholders dependent on the project site for various usages, OSTRO shall ensure that the EPC and O&M Contractor deploys a Social Officer or Site –In-charge to manage social (including labor and community) issues.

Project Management Structure of Ostro during both Construction and operation Phase:

The team of Ostro site team will comprise of a site head and 4 to 5 support engineers. The site team of Ostro will coordinate and monitor all the site activities which OEM/developer executes. For the environment, social and safety aspects, the site team will report to Safety head and ESG head of Ostro.

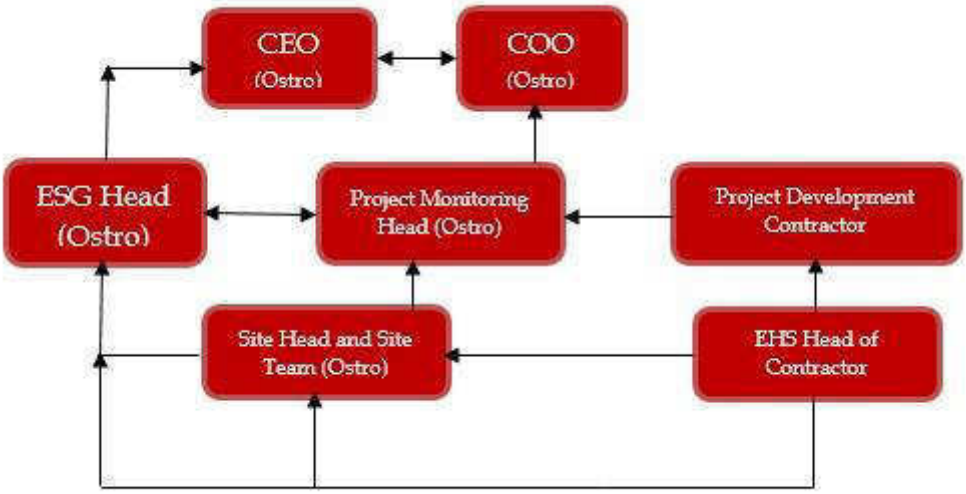
Ostro Kutch Wind Power Limited



EPC -Vestas

On the developer side, the site head will lead a team of 10-15 people to manage site activities. The team will include atleast 2-3 dedicated EHS professionals to manage the EHS aspects at site.

ESMS Committee:



In order to implement Ostro Energy's ESMS, Ostro has a well established ESMS/ESG committee at the corporate level. The proposed ESMS Committee has been presented above. The committee shall comprise of following persons from different functional departments:

- CEO & COO of Ostro;
- Project Monitoring Head;
- Ostro Site Head & Site Team;
- ESG Head (also Chair of the Committee).

7.1.1 Roles and Responsibilities of the ESMS/ESG Committee

The ESMS/ESG Committee is responsible for the following functions:

- Successful implementation of the ESMS at the corporate level and of environmental and social management plan/activities and mitigation measures at the project level;
- Closure of the Action Plan for timely and regularly updating of Environment and Social systems; and
- Integration of the identified risks, impacts and mitigation measures into the business operations as a whole and understand the financial competency to address the same.
- Monitoring of project compliance and implementation status of ESMS.
- Reporting of ESMS performance and project safeguard performance to OEPL management and to lenders.

ESMS committee is formed at corporate level to review the performance of project on environmental, health, safety and social aspects. Regular up-dation of ESMS is the responsibility of ESMS committee in addition to support the top management system to achieve the goal as committed in the Policy.

7.1.2 Roles and Responsibilities of the ESG Manager/Head

OKWPL ESG Head at the corporate level would be appointed as the ESMS Manager and will be assigned with the following roles and responsibilities:

- Chair the ESMS Committee;
- Ensure all activities of the ESMS process are completed;
- Ensure ESDD reviews (and ESIA reviews) are conducted and incorporated into the decision-making process at OEPL;

- ESAP and ESMP are documented, accepted, and incorporated into the action plans at the site and all offices of OEPL; and
- Report on progress and adherence to ESMS and items on ESAP/ESMP.

7.1.3 Roles and Responsibilities of Site Head and Site Team

The asset level or onsite ESMS Manager or personnel shall be responsible for:

- Ensuring ESAP and ESMP are implemented and followed-throughout the project lifecycle;
- Ensuring contractors and partners adhere to practices in line with ESMS policy; and
- Identifies occupational hazards along with site team on routine basis and gets is closed. Report of hazards identified to be submitted to ESG head.

Given the footprint of the project will be limited to the turbine sites and their immediate vicinity and the range of stakeholders dependent on the project site for various usages, OKWPL should ensure that the Vestas and other hired contractors deploys a Social Officer or Site In-charge to manage social (including labor and community) issues.

7.2 Training of Personnel & Contractors

OKWPL should 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 should be placed on traffic management, operation of cranes, stakeholder's engagement and grievance redressal. General environmental awareness should 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 minimizing adverse environmental impacts, ensuring compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment should be imparted to the contractors and sub-contractors prior to the commencement of the project.

An environmental and social management training programme should be conducted to ensure effective implementation of the management and control measures during construction and operation of the project. The training programme should 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 the project areas; and
- Aware of the potential risks from the project activities.
- A basic occupational training program and specialty courses should be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments.
- Training should 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 should ensure that service providers, as well as contracted and subcontracted labour, are trained adequately before assignments begin.

OKWPL ESMS details the training requirement for the site team and key contractor employees/workers, the same has been tabulated below in Table 7.1

Table 7.1: Training Requirements pertaining to OKWPL's Operations

SN.	Action Items	Frequency	Duration (days)	Responsibility	Target Participants
1	Training on hazard identification, risk assessment and Accident investigation and reporting.	Twice in year	1	ESG, site head, construction head	Ostro Site team, site supervisors and other key persons.
2	Training on defensive driving and Journey Management.	Every quarter	1	ESG, site head, construction head	Ostro Site team, site supervisors TM and other drivers.
3	Training on first aid and CPR	Twice in year	1	ESG, site head, construction head	Ostro Site team, site supervisors and other key persons.
4	Training on construction site safety.	Once in year	1	ESG, site head, construction head	Ostro Site team, site supervisors and other key persons.
5	Training on Emergency Response and Planning with mock drills	Twice in year	1	ESG, site head, construction head	Ostro Site team, site supervisors and other key persons.

7.3 Monitoring

In order to implement the ESMP, the on-site team should 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 should 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 should cover all stakeholders including contractors, laborers, suppliers and the local community impacted by the project activities and associated facilities thereby increasing the effectiveness of suggested mitigations measures. OKWPL should 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 should be carried out by an internal trained team and external agencies/experts. The entire process of inspections and audits should be documented and key findings of which should be implemented by the proponent and contractors in their respective areas.

Performance monitoring and measurement

The purpose of monitoring is to track the performance of project against the requirement in the ESMS. The monitoring outcomes will provide the basis for establishment of key quantitative and qualitative measures for social, environment, health and safety indicators.

As per Ostro Energy's ESMS manual, the site level OKWPL monitoring program shall be overseen by the ESMS Manager in the organization. The ESMS/ESG Committee shall monitor and measure the effectiveness periodically and review the ESMS implementation being supported by the EHS officers at the asset level. The EHS officers or site level EHS in-charge shall produce a monthly update on compliance to Health & Safety at their site through adequate documentation. This statistical information shall be collated into a report every month and presented to the ESMS committee for discussion.

Ostro Energy's Management Review:

The EHS site personnel shall provide specific site reports for the asset level to ESMS Manager to provide them with progress against targets for compliance. Annually, there would be an internal auditing system to ensure the continuing suitability, adequacy and effectiveness of health, safety and environmental arrangements. Thereafter, the review of the ESMS plan is to be carried out by the ESMS committee for addressing the following:

- Review of issues/initiatives raised through individuals;
- Review of implementation of ESAP, EMP, RP, Scheduled Tribes;
- Development Plan/IPP, and HS&E accidents, incidents and complaints;
- Review of Audit Results;
- Applicability of HS&E policies and procedures;
- Review of Objectives and Targets and status to date; and
- Review of Management structure, resources and training requirements.

The responsibility matrix is shown in **Table 7.2**

Table 7.2: Reporting Responsibility Matrix

SN.	Type of Reports	Responsible Person	Reporting To	Frequency of Reporting
1.	Hazard Identification Reports	Ostro Project Site Team	ESG & Project's Monitoring Team	Weekly
2.	Daily Progress Reports through emails	Ostro Project Site Team	ESG & Project's Monitoring Team	Daily
3.	Weekly Safety Reports	OEM/Developers	ESG & Project's Monitoring Team	Weekly
4.	Monthly Progress Reports	OEM/Developers	Project's Monitoring Team	Monthly
5.	Quality Inspection Reports	Third Party Expert	Project's Monitoring Team	Weekly
6.	ESMP Tracking Sheet	Project Site Head	ESG & Project's Monitoring Team	Monthly
7.	Community Grievance Register	Project Site Head	ESG & Project's Monitoring Team	Monthly
8.	Accident /Incident reports	Project Site Head /Site Team	ESG & Project's Monitoring Team/ CEO/COO	As per requirement
9.	CSR Report	Corporate CSR/ NGO	ESG & Project's Monitoring Team	Monthly

7.4 Documentation & Record Keeping

Documentation and record keeping system must be established to ensure updating and recording of requirements specified in ESMP. Responsibilities must be assigned to relevant personnel for ensuring that the

ESMP documentation system is maintained and that document control is ensured. The following records should 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

Table: 7-3 Environment and Social Management Plan

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
CONSTRUCTION PHASE							
A	**Environmental Management Plan**						
1	**LANDSCAPE AND VISUAL**	Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery.	**LOW**	▪ Ensure the construction site is left in an orderly state at the end of each work day ▪ Construction machinery, equipment, and vehicles not in use should be removed in a timely manner to the extent possible ▪ Proper handling of waste streams	**NO IMPACT**		Contractor under the supervision of OKWPL Personnel
2	**GROUND WATER ABSTRACTION**	The total water requirement is high but of short term, the region as per CGWB falls in critical zone and hence the impact is not much envisaged.	**LOW**	▪ The water should be sourced from authorised sources who have taken prior approval from CGWB.		Maximum efforts should be made to reuse and recycle water to reduce water consumption.	
3	**GROUND 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.	**LOW**	▪ Drip pans should be provided with vehicles with leaks to prevent soil contamination; ▪ Storage of oil should be undertaken on paved impervious surface and secondary containment should be provided for fuel storage tanks ▪ Adequate drainage of road based on road width, surface material, compaction and maintenance ▪ Leak-proof holding tanks for sanitary waste water should be constructed to protect the shallow ground water level. ▪ Waste water holding tanks / septic tank should be located at more than 500 m away from bore wells or any other underground water holding tanks. ▪ It should be ensured that the waste water does not find its way into surface waters or water wells.	**NO IMPACT**	▪ Machinery and vehicles should be thoroughly checked for the presence of leaks if any; ▪ Leakage of vehicles to be checked; ▪ Storage of oil on site to be checked	Project Developer/ Contractor under the supervision of OKWPL Personnel
4	**AIR QUALITY**	▪ Fugitive Dust due to movement of project vehicles ▪ Emission from Diesel Generators	**MODERATE**	▪ Vehicles speed to be restricted to 20-30 km/hr. on unpaved road. This will reduce dust emission. ▪ Raw material should be covered with tarpaulin sheet during transportation and in storage area. ▪ Practices water sprinkling wherever required on unpaved area but ensure use of tanker water purchased form authorized vendor only. ▪ All the project vehicles should have valid PUC certificate ▪ Ensure regular maintenance of project vehicles during construction and operational phase ▪ Turn off the DG sets & machineries which are not in use	**LOW**		Project Developer/ Contractor under the supervision of OKWPL's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				▪ DG sets preferably should be placed away from settlement area. ▪ It will be ensured that exhaust emissions of construction equipment adhere to emission norms as set out by MoEFCC/ CPCB.			
5	**SOIL QUALITY**	Top Soil Loss	**LOW**	▪ Provide appropriate storage of top soil in an isolated and covered area to prevent its loss in high wind and runoff. ▪ Allow only covered transportation of top soil within project site. ▪ Use top soil at the time of plantation ▪ Construction debris should be reused in paving on site approach road to prevent dust generation due to vehicular movement ▪ Re-vegetation should be done in the area after the completion of construction, in order to reduce the risk of soil erosion	**NO IMPACT**	▪ The workforce should be sensitized to handling and storage of hazardous substances viz. fuel oil, machine oil/fluid etc. ▪ The workers engaged in handling hazardous substances should be briefed about the possible hazards and the need to prevent contamination.	Project Developer/ Contractor under the supervision of OKWPL's Personnel
		Soil Contamination		▪ In case of any accidental spill, the soil will be cut and stored securely for disposal with hazardous waste. ▪ Store hazardous material (like used oil) in isolated room with impervious surface. ▪ Filling and transfer of oil to and from the container should be on impervious surface. ▪ Waste disposal grounds that are in use by the local people should be identified and permission from local administration for use of the same needs to be obtained for disposing domestic wastes. ▪ Hazardous wastes, when accumulated, should be disposed to facilities registered with the Central Pollution Control Board.			
6	**NOISE LEVEL**	▪ Disturbance to habitants ▪ Vehicular noise from heavy vehicles utilized to deliver construction materials and WTG parts ▪ Noise from DG sets ▪ Construction noise from using mobile equipment, cranes and concrete mixing	**LOW**	▪ Regular maintenance of construction machinery and equipment should be carried out to ensure noise emissions are maintained at design levels. ▪ Integral noise shielding to be used where practicable and fixed noise sources to be acoustically treated, for example with silencers, acoustic louvers and enclosures. ▪ Keep stationary source of noise such as DG sets (during construction phase) at farthest point from the settlements ▪ Restrict major noise generating activities during night time 10:00 pm to 6:00 am ▪ Provide personal protective equipment to workers working near DG sets and other high noise source. ▪ Local communities need to be informed about the vehicular movement before start of heavy vehicle carrying materials and machines to site. Sensitive	**NO IMPACT**	It will be ensured that noise emissions of construction equipment adhere to emission norms as set out by MoEFCC/CPCB	Project Developer/ Contractor under the supervision of OKWPL's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				locations should be identified and avoided as far as possible from the route and if unavoidable, drivers should be informed to restrict speed at those locations. ▪ Diesel generator sets, if used; will adhere to noise standards of MoEFCC.			
7	**HAZARDOUS WASTE**	Contamination of land and soil	**LOW**	▪ Hazardous materials like waste oil, used oil should be stored at designated locations in enclosed structures over impermeable surface. ▪ Maintain a register of all hazardous materials used and accompanying MSDS must present at all times. ▪ Spilled material should be tracked and accounted for. ▪ The hazardous materials stored at the construction site like acetylene cylinders, petroleum, spirit, diesel, lubricating oil, paints etc. should be stored as per the statutory provisions of Manufactures, Storage and Import of Hazardous Chemicals Rules. 1989 under the Environment (Protection) Act, 1986	**NO IMPACT**	Periodic EHS audits should be conducted to monitor the use of hazardous materials and its inventory maintained	Project Developer/ Contractor under the supervision of OKWPL's Personnel
8	**SOLID WASTE**	Contamination of land	**LOW**	▪ Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste". ▪ Domestic and construction waste like recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers	**NO IMPACT**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of OKWPL's Personnel
9	**CHANGE IN LOCAL TOPOGRAPHY**	Alteration in natural drainage pattern	**LOW**	▪ Don't allow the considerable alteration of contour level ▪ Provide alternatives to collect surface runoff from the project site during the monsoon period ▪ Don't allow exit of runoff from the project site in the adjacent areas. ▪ Site preparation activities should be designed to avoid any significant elevation of the land or blocking or altering natural drainage channels in the project site. ▪ Site preparation and development should be planned only after a detailed drainage plan has been prepared for site. ▪ If channels/drains get blocked due to negligence, it will be ensured that they are cleaned especially during monsoon season.	**NO IMPACT**	The drainage patterns of the area will be maintained.	Project Developer/ Contractor under the supervision of OKWPL's Personnel
10	**ECOLOGY**	▪ The construction activities may lead to loss of vegetation resulting in displacement of wildlife species. ▪ Disturbance to local livestock population	**LOW**	▪ The site clearance for tower erection, access road and ancillary facilities should be restricted to the necessary footprint area around WTG. ▪ The crane staging area, intervening areas, overhead clearance for suspended turbine components should be planned in such a way that minimum tree felling is required;	**NO IMPACT**	The entire workforce should be sensitized (by the construction contractor) to possible adverse ecological impacts during the construction phase by conducting awareness programs	Project Developer/ Contractor under the supervision of OKWPL's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				▪ Contractors should ensure that labour colonies are not set up in the regions where faunal species are commonly found; ▪ In order to avoid deterioration of water quality and to prevent release of pollutants into the water body by the workers, project proponent should provide adequate sanitation facilities and garbage disposal bins in the labour camp. ▪ Sign boards on the roadside should be installed and strict regulations on speed limits should be imposed to control the road kills of animals during transportation of materials			
11	**BIODIVERSITY**	Site development will lead to the loss of mainly herbaceous species	**LOW**	▪ Care should be taken to install the wind turbine in non-monsoon season and special precautions will be taken to minimize sediment run-off during the rainy days. ▪ Excavated soil should be kept in bund walls to protect sediment run-off during rainy days especially near water body and areas with natural slope; ▪ Store topsoil and other soil separately in designated areas of the construction compounds, in such a way that it is not mixed with subsoil or trafficked on by vehicles; ▪ To limit the disturbance of soil structure, humus/topsoil layers has been separated from the infertile deposits to use it correctly after completion of works; ▪ Care should be taken towards deciding the approach road, it should not be an obstruction to micro drainage channels near water body, local drainage should not be blocked. ▪ Green area is proposed in the area. Plantations along the approach roads, site office is one of the preferred methods to not only increase the green cover of the area but also serve as a sink for air pollutants	**NO IMPACT**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of OKWPL's Personnel
B	**Social Management Plan**						
1	**ENGAGEMENT OF LOCAL AND MIGRANT LABOUR**	Conflicts between labour and contractor	**LOW**	▪ Employment will be provided to local people wherever possible, especially as unskilled construction workers and security guards ▪ OKWPL should include clause or provisions related with non-engagement of forced and child labour, gender equity, non-discrimination on employment and opportunity and freedom to express their view in contractors agreement and HR policy ▪ OKWPL through its contractors should ensure that labour is being adequately paid by contractors. Also ensure that wages is being paid as per the requirement of minimum wages act	**LOW**	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of OKWPL's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				▪ OKWPL should conduct internal audits as when required to monitor the performance of contractor. ▪ OKWPL through the contractor inform the labour about emergency preparedness plan and communication system to be followed during emergency situation ▪ OKWPL through contractor should ensure that labour receive training on health and safety issues involved in the proposed project.			
2	**LABOUR ACCOMMODATION (Onsite and offsite Labour camp)**	Conflicts between labour and local community	**MODERATE**	▪ OKWPL to setup onsite labour camp for labours employed through contractors to restrict the interaction of migrated labour with local community as to avoid any conflict.	**LOW**	Grievance Redressal mechanism should be followed and monitored	Project Developer/ Contractor under the supervision of OKWPL's Personnel
3	**SOCIAL/LIVELIHOODS**	▪ ROW for transmission lines ▪ Obstruction to places of relevance	**MODERATE**	▪ The layout for access roads and transmission lines should consider minimum land requirement and should avoid procurement of agricultural land; ▪ The project management should undertake a formal consultation with all farmers from whom right of way should be obtained, gain an informed consent ▪ Site Management should ensure that all agreements will be executed properly and documented ▪ The access road to the turbines should not obstruct the access to the religious structure in any way ▪ Any waste generated during the construction phase should not be accumulated near the religious structure as this might affect the sentiment of the locals ▪ Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding project related components are promptly and adequately investigated and resolved	**LOW**	▪ Construction contractors should adhere to social obligations, labour laws and international commitments ▪ OKWPL through contract agreement, should ensure that The contractor should provide the migrant workers adequate information on expected social behaviour and hygiene practices to be followed at site ▪ Water usage should be monitored and controlled to minimize the wastewater generation ▪ OKWPL to ensure that all site personnel and migrant labourers avoid using any community infrastructure facilities like water bodies, electricity etc., without prior permission from the Panchayats	Project Developer/ Contractor under the supervision of OKWPL's Personnel Social Management team for grievance Handling
4	**COMMUNITY ENGAGEMENT**	Community empowerment	**MODERATE**	▪ Given the short duration of the Project construction phase efforts will be made to engage with the community through the Panchayati Raj Institution representatives and key identified leaders of the community.	**LOW**	▪ Continuously throughout the project lifecycle. ▪ Grievance Redressal Mechanism should be followed and grievance register should be maintained onsite.	Contractor under the supervision of OKWPL's Personnel / PRI representatives

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
5	**OCCUPATIONAL HEALTH AND SAFETY**	▪ Material handling and storage ▪ Possible injuries associated with working at height (≥ 2m ▪ Other occupational hazards	**MODERATE**	▪ All material will be arranged in a systematic manner with proper labelling and without protrusion or extension onto the access corridor. ▪ Loading and unloading operation of equipment should be done under the supervision of a trained professional ▪ All work at height to be undertaken during daytime with sufficient sunlight ▪ Proper PPEs should be provided to workers handling welding, electricity and related components. ▪ Fire extinguishing equipment should be provided in adequate number on site to handle any possible fire outbreaks ▪ An accident reporting and monitoring record should be maintained ▪ Display of phone numbers of the city/local fire services, etc. at site should be done ▪ The labour engaged for working at height should be trained for temporary fall protection devices	**LOW**	▪ The labour engaged for working at height should be trained for temporary fall ▪ All the workers should be made aware of the possible occupational risks/hazards by the way of an OHS training/awareness programme ▪ An accident reporting and monitoring record should be maintained	Contractor under the supervision of OKWPLs Personnel
6	**COMMUNITY HEALTH AND SAFETY**	▪ Blasting operations during access road construction	**LOW**	▪ Use of proper amount of explosive taking into consideration the geomechanically conditions of the site. ▪ Controlled blasting will usually be done in daytime during the shift change over period. ▪ Controlled blasting technique will be adopted in the project. So, there will be no adverse effects on life, property and ambient noise. ▪ Before blasting is done, warning sound shall be given and placards/flags will be displayed so that people can move to safe places. ▪ For vibration control: Proper conformation to measures for safe blasting, to avoid damage to any structure or annoyance to the people in the adjoining areas. ▪ If blasting is required then the procedure of blasting should be followed as per OSTRO's protocol for blasting. ▪ Provision of first-aid kits at all work-areas onsite ▪ Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access. ▪ Safety signage and posters will be displayed at strategic locations within the site.	**NO IMPACT**	▪ All the people in the adjoining areas should be made aware of the possible risks/hazards by the way of an OHS training/awareness programme ▪ An accident reporting and monitoring record should be maintained	Contractor under the supervision of OKWPLs Personnel
7	**CORPORATE SOCIAL RESPONSIBILITY**	Community empowerment	**MODERATE**	Employment will be provided to local people wherever possible, especially as unskilled construction workers and security guards	**NO IMPACT**	CSR Activities should be documented	Project Developer/ Contractor under the supervision of OKWPL's Personnel
				Developmental needs and expectations (such as employment in the project or up-gradation of educational health care facilities, cultural property and infrastructure)		Should be conducted continuously through the project cycle.	OKWPL's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				of local communities will be identified through the Gram Panchayat, villagers and local administration.			
				Opportunities for contributing to the economic and developmental needs of villagers through skill training will be explored.		Should be conducted continuously through the project cycle.	OKWPL's Personnel
OPERATION PHASE							
A. ENVIRONMENT MANGEMENT PLAN							
1	**AMBIENT NOISE LEVELS**	Noise generation due to operation of wind turbines.	**LOW**	▪ Wind turbines should be designed in accordance with the international acoustic design standards ▪ Proper and regular maintenance of the WTG's ▪ Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding operational noise are promptly and adequately investigated and resolved; ▪ Operating turbines in reduced noise mode. ▪ Building walls/appropriate noise barriers around potentially affected buildings (only an option in hilly terrain, due to the height of turbines) ▪ Curtailing turbine operations above the wind speed at which turbine noise becomes unacceptable in the project-specific circumstances. ▪ As detailed earlier in Limitations that a total of 53 WTG locations have been identified by OKWPL after Arcadis team conducted site visit. It has been reportedly been ensured by OKWPL that new 53 WTG locations are identified at approximately 300 m away from nearby village settlements/ houses in order to avoid possible noise and shadow flicker impacts as recommended by IFC in its guidelines for Wind Energy Sector. - Also, locations are sighted in a way that they are away from the nearest public roads, EHV lines, railway tracks by 'falling distance', which is (Hub Height + Blade length + 5m). - It is also evaluated by OKWPL that no proposed locations fall in any ecologically sensitive areas such as forest, bird sanctuaries etc and such locations are cancelled for further consideration, thereby avoiding potential ecological impact. - All such locations which doesn't meet the above points are informed to WRA and Contracts team. - WRA then finds alternate locations, which is again verified on ground by site teams.	**NO IMPACT**		VESTAS / OKWPL's Personnel
2	**BIODIVERSITY**	▪ Bird Collision ▪ Modification of habitat	**LOW**	▪ Adequate space between each turbine; ▪ The vane tips of the wind turbine should be painted with orange colour to avoid bird hits;	**LOW**	Bird and bat monitoring study should be conducted per season for one year.	OKWPL personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				▪ Conduct birds and bats survey by an independent ornithologist in operation stage of wind power project during migratory season. During this study carcass monitoring will also be conducted. ▪ Bird guards will be installed on 11 kv transmission line poles. ▪ Flash lamps on the WTGs should be installed to reduce collision risk to bird at night ▪ Identify the season in which the impact on birds and bats is significant; and ▪ In case of high mortality of birds or bats, further study will be conducted to understand whether impacted birds are having high conservation status. In case of high impact on any critically endangered bird species, feasible options to reduce the impact may be considered. ▪ The specific measures will be identified on the basis of outcomes from post-construction/operational monitoring. Client should keep track of the latest solution to mitigate impact of wind periodturbines on birds and bats so as to choose the best option. ▪ As detailed earlier in Limitations that a total of 53 WTG locations have been identified by OKWPL after Arcadis team conducted site visit. It has been reportedly been ensured by OKWPL that new 53 WTG locations are identified at approximately 300 m away from nearby village settlements/ houses as recommended by IFC in its guidelines for Wind Energy Sector. - It is also evaluated by OKWPL that no proposed locations fall in any ecologically sensitive areas such as forest, bird sanctuaries etc and such locations are cancelled for further consideration, thereby avoiding potential ecological impact. - All such locations which doesn't meet the above points are informed to WRA and Contracts team. - WRA then finds alternate locations, which is again verified on ground by site teams.			
3	**SHADOW FLICKER AND BLADE THROW HAZARD**	• Disturbance to nearby community due to shadow flickering caused by wind turbines • Injury due to accidental blade throw	**LOW**	▪ As detailed earlier in Limitations that a total of 53 WTG locations have been identified by OKWPL after Arcadis team conducted site visit. It has been reportedly been ensured by OKWPL that new 53 WTG locations are identified at approximately 300 m away from nearby village settlements/ houses in order to avoid possible shadow flicker impacts as recommended by IFC in its guidelines for Wind Energy Sector. - Also, locations are sighted in a way that they are away from the nearest public roads, EHV lines, railway tracks by 'falling distance', which is (Hub Height + Blade length + 5m).	**LOW**	Necessary procedure will be followed and records will be maintained for consultations, essential documents, compensation benefits etc.	Vestas/ OKWPL's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				- All such locations which doesn't meet the above points are informed to WRA and Contracts team. - WRA then finds alternate locations, which is again verified on ground by site teams. ▪ During site selection of the project, measures are taken to select the WTGs location at least 300 m from all the temporary and/or permanent structures. However, if the settlements are located within the narrow bands (300m), each dweller will be informed about possible negative impacts i.e. noise, shadow flicker, blade throw etc. If the owner is willing to relocate, the structure will be dismantled with mutual agreement and appropriate compensation will be provided as per local/national regulations and in line with IFC PS' physical and/or economic displacement requirements. ▪ Ensure that the receptor has blinds or curtains to mask the shadow flicker effect. ▪ Equip wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary. ▪ Regularly maintain the wind turbine. ▪ Use warning signs to alert the public of risk.			
4	**Aviation Hazard**	• Potential collision or alteration of flight paths in low flying areas • Wind energy facility close to aviation radar will pose signal distortion, which may cause loss of signal, masking real targets and/or erroneous signals on the radar screen, creating flight safety issues	HIGH	▪ Consultation with relevant aviation authorities before installation, in accordance with air traffic safety regulations. ▪ When feasible, avoid siting wind energy facilities close to airports and within known low-flying areas or flight paths. Cumulative impacts associated with the number of existing wind energy facilities within, or in close proximity to, low-flying areas or flight paths should be a consideration in siting turbines. ▪ Consultation should be undertaken with the relevant aviation authorities to determine prevention and control measures. ▪ Consider wind energy facility design options, including geometric layout, location of turbines, and changes to air traffic routes.	**LOW**	Necessary consultations with aviation authorities should be undertaken	Vestas/ OKWPL's Personnel
B	**SOCIAL MANAGEMENT PLAN**						
1	**COMMUNITY HEALTH AND SAFETY**	▪ All WTGs should be located away from habitations ▪ Visual Aesthetics and Blade Glint ▪ Electromagnetic Field (EMF) interference	**LOW**	▪ 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 ▪ Implement the recommended complaint resolution procedure (Grievance Redress Mechanism) to assure that any complaints regarding blade glint are promptly and adequately investigated and resolved	**NO IMPACT**	Complaint Register should be maintained and grievances registered and timely action should be taken	Vestas/ OKWPL's personnel Social Management Team for Grievance Handling

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
2	**OCCUPATIONAL HEALTH AND SAFETY OF WORKERS**	▪ Electrocution ▪ Firing due to short-circuit ▪ Possible injuries associated with working at height ▪ Diseases due to unhygienic condition	**MODERATE**	▪ Provide and ensure wearing of personal protective equipment's viz., gloves, helmets, ear plug, safety belt etc. ▪ Ensure effective work permit system for critical activities such as electrical work and working at height ▪ Prepare emergency communication system and emergency preparedness plan ▪ Ensure proper sanitation facilities.	**LOW**	Periodic EHS audits	Vestas/ OKWPL's EHS officer
6	**SOCIAL WELFARE**	Dissatisfaction among locals due to project operation	**MODERATE**	▪ Maximum employment should be provided to local people, especially as security guards wherever possible on need basis. This should be incorporated in the agreements with contractors and the local employment and procurement policy. ▪ A Community Development Plan should be prepared to address community needs and improve social conditions of the local. ▪ Grievance Redressal Mechanism should be prepared and implemented to address communities concerns and resolve conflicts if any. ▪ Stakeholder Engagement Plan for engaging and communicating with various stakeholders (local communities, concerned Government and regulatory bodies, lenders/financial institutions etc). ▪ Typical communication mechanism with various stakeholders include but not limited to: ▪ Consultations with community members and key stakeholders through all the phases of the project ▪ Building trust among the community members and other stakeholders for successful implementation of the project as well as community development plan ▪ Role of OKWPL in development activities of the villages and its commitment towards the community development programs need to be clearly defined as community members, village level institutions and local government department may have expectations from OKWPL. ▪ The local, state level and the central governments have many existing/ongoing development programs for up-liftment of village communities. In such cases the project need not duplicate the efforts, rather the community development programs can be dove tailed into ongoing government programs ▪ The community development plan should be able to yield long-term benefits to the community members. ▪ The community development plan would initially be targeted to villages close to project site	**LOW**	Periodic EHS audits	Vestas/ OKWPL's EHS officer

7.5 Environmental Management Plans

The ESMP is comprised of some site specific management plans viz. Emergency Management Plan, Waste Management Plan, Storm Water Management Plan, Environmental Monitoring Plan, Traffic Management Plan and Social Development Plan for the OKWPL 250 MW Wind Power Plant at Kutch district of Gujarat. The management plans will be executed through Environmental Social Management System.

7.5.1 Emergency Preparedness and Response Plan

Purpose

Ostro energy under which OKWPL is a subsidiary unit already has an Emergency Response plan at the corporate level. However, OKWPL will develop a site specific Emergency Management Plan for implementation at the proposed site in the event of an emergency situation so that the loss of life and damage to the properties & natural resources are minimized. This plan outlines a series of emergency actions that will be executed by OKWPL L & its Contractors to ensure preparedness and response to emergency situations throughout the life-cycle of the project.

Emergencies

The emergency situations that are probable to occur at the site and the probable causes are listed below:

- Fire at site during temporary construction phase which cannot be doused by fire extinguishers; Also fire due to short circuit at the plant and equipment during both construction & operation phase.
- Collapse of any structure
- Outbreak of endemic disease among a large section of construction workers due to contaminated drinking water, unhygienic conditions that have developed at workplace;
- Protests by the local community or other stakeholders at any point of the project lifecycle due to grievances;
- Severe injury or death of employee or sub-contracted worker at work, due to non-work related illness or work-related accident.
- Onset of any natural disaster like earthquake. The site is located in a very high risk zone V and hence prone to earthquake. Considering the massive earthquake in 2001 which hit Bhuj., proper emergency management training should be imparted to the staff members onsite.

Emergency Management

The following steps should be taken to ensure proper management of emergency or crisis situations:

- The nearest civil hospitals, private health care centers or practitioner clinic should be identified and agreements should be made with the aforesaid medical centers/practitioners to provide prompt health care services (including ambulance services) in the event of an emergency situation at site.
- A list of important telephone numbers such as fire brigade, health care facility/practitioner, police station, EHS and Social Coordinator, project office, head offices should be displayed at all the prime locations at site & the worker's camp (during construction phase).
- Regular liaising with the police, Gram Panchayat, district administration should be carried out to ensure that prompt assistance is readily available in the event of an emergency.
- An Emergency Management (including Disaster Management) team comprising of 4-6 professionals both from the developer and contractors' side, during construction phase and 2-3 professionals during operation of the proposed project; should be formed to combat any emergency situation and ensure safety of the life and property at site. For this purpose 2-3 personnel employed in the plant during operation phase should be trained on Emergency scenarios and their management measures including their roles and responsibilities in case of an emergency situation.

- The workers (staff & contractual workers from both OKWPL & contractors) should be trained on their duties and emergency preparedness during an emergency. In case of an emergency, all site personnel should be trained to follow the communication lines given below:
  a. Personnel at site affected by the emergency situations immediately inform the project office and the external agencies (such as police, fire brigade, ambulance services); In case, project office cannot be reached, the coordinator will be informed directly;
  b. The EHS Manager being informed about the emergency by project offices or by the employee directly; reaches site if necessary, and also follows-up with the aforesaid external agencies for aid;
  c. The EHS Manager takes charge of the emergency response and direct further action and co-ordination, including escalating the matter to the CEO or other top-level managers as required.

Responsibilities

The EHS Manager will be responsible for implementing this procedure, which includes

- Ensuring that the emergency preparedness measures are in place;
- Providing training to the personnel at site regarding reporting of the emergencies, and to site office personnel regarding response to emergency calls from the site personnel,
- Direct action-and co-ordination at the time of an emergency

Community health and safety hazards specific to wind energy facilities primarily include the following:

Electromagnetic Interference and Radiation: Wind turbines could potentially cause electromagnetic interference with telecommunication systems (e.g., microwave, television, and radio). This interference could be caused by path obstruction, shadowing, reflection, scattering, or re-radiation. The nature of the potential impacts depends primarily on the location of the wind turbine relative to the transmitter and receiver, characteristics of the rotor blades, signal frequency receiver characteristics, and radio wave propagation characteristics in the local atmosphere. Suitable mitigation measures to enhance the quality of the television signal and lower the impact of wind turbine on telecommunication need to be adopted.

Public Access: Safety issues may arise with public access to wind turbines (e.g., unauthorized climbing of the turbine) or to the wind energy facility substation. Any public rights of way located within and close to the wind energy facility site should be identified prior to construction to establish any measures that may be required to ensure the safety of their users. Prevention and control measures to manage public accesses include:

- Use gates on access roads.
- Where public access is not promoted to the site and/or there are no current rights of way across the site, consider fencing the wind energy facility site, or individual turbines, to prohibit public access to the turbine.
- Provide fencing of an appropriate standard around the sub-station with anti-climb paint and warning signs.
- Prevent access to turbine tower ladders
- Post information boards about public safety hazards and emergency contact information.

Blade Throw: A failure of the rotor blade can result in the “throwing” of a rotor blade, or part thereof, which may affect public safety. The overall risk of blade throw is extremely low. Blade throw risk management strategies include:

- Establish setback distances between turbines and populated locations. The minimum recommended setback distance is 2 x hub height, although it can vary with the size, shape, weight, and speed of the blades, and the height of the turbine.
- 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.
- Carry out periodic blade inspections and repair any defects that could affect blade integrity.

- Equip wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.

7.5.2 Community Liaison Plan

The Community Liaison Plan is a critical element of the overall Social Management Plans. Regular transparent communication between both the project and the communities and vice versa is crucial in building positive relationships between the two parties. This relationship should be crucial for managing unexpected situations which might arise during the course of the project. This plan should be read with other social management plan because the liaison which needs to be done for the individual plan is detailed within the plan. The communication plan mainly focuses on the communication issues during the construction stage however it also includes some community Liaison measures for the operation phase as well.

Objectives:

The Performance Standards mandates continuous communication between project and the different stakeholders e.g. Workers, local community. The onus of initiating the process of communication rests on the project proponent. The project proponent should ensure that disclosure of relevant project information that would help the affected communities understand the risks, impacts and opportunities of the project. The Community Liaison Plan is developed to ensure a clear communication channel between the project and the local community. Even though the focus of the plan is primarily on communication with the community areas where there are likely interactions between the community and the Contractors such areas have also been covered. The community liaison plan would concentrate on the following aspects:

Communication with the Community: As mandated in the Performance standards OKWPL would disclose the project details to make the community aware of the important features of the project. A Project Information Booklet would be prepared and distributed in the project affected villages. This booklet should preferably be presented in local language. The booklet in addition to containing the salient features of the project should have a map depicting the boundaries of the plant and its ancillary facilities. The important landmarks e.g. the settlement, schools and the roads, etc. should also be demarcated so that it becomes easy for the people in the villages to relate to the ground conditions. In addition to the project information the booklet should also highlight the impacts on the community as presented in the ESA document and the commitments for the safeguards including the entitlement matrix. To ensure wide circulation of the Project Information Booklet the booklet would be made available at all the schools, Anganwadi centers, and other public facilities in the project affected village.

To ensure continuity of the flow of information to the community it is suggested that a quarterly **Community Information Booklet** should be published. During the construction phase the booklet would contain the information about the progress of the project and also information which are pertinent to community e.g. disruption of the transportation links, outcome of consultation process on community development etc. It is proposed that the community Information Booklet be continued even during the operations stage where this also acts as a transfer of information from the project to the community. In addition, it can also be used to share information between the communities e.g. achievement of a particular member of the community or any worker can be published in this booklet.

7.5.3 Grievance Redressal Mechanism

IFC PS requires that the client will establish a grievance mechanism to receive and address specific concerns about compensation including a recourse mechanism designed to resolve disputes in an impartial manner. If the client anticipates ongoing risks to or adverse impacts on affected communities, the client will establish a grievance mechanism to receive and facilitate resolution of the affected communities' concerns and grievances about the client's environmental and social performance. The grievance mechanism should be scaled to the risks and adverse impacts of the project. It should address concerns promptly, using an understandable and transparent process that is culturally appropriate and readily accessible to all segments of the affected communities, and at no cost and without retribution. The mechanism should not impede access to judicial or administrative remedies.

The client will inform the affected communities about the mechanism in the course of its community engagement process.

In efforts to develop an effective two-way communication a Grievance Redressal Mechanism has been developed by OKWPL **(Appendix J).** The broad outline of the mechanism is as follows:

- The decision on the grievance would be communicated to the aggrieved person within a timeframe to be stipulated during the preparation of the ESAP.
- There should be a single point of contact between the community and OKWPL for the Redressal of grievance.
- All grievances should be documented and indexed for future reference. The proceeding and actions against each of the grievance should be documented and should also carry this index number for easy traceability.
- If required the aggrieved community member can also be made a part of the Redressal process so he is able to place his point of view.
- The Grievance Redressal committee should meet at regular interval and discuss on the grievance and take necessary action.

The type of grievances has been categorized as:

- Internal Grievances
- Employee Grievance (Separate procedure in place as part of the Human Resources and General Administration (HRGA). These include the employees hired specifically for the site.
- External Grievances
- Contractor and labour related grievances;
- Community grievances including those on land and resettlement issues, project activities, CSR intervention, employee-community conflicts, and other project related issues

Communication with Contractor Staff: During the construction phase, there would be an influx of people into the project area. As these people would have cultural differences with the resident population there is a potential of conflicts arising because of issues related to safety and privacy issues of the women in the surrounding villages, spread of various communicable diseases, nuisance caused by workers due to improper sanitation facilities, etc. It is thus proposed a Community Interaction Brochure would be prepared specifically stating the 'Dos' and 'Don'ts' and requesting proper behavioural actions and discipline amenable with the local customs and traditions during their association with the project. The brochure would also be highlight the importance of any of nearby cultural place and need to maintain the sanctity and dignity of the place. This Community Interaction Brochure would be made available to all employees during their induction into the project and also when they report back to the project after leave or absence. A record of the induction or refresher on the community interaction would be maintained.

Responsibility: OKWPL (through the implementing agency) would prepare all the information disclosure booklets as discussed above. They would also ensure circulation of the booklet among the community in the project affected villages.

During construction OKWPL and its contractors would ensure that each of the people working on the project is aware of the Do's and Don'ts of community interaction. OKWPL and also the contractors would ensure that the record of the induction and refresher is maintained. All the resources required for the implementation of the different subcomponents of the plan would be provided by OKWPL and its contractors.

7.5.4 Waste Management Plan

The Waste Management Plan (WMP) will be applicable to the wastes arising during commissioning and operation of the proposed wind power plant of OKWPL. Major waste streams from the project include non-hazardous solid waste, wash water generated from panel washing and sewage.

WMP is intended to serve as a guideline for OKWPL and the contractor(s) to manage wastes effectively during the project life cycle. The WMP describes how wastes will be managed during the project life cycle and how the project will:

- Minimize the potential to cause harm to human health and the environment.
- Comply with Indian Environmental Regulation and IFC Performance Standards.
- Reduce operational costs and reduce any potential liabilities which may arise from waste handling operations.
- This plan also ensures that every waste stream and solid waste materials from the main plant site and bracketed facilities will be managed effectively.

The EPC contractor will manage the waste generated during construction phase like construction debris, packing material, paint containers and filters. The management measures of the aforementioned solid wastes and the hazardous wastes are discussed in detail below:

- The recyclable and non-recyclable non-hazardous solid waste generated onsite should be collected and stored in a temporary waste storage facility from where all wastes will be sent for recycling and disposal to appropriate facilities.
- The reusable wastes like wooden waste and cardboards from packing materials, empty cement bags, construction debris, etc. can also be given to locals for their use or give it back to original equipment manufacturer (OEM).

7.5.5 Community Property Resource

During the project construction phase, there might be some sharing of resources by the villagers and the workers working on the project. To an extent feasible this should be avoided to prevent potential conflicts between the project and the community. The movement of heavy vehicles and machineries might lead to conditions like disruption of electric wires and telephone wires in the project area and along transportation routes. All these damage utilities should be repaired/replaced to normal conditions, at the earliest. An account of the damage to the community resource should be documented and the root cause analysis carried out. The findings of the root cause analysis should also be documented and discussed with the agency/agencies found responsible for the incident. No water should be extracted from surface water bodies which are used by the community for drinking or domestic purpose. Any vacant or barren land, not assigned for project, should not be used for storage of fill/construction material, wastes, etc.

Responsibility: OKWPL would take responsibility for construction of the road before the existing road is diverted / closed for use by villagers. OKWPL (through the implementing agency) should start the process of dialogue with the community to decide on the alignment of the road and also fix up the likely time line for the construction.

OKWPL and its contractors should ensure that the sharing of community resource is minimized by organizing necessary support infrastructure/facilities within premises. However, in case where sharing would be essential OKWPL (including contractors) should have an agreement with the Gram Sabha for the sharing of the resource. In case of damage to community property OKWPL including its contractors should ensure that it is repaired or replaced to the satisfaction of the community at the earliest. OKWPL should maintain documentation of all incidents of damages to the community property. All cost for repair/replacement should be borne by OKWPL /Contractor.

As part of the Environmental and Social Management System proposed, a system should also be developed for recording such incidents and tracking the incident till it is closed to the satisfaction of the community.

7.5.6 Occupation Health and Safety Management Plan

The Occupational Health and Safety (OHS) of the employee and contractual labours will be maintained at the work sites during both construction and operation phase. The OHS Management measures should comply with the Indian Regulatory requirements under OHSAS and the Factories Act.

OSTRO has its own Health and Safety Policy and has been annexed as **Appendix I** OHS hazards specifically for the project primarily include the following:

- Work at height
- Work in confined spaces

- Lifting operations
- Blasting Operations

Work in height Work in confined spaces:

- Eliminate or reduce the requirement to work at height. During the planning and design phases of an installation, specific tasks should be assessed with the aim of removing the need to work at height, if practicable such as assembling structures and carrying out ancillary works at ground level, then lifting the complete structure into position to the extent that is feasible and cost effective.
- Collective protection systems such as edge protection or guardrails should be implemented before resorting to individual fall arrest equipment
- Ensure all structures are designed and built to the appropriate standards, and have the appropriate means of working at height systems fitted.
- Suitable exclusion zones should be established and maintained underneath any working at height activities, where possible, to protect workers from falling objects.
- Ensure all employees working at height following work permit system, are trained and competent in the use of all working at height and rescue systems in place.
- Provide workers with a suitable work-positioning device; also ensure the connectors on positioning systems are compatible with the tower components to which they are attached.
- Ensure that hoisting equipment is properly rated and maintained and that hoist operators are properly trained.
- When working at height, all tools and equipment should be fitted with a lanyard, where possible, and capture netting should be used if practicable.
- Signs and other obstructions should be removed from poles or structures prior to undertaking work.
- An approved tool bag should be used for raising or lowering tools or materials to workers on elevated structures.
- Avoid conducting tower installation or maintenance work during poor weather conditions and especially where there is a risk of lightning strikes.
- An emergency rescue plan should be in place detailing the methods to be used to rescue operatives should they become stranded or incapacitated while at height.

Blasting Operations:

The facility site includes excavation/blasting for construction materials such as sands and gravels, and access road construction. If blasting is required then the procedure of blasting should be followed as per OSTRO's protocol for blasting. Vestas and its team should follow the laid down procedure to avoid any hazard to life during the blasting operation. The OHS plan will also be serving as a reference document for finalization of safety procedures with respect to other construction and operational activities. The suggested measures to be implemented both during construction and operational phase have been discussed below:

- The onsite workers shall be provided with proper personal protective equipment (PPEs) i.e. safety shoes & goggle, helmet, coverall, gloves, ear plugs, safety harness in case working at height etc during construction related activities to ensure health and safety of the workers at workplace.
- Provision of first-aid kits at all work-areas onsite. Appropriately equipped first-aid stations should be easily accessible throughout the place of work
- Adequate light and ventilation shall be provided for the workers working in confined spaces.
- Passageways for pedestrians and vehicles within and outside buildings should be segregated and provide for easy, safe, and appropriate access
- Hand, knee and foot railings should be installed on stairs, fixed ladders, platforms, permanent and interim floor openings, loading bays, ramps, etc.

- Eye-wash stations will be provided close to all workstations where immediate flushing with water is the recommended first-aid response
- Safety signage and posters will be displayed at strategic locations within the site. Hazardous areas (electrical rooms, compressor rooms, etc), installations, materials, safety measures, and emergency exits, etc. should be marked appropriately.
- Monitoring weather forecasts for outdoor work to provide advance warning of extreme weather and scheduling work accordingly
- Provisions should be made to provide OHS orientation training to all new employees to ensure they are apprised of the basic site rules of work at / on the site and of personal protection and preventing injury to fellow employees.
- Training should consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. Any site-specific hazard or colour coding in use should be thoroughly reviewed as part of orientation training.
- Ready reference to OSTRO's H & S Policy and Vestas's EHS Manual should be made to maintain health and safety on site both during construction and operation phase of the project.

Any incident occurring during the construction and operation phase of the proposed project should be registered and documented in Accident & Incident Investigating standard as developed by Ostro **(Refer Appendix Y)**

7.5.7 Community Health and Safety Management Plan

Community health and safety hazards specific to wind energy facilities primarily include the following:

Shadow Flicker : Shadow flicker may become a problem when potentially sensitive receptors (e.g., residential properties, workplaces, learning and/or health care spaces/facilities) are located nearby, or have a specific orientation to the wind energy facility. Reference to section 6.3.3, the modeling conducted for shadow flickering show 9 receptors will be cumulatively impacted by 8 WTG's. on the ground truthing conducted for these receptors, the following mitigation measures are recommended.

- It is recommended that the predicted duration of shadow flicker effects experienced at a sensitive receptor should not exceed 30 hours per year and 30 minutes per day on the worst affected day, based on a worst-case scenario. Wind turbines can be programmed to shut down at times when shadow flicker limits are exceeded.
- Provide curtain and blinds in households with open roof, and windows, doors facing WTGs.
- Undertake plantation to hide shadow flicker near receptors (households) identified with significant impact

It should be noted that the remaining 3WTGs are new WTGs identified by OKWPL in the month of July, 2017, the receptors of which have been identified by google earth but needs ground truthing exercise to understand the type of permanent or temporary structure.

Electromagnetic Interference and Radiation: Wind turbines could potentially cause electromagnetic interference with telecommunication systems (e.g., microwave, television, and radio). This interference could be caused by path obstruction, shadowing, reflection, scattering, or re-radiation. The nature of the potential impacts depends primarily on the location of the wind turbine relative to the transmitter and receiver, characteristics of the rotor blades, signal frequency receiver characteristics, and radio wave propagation *characteristics in the local atmosphere. Suitable mitigation measures to enhance the quality of the television signal and lower the impact of wind turbine on telecommunication need to be adopted.*

Public Access: *Safety issues may arise with public access to wind turbines (e.g., unauthorized climbing of the turbine) or to the wind energy facility substation. Any public rights of way located within and close to the wind energy facility* site should be identified prior to construction to establish any measures that may be required to ensure the safety of their users.

Blade Throw: A failure of the rotor blade can result in the "throwing" of a rotor blade, or part thereof, which may affect public safety. The overall risk of blade throw is extremely low. Blade throw risk management strategies include:

- Establish setback distances between turbines and populated locations. The minimum recommended setback distance is 2 x hub height, although it can vary with the size, shape, weight, and speed of the blades, and the height of the turbine.
- 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.
- Carry out periodic blade inspections and repair any defects that could affect blade integrity.
- Equip wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.

7.5.8 Climate change vulnerability adaptive measures

To manage the natural disaster risk as well as the uncertain climate change vulnerability, the following measures can be adopted.

- Increase in rainfall intensity and the vulnerability to flooding will be considered in designing the sanitary landfill site and drainage system improvement.
- The OKWPL team should have an emergency response team onsite adequately trained with clear roles and responsibilities to counter to the maximum possible risks and natural disasters and provide a safe, timely, effective and coordinated response in consultation with the other local, and government agencies to prevent or minimize a major emergency that may arise during proposed operations.
- The project will incorporate, during detailed design, adequate mitigating measures for these risks related to floods and climate change. The TORs of relevant professionals (design, supervision and management consultant) will include this requirement.
- Capacity building of municipalities will be supported to strengthen the enforcement of national building codes to reduce disaster risks.

7.5.9 Road Safety and Traffic Management Plan

Scope and Purpose

The plan encompasses the community safety related impacts that may arise from the increased vehicular traffic due to movement of heavy equipment/machineries and vehicles along the site access and approach roads particularly during construction phase. The plan will be regularly updated by the contractor with the project progress and as vehicle movement requirements are identified in detail. Designated traffic coordinator will be responsible for overall coordination of traffic management.

During Construction Phase

The following mitigation measures will be implemented during this phase:

- Project vehicular movement will be restricted to defined access routes.
- Proper signage will be displayed at important traffic junctions along the vehicular access routes to be used by construction phase traffic. The signage will serve to prevent any diversion from designated routes and ensure proper speed limits are maintained near residential areas.
- Any road diversions and closures will be informed in advance to the project vehicles accessing the above route. Usage of horns by project vehicles will be restricted near sensitive receptors viz. schools, settlements etc.

- Traffic flows will be timed wherever practicable during period of increased commuter movement in the day.
- Temporary parking facilities should be provided within the work areas and the construction sites to avoid road congestion.
- Vehicular movement to be controlled near sensitive locations viz. schools, colleges, hospitals identified along designated vehicular transportation routes.
- Routine maintenance of project vehicles will be ensured to prevent any abnormal emissions and high noise generation.
- Adequate training on traffic and road safety operations will be imparted to the drivers of project vehicles. Road safety awareness programs will be organized in coordination with local authorities to sensitize target groups viz. school children, commuters on traffic safety rules and signage.
- The contractor(s) should frame and implement a "No Drug No Alcohol" Policy to prevent road accidents/incidents.

During Operational Phase

Since limited vehicular movement is anticipated during operational phase considering only the daily movement of project personnel any impacts arising from the same can be effectively addressed through implementation of mitigation measures as discussed during the construction phase. In addition, the following measures will be emphasised.

- Use of horns near the villages along the access road to villages, main plant and internal roads should be restricted.
- The vehicular movements along the access roads and highways should be restricted during the night time.
- All the vehicles entering the access roads and plant should have Pollution under Control (PUC) certificates.
- The speed limit in the internal roads should be restricted to 25 km/hr. Proper warning signs and road safety awareness posters should be displayed to create road safety awareness among the personnel accessing the site.
- Periodic Road Safety and Traffic Management campaigns and awareness sessions should be carried out among the villagers and the plant workers/personnel to develop road safety awareness among the people likely to be impacted by the project.
- An emergency road safety plan should be framed by the Proponent to combat any emergency conditions/accidents along the highways, access roads and within plant area.
- The Proponent should frame and implement a "No Drug No Alcohol" Policy to prevent road accidents/incidents.
- The drivers should be given an induction on road safety and traffic management policy.
- A permanent parking lot should be provided within the main plant site (in individual work areas) and the associated facilities.
- Use of seat belts for both drivers and passengers should be made compulsory to minimize death & injuries in the event of an accident.

7.5.10 Stakeholder Engagement Plan (SEP)

OSTRO has developed broad level Stakeholder Engagement Plan to guide stakeholder engagement across the lifecycle of the project, demonstrating Company's commitment towards its stakeholders while also addressing the requirements of the International Finance Corporation (IFC) Performance Standards (PSs). SEP is the process of developing appropriate management strategies to effectively engage stakeholders throughout the lifecycle of the project, based on the analysis of their needs, interests and potential impact on project success. This plan provides details on the general principles for Ostro stakeholder engagement which shall be used for implementing, monitoring and evaluating stakeholder engagement activities. The main objectives of the SEP are to:

- Enable management to develop effective stakeholder management strategies for the proposed project in order to build longer term relationships so as to ensure smooth functioning of the projects;
- To define and standardize the processes that the projects will use to communicate with respective stakeholders;
- To ensure regular and timely sharing of information with project teams to spruce up their understanding and skills of engaging with the stakeholders;
- Ensuring coordination in approach and message to be shared with the community regarding the company and the projects;
- To assess the efficiency of the communication process in meeting the objectives of the Stakeholder Engagement Plan and ensuring the project's 'Social License to Operate'

Stakeholder Identification, Mapping & Analysis

"Stakeholder mapping" is a process of examining the relative influence that different individuals and groups have over a project as well as the influence of the project over them. Effective stakeholder mapping is done by identifying the people/groups that have stakes/ interests in the Project either directly or indirectly and the manner in which both can mutually benefit from each other.

Categorization of Stakeholders

A stakeholder is "a person, group, or organization that has a direct or indirect stake in a project/organization because it can affect or be affected by the Project/organization's actions, objectives, and policies". Stakeholders thus vary in terms of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on or are directly impacted by the project are known as **Primary Stakeholders** (land sellers, local labourers, sub-contractors and Gram panchayat), those who have an indirect impact or are indirectly impacted are known as **Secondary Stakeholders as in the following table.**

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	Sub-contractors Local Labourers	Local community Agricultural Labourers Vulnerable Community
Institutional	*Gram Panchayats* Project investors	Village Institutions (schools, ;
Government Bodies	Regulatory Authorities; District Administration	
Other Groups		Media, NGO, Other industries/projects

Stakeholder engagement & Communication Strategy

Stakeholder engagement and communication strategy will take into cognizance the various stakeholder engagement and CSR activities already being undertaken by the company or partner NGO, or developer under turnkey model and existing communication routes being followed. Presence of CSR agencies needs to be considered, as they are considered to be an extension of the project and the staff therein is considered, to an extent, representative for the project. The construction team mobilised at the site, serves as another extension. Coordinated flow and collation of information, concerns and grievances, therefore becomes important.

Overall Stakeholder engagement strategy

The overall stakeholder strategy will be cognisant of the requirement of the various stakeholders and the level at which communication is presently being undertaken by the project.

Table: 7-4 Stakeholder engagement strategy

Sl. No.	Particular	Responsibility
1.	Regulatory Authorities	The regulatory authorities will be coordinated directly by Ostro legal team via OEMs/developers, or project based team. These consultations are in relation to the Power purchase agreement, power evacuation arrangements; Consent to establish related permits, revenue land allotment, or other requirements required for the wind power projects. The copy of the permits and communication will be made available to Ostro at various levels. Ostro team at the corporate level will be responsible for driving the timely fulfilment of the project level regulatory compliances. After completion, a copy of the relevant permits and compliances will be provided to the corporate team from all the projects, for records.
2.	Community around the project	The project liaison officer of each site will be solely responsible for interaction with the community members residing near each project, through village meetings and other platforms. The minutes of the meetings will be shared with the respective site in-charge as well as the corporate liaising team in standard reporting formats in pre-decided time intervals.
3.	NGOs, Civil Society, Political leaders and Media	Ostro's ESG head along with the developers CSR team will be accountable for any communication with local NGOs, civil society members, political leaders and media. The details of any such communication concerning the projects will be made available to the Ostro corporate team in the form of stakeholder engagement records. Nobody apart from designated the Ostro corporate liaising in-charge will be responsible for communication with the above-mentioned stakeholder.

Organizational Structure & Roles and Responsibilities

During the construction stage, owing to the interplay of the various actors involved, it is important to have a system in place which ensures that the community as one of the key stakeholders is aware about the Stakeholder engagement as well as the communication protocol including the grievance mechanism. Due to the interplay of various actors, the organizational structure for CSR and stakeholder engagement has been shown in context to the complete organizational structure.

Engagement Methods

The methods of communication can be either verbal or written, on the basis of the purpose of communication and the target stakeholder group. Some of the key methods of communication are as follows:

Meetings and Discussions: Meetings and discussions are an essential component of any communication exercise. The corporate CSR team of Ostro will have regular interface with their counterparts in the project in order to review the current engagement with local community. These discussions are will be to communicate specific information to the target stakeholders and allow for the collective opinion of the groups to be captured and assessed.
Reports and Notices: Information disclosure is an important process of communication with the local stakeholders and is part of the applicable reference framework for the project. A mandatory communication from the corporate team will guide project teams for the forthcoming meetings in each project. The process of disclosure of information to the communities at the project will involve the provisioning of information in an accessible manner (a manner which allows for easy understanding, such as in the local language) to the various stakeholders in a project. There will be visits of the designated members of corporate team at regular intervals to each project.

Table 7.5 Stakeholder engagement plan

Relevant Stakeholders	Stage at which the consultation	Purpose of the Consultation	Mode of engagement	Responsible person	Reporting	Reporting Format
Developers and EPC Contractors (Vestas)	Mobilisation Construction Stage Operation stage	• Engagement by Project team will be at various stages of the project	• Meetings • Submission of reports	• HSE officer, Vestas for implementation and site head (Ostro) for supervision	• Construction head, Ostro	• Reports on various aspects
Regulatory Authorities	Mobilisation Construction Stage Operation stage	• Various permissions and licenses related to setting up of the project • Land procurement on lease; • Submission of compliance related returns;	• Meeting • Submission of compliance documents; • Official letters	• HSE officer, Vestas for implementation and site head (Ostro) for supervision	• Construction head, Ostro	• Evidence as well as details of communication
District/Tehsil Administration (Sub- registrar Officer, Bhuj	Mobilisation Construction Stage Operation stage	• Some of the regulatory permission in relation to land; • Development intervention for the district; • Other issues seeking participation of the project by the District Administration	• Meeting • Submission of compliance documents; • Official letters	HSE officer, Vestas for implementation and site head (Ostro) for supervision	• Construction head, Ostro	• Evidence as well as details of communication • Verbal communication and relevant records as applicable
Gram Panchayats (Bandra Nana, Chubdak, Jadura, Naranpur, Reha, Sanosara, Sedata, Vadajar and Vadva)	Mobilisation Construction Stage Operation stage	• NOC from the local Panchayat • Information on the project at village level	• Meetings	• Land Team, Ostro • CSR Officer, Ostro	• Construction head, Ostro	• Records of communication at site level
Local Community (Panchayat members, Villagers)	Mobilisation	• Information sharing on the project; • Compensation and other issues; • Details on the activities to the project; • CSR and other benefits to the local population	• Meetings on regular basis	• CSR Officer, Ostro	• Construction head, Ostro	• Records of communication at site level
	Construction Stage	• Information on employment opportunity; • Information on movement of vehicles and equipment; • Regular update meetings on monthly or bimonthly basis	• Meetings on regular basis	• CSR Officer, Ostro	• Construction head, Ostro	• Records of communication at site level
	Operation stage	• Benefits from the project	• Meetings on regular basis			• Records of communication at site level
Vulnerable Community (Widow, Handicapped and landless people at village level)	Mobilisation	• Benefits from the project	• Meetings on regular basis	• CSR Officer, Ostro	• Construction head, Ostro	• Meeting records maintained at the village level as well as submitted to site incharge.
	Construction Stage Operation stage					• Meeting records submitted to the site incharge
Sub-contractor/ Local Labourers/ Migrant Workforce (Vestas - civil contractor)	Construction Stage	• Working conditions and terms of employment; • Any other issue including conflict of the migrant population with the locals	• Meetings on regular basis	• CSR Officer, Ostro	• Construction head, Ostro	• Meeting and grievance records submitted to the site incharge
Civil Society/Local NGOs/ media	Mobilisation Construction Stage Operation stage	• Information sharing on the project; • Discussion on specific issues	• Meetings	• CSR Officer, Ostro	• Construction head, Ostro	• Records of communication at site level

7.6 Environmental monitoring plan

Monitoring is one of the most important components of a management system. Continuous monitoring needs to be carried out for regulatory requirements, to monitor the environmental quality and to determine performance of proposed mitigation measures. Monitoring indicators have been developed for each of the activity considering the mitigation measures proposed. Indicators have been developed for ascertaining the environmental quality and the performance of the EMP implementation through Environmental Quality Indicators (EQI's) and Environmental Performance Indicators (EPI's) respectively. This focuses not only on quantifying or indexing activity-environment interactions but also may potentially impact the environment. At the same time, it also helps in comparing different components of environmental quality against previously established baseline status. Monitoring results would be documented, analyzed and reported internally to Head – EHS of OSTRO. Monitoring requirements (including monitoring frequency) have been presented in the following **Table 7.6**

Table: 7-6 Monitoring requirement for the proposed project

A. Environmental Performance Monitoring

EPI No.	Environmental Performance Indicator (EPI)	Monitoring Parameter	Location	Period & Frequency	Monitoring Entity	Applicable IFC PS
A.	**CONSTRUCTION PHASE**					
A1	Soil compaction and contamination	Dumping of construction material on site and adjacent agriculture fields	Near WTG locations	Monthly	Vestas and Ostro Site team	PS I: Assessment and Management of Environment and Social Risks and Impacts
A2	Rise of emergency conditions and accidents. Forms integral part of Occupational H & S Management system	Training for work at height, use of PPEs and health and safety on site for workers and client personnel		On routine basis through daily tool box talks and a one 1 day training to site supervisors on PPEs and occupational health and safety.	Vestas and Ostro Site team	PS I: Assessment and Management of Environment and Social Risks and Impacts
A3	Integral part of Management System and occupational health and safety	Audits of the contractors and sub-contractors		Quarterly	Suzlon and Ostro Site team	PS I: Assessment and Management of Environment and Social Risks and Impacts
A4	Air emissions from vehicles and machineries	CO, HC based on emission factors % of vehicles possessing valid PUC Certificates	Exhausts near project site	Monthly during construction phase	Vestas and Ostro Site team	PS 3: Resource Efficiency and Pollution Prevention
A5	Dust generated from site clearance / levelling	Visual observation of dust generation	Project site & access roads	Weekly during site preparation	HSE Manager	PS 3: Resource Efficiency and Pollution Prevention
A6	Noise emissions from vehicles and machineries (15-25 KVA)	Noise pressure level in dB(A) Compliance with CPCB noise limits specified for DG sets Check for valid certificates of Type Approval and also valid certificates of Conformity of Production for equipment's particularly DG sets.	Near WTG sites	Quarterly during site preparation	HSE Manager	PS 3: Resource Efficiency and Pollution Prevention
A7	Gaseous pollutant emissions from DG Set (15-25 KVA)	Pollutant concentrations in gaseous emissions and maintenance parameters (air, fuel filters & air-fuel ratio) of DG sets influencing air emissions Emission rates of PM, NOx, SOx, CO, HC based on emission factors	DG Stack	Once during construction phase	Vestas and Ostro Site team	PS 3: Resource Efficiency and Pollution Prevention
A8	Sourcing of water	Volume of water sourced and consumed for construction work	Sourcing and usage areas	Monthly	Vestas and Ostro Site team	PS 3: Resource Efficiency and Pollution Prevention
A9	Fugitive emissions from handling and storage of raw materials	Visual observation	Material stockpiles	Daily during construction phase	HSE Manager onsite and corporate	PS 3: Resource Efficiency and Pollution Prevention
A10	Community health and safety	Complaints registered by the local communities No. of. Accidents reported if any.	Grievance Records Safety Records	Monthly during construction phase.	HSE Manager and head at corporate	PS 4: Community Health Safety and Security
A11	Occupational health and safety	Health surveillance of workers	Medical records	Monthly during construction phase	HSE Head at corporate level	PS I: Assessment and Management of Environment and Social Risks and Impacts
		Sanitation status of labours working during construction phase	Onsite records		HSE Head at corporate level	PS I: Assessment and Management of Environment and Social Risks and Impacts
		Potable nature of drinking water viz. coliform, pH, TSS, Residual chlorine	Drinking water storage tanks		HSE Head at corporate level	PS I: Assessment and Management of Environment and Social Risks and Impacts
		Usage of proper PPEs Safety performance indicators viz. LTIs. Near misses, fatalities etc	Construction site	Daily during construction phase	HSE Head at corporate level	PS I: Assessment and Management of Environment and Social Risks and Impacts

EPI No.	Environmental Performance Indicator (EPI)	Monitoring Parameter	Location	Period & Frequency	Monitoring Entity	Applicable IFC PS
A12	Disposal of sewage	Visual observation of leaks, overflows etc and odour problems if any.	Septic tank and soak pits	Daily during construction phase		
A13	Surface run-off discharge	Visual observation of water logging due to drainage disruption	Areas abutting construction site	In the event of storm/floods during construction	HSE Manager onsite and corporate	PS 3: Resource Efficiency and Pollution Prevention
		CPCB Inland Water Discharge Parameters	Discharge point		HSE Manager onsite and corporate	PS 3: Resource Efficiency and Pollution Prevention
A14	Domestic waste generation, storage, handling and disposal	Quantity of waste generated and recycled Visual observation of waste segregation and storage conditions viz. usage of labelled and covered bins, insect repellents etc.	Waste generating areas viz. canteen, site office.	Weekly during construction phase	HSE Manager onsite and corporate	PS 3: Resource Efficiency and Pollution Prevention
		Awareness level of onsite workers	Workers involved in waste handling and storage		HSE Manager onsite and corporate	
A16	Accidental killing of Schedule I species or livestock	Reporting, inspection and record keeping	Access routes and WTG locations	Once in a month	Onsite & Head EHS manager	PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
A17	Hunting of Schedule I and other animals					
A18	Hazardous chemicals and waste storage, handling and disposal	Quantity of fuel consumed	Chemical and fuel storage and consumption areas	Daily during construction phase	Head EHS Manager	PS I: Assessment and Management of Environment and Social Risks and Impacts
		Visual observation of fuel and chemical storage conditions viz. presence of spill kits, drip trays, fire extinguisher, etc			Head EHS Manager	
		Quantity of waste oil and other hazardous waste generated and recycled to registered recyclers Awareness level of onsite workers	Hazardous waste storage areas Workers involved in waste handling and storage	Weekly during construction phase		PS I: Assessment and Management of Environment and Social Risks and Impacts
B.	**OPERATIONAL PHASE**					
B1	Noise generated from operation of wind mill	Noise pressure level in dB(A)	Near noise sources (5m)	Once in 6 months		PS 3: Resource Efficiency and Pollution Prevention
		Maintenance parameter check with respect to noise attenuation and control	Noise generating equipment	As per supplier manual		PS 3: Resource Efficiency and Pollution Prevention
B2	Water sourcing and consumption	Volume of water sourced and consumed	Water usage areas	Monthly	EHS Head	PS 3: Resource Efficiency and Pollution Prevention
B3	Surface run-off discharge	Visual observation of water logging due to any possible drainage disruption	Areas abutting plant site	In the event of storm/flood during operation	EHS Manager and head at corporate	PS 3: Resource Efficiency and Pollution Prevention
		CPCB Inland Water Discharge Parameters and Effluent Standards of IFC Thermal Power Plant EHS Guidelines	Discharge point		EHS Manager and head at corporate	PS 3: Resource Efficiency and Pollution Prevention
B5	Domestic waste generation, storage, handling and disposal	Quantity of waste generated and recycled needs to be monitored Segregation of wastes should be practised. Canteen wastes should be disposed through composting.	Waste generating areas viz. canteen, site office etc.	Monthly	EHS Manager and head at corporate	PS 4: Community Health Safety and Security

EPI No.	Environmental Performance Indicator (EPI)	Monitoring Parameter	Location	Period & Frequency	Monitoring Entity	Applicable IFC PS
		Awareness level of operational workforce	Workforce involved in waste handling and storage		EHS Manager and head at corporate	PS 4: Community Health Safety and Security
B6	Hazardous chemicals and waste storage, handling and disposal	Visual observation of chemical storage conditions viz. presence of spill kits, drip trays, fire extinguisher, display of MSDS etc.	Chemical and fuel storage and consumption areas	Monthly	Head EHS Manager	PS I: Assessment and Management of Environment and Social Risks and Impacts
		Quantity of waste oil and other hazardous waste generated and recycled to registered recyclers Awareness level of operational workforce	Hazardous waste storage areas Workforce involved in waste handling and storage	Monthly	Head EHS Manager	PS I: Assessment and Management of Environment and Social Risks and Impacts
B7	Community health and safety	Complaints registered by the local communities No. of. Accidents to be reported	Grievance Records Safety Records	Monthly during operational phase	EHS Head at corporate level	PS 4: Community Health Safety and Security
B8	Occupational health and safety	Health surveillance of workers	Medical records	Monthly during operational phase	EHS Manager	PS 2: Labor and Working Conditions
		Sanitation status of onsite office building and canteen	Office building maintenance records		EHS Manager	PS 2: Labor and Working Conditions
		Potable nature of drinking water viz. coliform, pH, TSS, Residual chlorine	Drinking water storage tank		EHS Manager	PS 2: Labor and Working Conditions
		Usage of proper PPEs Safety performance indicators viz. LTIs. Near misses, fatalities etc	Operational sites	Daily during operational phase	EHS Manager	PS 2: Labor and Working Conditions
B9	Monitoring of Collision mortality of bird and bats	Monitoring, reporting, Inspection and record keeping	WTGs, transmission line route and near substation	Monthly monitoring, reporting and record keeping	Onsite EHS manager	

B. Environmental Quality Monitoring

EQI No	Environmental Quality Indicator (EQI)	Monitoring Parameter	Location	Period & Frequency
A.	**CONSTRUCTION PHASE**			
A1	Ambient Air Quality	Measurement of $PM_{2.5}$, SOx, NOx, CO	Nearest receptor viz. villages, schools, ecological habitat	Once or twice during construction phase
A2	Ambient Noise quality	Measurement of Noise Pressure Level in dB(A)	Nearest receptor viz. villages, schools, ecological habitat	Once or twice during construction phase
B.	**OPERATIONAL PHASE**			
B1	Ambient Noise quality	Measurement of Noise Pressure Level in dB(A)	Nearest receptor viz. villages, schools, ecological habitat	Six monthly during operational phase

7.7 Budgetary Provisions for ESMP Implementation

Environmental and social management plan will not be successful without a proper designated team and financial support for the same. Adequate budgetary provision will be made by OSTRO for execution of environmental management plan.

It is proposed that approximately 20 lacs of capital cost will be required for EMP implementation.

8.0 CONCLUSION

The proposed project is categorized as ***Category B*** (as per IFCs categorization of projects), which specifies that this project is expected to have limited environment and social impacts which, can be mitigated by adopting suitable mitigating measures.

An environment and social analysis has been carried out looking at various criteria such as topography, air, noise, water resources and water quality, ecology, demography of the area, climate, natural habitat, community and employee health and safety etc. There is no adverse impact on the migration of habitat, any natural existing land resources and effect in the regular life of people. There is no impact on cultural resources as well as indigenous people.

Most impacts are expected to occur during the construction phase which are considered to be of a temporary in nature. The main project impacts are associated with clearing of shrub vegetation, waste management, avifauna collision risk, noise emanated from the wind turbines, shadow flickering impact and excavation and movement of soils. From this perspective, the project is expected to have a small "environmental footprint". No endangered or protected species of flora or fauna are reported at any of the subproject sites. Adequate provisions have been made for the environmental mitigation and monitoring of predicted impacts. The following conclusions are drawn from the project:

- According to CPCB recent notification B-29012/ESS/CPA/2016-17 dated 18th January 2017 renewable power like wind power of all capacities is exempted from obtaining consent to establish and consent to operate.
- As per the guidelines of Airport authority of India, “No objection” for height clearance is required from Airport Authority of India (AAI) if the height of the structure is above 150m above ground level[26]. In addition to this, structure located within 20km as per Visual Flight Rules, also requires NOC. The hub height of Vestas model V110-2.200 is 110m to which the rotor blade length will also be added. Besides, the project site is located at a distance of 12.5km south; hence NOC for height clearance is required from AAI and Ministry of Defence[27].
- Government land is being procured for all proposed WTGs and the application of the same has been reportedly submitted.
- KUT 31, BHO105 and BHO 82 are three WTG locations where transmission line passes within 80-450m distance from the WTG location. In particular, high tension transmission line passes within 80-100m distance from BHO 82 WTG location. Hence, appropriate distance from the WTG location should be maintained to rule out disturbance during the times of blade throw in case of emergency.
- A total of 80 avifauna species were sighted during the site visit, out of which 8 were Schedule I species as per Wildlife Protection Act 1972 and five avifaunal species viz. Pallid Harrier (raptor), Darter, Painted Stork, River Tern and Black headed ibis fall in Near Threatened category, as per IUCN Red List. No threatened terrestrial floral species were sighted. A detailed bird and bat study is recommended to gather more concrete information on bird species, their abundance diversity, local migrating flying path, nesting & breeding areas, flying height and flying duration for a period of 1 year or at least two time a season for four seasons.
- All WTG locations are proposed on revenue land, hence no resettlement or rehabilitation is required.
- In addition, demand for auxiliary services such as canteen and food catering, tea and snacks stalls, poultry, farm products and lodging facilities, is expected to increase. The affected villages are likely to gain economically in this manner.

[26] http://nocas2.aai.aero/nocas/#

[27] http://nocas2.aai.aero/nocas/AAI_Links/FAQ_1st_April_2015.pdf

- With expected improvement in existing road conditions, the villagers should have improved access to transportation and nearby towns.
- Access to essential services including electricity, medical facilities, water and higher education is likely to improve due to better road connectivity and possible CSR initiatives by the wind farm investors.

Proper Grievance Redressal Mechanism (GRM) will have to be implemented by OKWPL to overcome public inconvenience during the proposed project activities. Based on the environmental and social assessment and surveys conducted for the project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP.