

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

252 MW Wind Power Project in Thoothukudi District,
Tamilnadu

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**Mytrah Vayu (Sabarmati) Pvt. Ltd.
(An SPV of Mytrah Energy (India) Pvt. Limited)**

Prepared by:

Arcadis India Pvt. Ltd.

CONTACTS

SUMIT BARAT

Project Director

t. +91 (120) 4368400
f. +91 (120) 4368401
e. sumit.barat@arcadis.com

ARCADIS India Pvt. Ltd.

3rd Floor, Tower B, Logix Techno Park,
Sector – 127, Noida – 201301,
Uttar Pradesh, India

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		Girish Shukla	
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		Jaydeep Banerjee	
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		Jaydeep Banerjee	
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		Jaydeep Banerjee	
		Alok Chandra Adhikari	

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EXECUTIVE SUMMARY

Background	<p>Mytrah Energy India Private Limited (hereafter known as MEIPL), a subsidiary of Mytrah group, is an independent power producer company in field of rapidly growing energy sector. MEIPL through an SPV namely, M/s Mytrah Vayu Sabarmati Private Limited (MVSPL) intends to develop 252 MW wind power project in Thoothukudi (also known as Tuticorin) district of Tamilnadu.</p> <p>MEIPL has executed a lump sum turnkey contract with GE for development of this proposed project. GE will be responsible for construction of WTG and other sub contractors are responsible for constructing pooling substation and laying of transmission line. Post construction, GE will be responsible for long term operation and maintenance of the site. Presently, micro siting of the wind turbines is completed whereas land procurement is ongoing. As on Febuary, 2018 as informed by Mytrah Energy (India) Private Limited out of 105 WTG locations, land for 66 WTGs have been procured and negotiation for rest 39 WTGs are in progress. MEIPL 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.</p> <p>ARCADIS India has been appointed by MEIPL 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.</p>
Project Overview	<p>The project consists of 105 WTG's each with 2.4 MW installed capacity and is proposed in Kayathar tehsil. Kayathar tehsil is recently formed tehsil and comprises part of both Kovilpatti and Ottapidaram Tehsil. Nearest railway station is Maniyachi.</p> <p>The proposed site is accessed through State Highway SH-77 and NH-44. The WTGs, are spread in 30 villages of three taluka namely Kayathar, Kovilpatti and Ottapidaram in the district of Thoothukudi.</p> <p>The power will be pooled to the pooling substation (PSS) of 33/230 KVA capacity located in Ottudanpatti village under Kadambur GP. The power from PSS will be evacuated to Power Grid's Tirunelveli 230/400 KV grid substation(GSS) located at Vadakuvandanam village via 230 KV DC transmission line of approx. 8 km in length.</p>
Applicable IFC's Performance Standards	<p>The Environment and Social Management Plan (ESMP) for the project has been designed considering the requirement and framework of Indian environmental legislation, IFC's Performance Standards, Equator Principles and IFC's Industry Specific EHS guidelines.</p> <p>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, and PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. Also, IFC's core labour standards are applicable to the project.</p>

	<p>The other performance standards PS5: Land Acquisition and Involuntary Resettlement and PS7: Indigenous Peoples and PS:8 Cultural Heritage are not applicable for this project.</p>
<p>PS1: Social and Environmental Assessment and Management Systems</p>	<p>The project will have environmental and social impacts due to generation of onsite noise, domestic wastes from labour accommodation and generation of hazardous wastes from the construction site. MEIPL needs to implement Environmental and Social Management System to manage the risks associated with proposed project operations. This ESIA report includes the environment and social risks arising from the project activities along with recommended mitigation measures. MEIPL should also appoint qualified E&S personnel with appropriate responsibility to implement/ oversee/ monitor the following:</p> <p><u>Construction Phase</u></p> <p>Performance of contractors on labour and health & safety aspects</p> <p><u>Operation Phase</u></p> <p>Periodic monitoring of social and environmental performance</p> <p>Internal and third party audit</p> <p>Management review</p> <p><u>Both for Construction and Operation Phase</u></p> <p>The implementation of the ESMP</p> <p>Community engagement and grievance redressal system/mechanism</p> <p>Regular training of employees and contractors</p> <p>Emergency preparedness and response</p> <p>Periodic reporting of E&S performance to the management</p>
<p>PS2: Labour and Working Conditions</p>	<p>During construction, around 300 workers along with additional 15-20 security personnel would be employed for a duration of 8-9 months. The contractor's workforce will comprise of both skilled and unskilled labours. As per the information provided by MEIPL, unskilled labourers will be sourced from the nearby village settlements depending on their skills and capabilities. Skilled personnel will be sourced from outside places, who will be accommodated in rented arrangements with separate provision and facilities complying the requirements of ILO and other international guideline standards.</p> <p>Hence, there is no chance of conflict between labourers and local people during course of construction.</p> <p>During the operations phase, approx. 15-20 nos. of technical personnel in addition to 15-20 security guards will be deployed on site.</p> <p>Hence PS 2 is applicable</p>
<p>PS3: Resource Efficiency & Pollution Prevention</p>	<p>The construction works for the development of project will result in generation of 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.</p>

	<p><i>During Construction</i></p> <p>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. Top soil will be impacted as its removal is envisaged during construction phase.</p> <p><i>During Operation</i></p> <p>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</p> <p>Hence PS 3 is applicable</p>
<p>PS4: Community Health, Safety and Security</p>	<p><i>During Construction</i></p> <p>The project will involve movement of vehicles on the approach road passing close to few villages, entering the site through the State Highway SH-77 and NH44. As informed by MEIPL that unskilled labourers would be hired locally through contractor. Hence, there would be no influx of labourers. Thus there is no risk envisaged in this regard. 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.</p> <p><i>During Operation</i></p> <p>Blade throw, Shadow flicker, Noise emission during wind turbine operation and Electro Magnetic field from transmission line may impact community health and security. However, electromagnetic fields produced by the generation and export of electricity from a wind farm is not significant and do not pose a threat to public health. The grid connection lines are like other power lines and generate low levels of EMF, comparable to those generated by household appliances. Thus, EMF generated by grid lines in case of wind power plant will be insignificant to cause health impact.</p> <p>Hence PS4 is applicable</p>
<p>PS 5: Land Acquisition and Involuntary Resettlement</p>	<p>In the present 252 MW Wind Power project, only private land are being procured. No government land will be procured in this project. Further, land will be procured based on willing to buy and willing to sell basis. The land requirement for each wind turbine generator (WTG) is 4.2 Acre. Since the land requirement for each WTG is low, associated land use such as agriculture can be practised in the surrounding area. 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 procured from individual land owners based on negotiations facilitated by vendors appointed by MEIPL. As on February, 2018, as informed by MEIPL, land for 66 WTGs have been procured while process is ongoing for the rest 39 WTGs. All the land procured for 66 WTGs are free of any settlement and physical structure. As observed during ESIA study,</p>

	<p>information derived through consultations there is no agricultural/ any other economic activity in the lands procured.</p> <p>As understood during ESIA study and information derived from MEIPL there is no formal or informal users in the procured land.</p> <p>As, land procurement is on willing to sell and buy basis and no involuntary resettlement is involved, PS 5 is not applicable.</p>
<p>PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources</p>	<p>Proposed WTGs and associated facilities are only on private land. No component of project is on forest land and within the National park and wildlife sanctuary. There are two sanctuaries i.e. Vallanadu Wild Life Sanctuary and Gangaikondan Spotted Deer Sanctuary exist in the area at a distance of 17 km and 8.6 km respectively from the nearest WTG MAN 126.</p> <p>As per the Wildlife Act 1972, project falls under Eco sensitive zone (ESZ) (by default 10 km). However, renewable energy projects are considered as permitted ¹and recommended to be promoted, even within the ESZ area.</p> <p>Koonthankulam bird sanctuary is another sanctuary which is located at 60-70 km from the project profile area and known for many winter migratory bird's visit in December.</p> <p>Considering the ecological sensitivity of project area, impact on birds are envisaged and should be assessed in details through short term/long term bird and bat monitoring study.</p> <p>Hence PS 6 is applicable</p>
<p>PS7: Indigenous Peoples</p>	<p>The project is located in a region with almost no tribal population hence PS 7 is not applicable.</p>
<p>PS 8: Cultural Heritage</p>	<p>As observed during ESIA study, there is no cultural heritage site present within 10 km radius of any proposed WTG locations and no Archaeological Survey of India (ASI) recognised heritage site is located within study area.</p> <p>It was observed during site visit that in Kottali village, one old temple known as Krishna Kovil located more than 1 km from the nearest WTG location. As information gathered through community, this temple is about 50 - 80 years old. No other culturally significant site exists in the project area. As understood there may not be any direct impact on this due to the project activity but such chances cannot be ruled out. Although PS-8 is not applicable, however, Chance find Procedure could be applied. Hence PS 8 is not applicable.</p>
<p>Project Impacts – Construction Phase</p>	<p><i>Impact on air quality:</i> Because of generation of fugitive dust due to movement of project vehicles and emission from diesel generators.</p> <p><i>Water resources:</i> Project falls under over exploited zone from ground water perspective. During construction period, water requirement would be about 70 KL per WTG to build foundation of tower and 13.5 KLD for domestic water use considering 300 workers during peak hours. In operational phase water will be used for the domestic use of project staff at the site, which is estimated to be</p>

¹ Guideline for declaration of Eco-Sensitive Zone around National Parks and Wildlife Sanctuaries. F.No.1-9/2007 WL-I, dated 9th February 2011

around 0.9 KLD considering 15-20 technical persons present on site in shift and about 15-20 security personnel.

Conflict between migrant and local community: About 300 workers are expected during the peak construction phase. As confirmed by MEIPL that unskilled labourers would be deployed from the local populace.

Only skilled personnel would come from outside places, who will be accommodated in rented arrangements in the nearby areas.

Hence, there would be no adverse impact or chances of conflict in this regard. However, this would have positive impact on local populace in terms of exchange of thoughts and cultural exchange.

Traffic Load: The road connecting SH77 and NH44 to project site 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 private land and it is being purchased to erect WTGs, access road and for erection of transmission towers.

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 accommodation and physical injuries.

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 heavy equipment usage after construction phase.

Impact on 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 II-strong damage risk zone of getting affected due to earth quakes as per the Seismic Zones of India Map IS 1893 – 2002, BIS. Further, District Disaster Management Authority has identified flood, cyclone and Tsunami as other natural disasters in the Thoothukudi District.

**Project Impacts
– Operation
Phase**

Community Health and Safety: Impact is envisaged on community health during operation due to Electromagnetic Field (EMF) interference, shadow flicker and accidental blade throw. But with appropriate mitigation measures, the same can be minimized.

Shadow flicker impact:

Based on the modelling results, a total of 6 receptors will be impacted cumulatively by 2-3 WTG's. The shadow impact at these receptors was found

in the range of 31-47 hr/year; whereas receptor near WTG MAN 159 and MAN 183 is worst effected with shadow flickering of 147 hr/year.

Noise impact

Based on the modelling results, it is interpreted that four of the WTG locations will have noise generated above the CPCB standard for night time i.e. 45 dBA set for residential areas. However, none of the locations have been interpreted to cross the CPCB standard for day time i.e. 55 dBA set for residential areas. The identified receptor locations are near WTG MAN 183, MAN 148, MAN 388 and MAN 178. The cumulative noise level were estimated to vary from 45.4 to 49.4 dB (A) near the identified receptor locations where CPCB noise standard exceeds for night time.

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, 58 bird species were sighted from the entire project profile area and out of those, four Schedule-I species (three raptors and one common peafowl) were sighted. No bat roosting sites were sighted during site survey. Koonthankulam bird sanctuary is located at 50-60 km from the project profile area, which is also an Important Bird Area (IBA). Many waterfowls visit this sanctuary during winter. But, impact from project on the movement of migratory birds (coming in and going out) around Koonthankulam bird sanctuary is not envisaged.

At the same time, the avifaunal collision risk due to operation of wind turbines cannot be completely ruled out and hence the overall impact on birds and bats due to the project activity during the operational phase is “Moderate”.

Impact due to natural disaster: The proposed project is situated in Zone II-strong damage risk zone of getting affected due to earth quakes as per the Seismic Zones of India Map IS 1893 – 2002, BIS. Further, area is vulnerable to the risk of flood, cyclone and Tsunami.

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 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

Mitigation Measures

Appropriate mitigation measures have been planned and recommended in the 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 area prone to natural disasters such as earthquake, flood, cyclone and Tsunami and hence the impact due to such natural disaster will be both during construction and operation phase. Hence all materials for construction of the wind power plant shall have considered risk of natural disasters while planning and designing the windfarm.

Construction Phase

It should be ensured that the labour accommodation should have basic amenities such as electricity, drinking water, health & sanitation facility, kitchen and rest room.

Safety signage and posters will be displayed at strategic locations within the site.

Provision of first-aid kits at all work-areas onsite.

Proper water sprinkling on unpaved roads should be undertaken to reduce the fugitive emissions during transportation.

Grievance Redressal mechanism should be followed by MEIPL 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.

Hazardous materials such waste oil, used oil should be stored in storage yard/designated locations in enclosed structures over impermeable surface.

During procurement of private land, adequate compensation in terms of agreed price can nullify the impact of land procurement (if any). 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.

Based on the primary survey and professional judgement, we recommend for a short term/long term 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.

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 sensitive², diverse or unprecedented. It is envisaged to have moderate 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.

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.

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.

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.

² 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.

1 INTRODUCTION

1.1 Background

Mytrah Energy India Pvt. Ltd. (MEIPL), a subsidiary of Mytrah group, is an independent power producer company in field of rapidly growing energy sector. MEIPL was established in year 2009 and have grown till 2017 with more than 450 professionals. Mytrah team leads an organisation of over 450 people, including some of the world's most experienced wind energy professionals in the areas of wind resource assessment, land acquisition, engineering, procurement and construction (EPC), commercial analysis, vendor framework, grid analysis, operations and maintenance, and financing. Mytrah has built 2000 MW of operational & under development power capacity in the Renewable Energy sector. These assets are spread across 15 wind farms in nine states—Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Telangana, Karnataka, Punjab and Tamil Nadu. Mytrah sells power mainly to state grids through 13 to 25 year Power Purchase Agreements.

Mytrah Energy (India) Pvt Ltd has the largest wind data bank in India, being the only independent power producer that has 200 wind masts across the country.

MEIPL through an SPV namely, Mytrah Vayu Sabarmati Pvt Ltd. intends to develop 252 MW wind power project in Thoothukudi (Tuticorin) district of Tamilnadu. The entire 252 MW project with 105 WTGs of 2.4 MW individual capacity each. Micro siting of all the wind turbines and procurement of land for 66 WTGs has been completed.

The plant is proposed to be connected via a 230 KV D/C transmission line to the Pooling Sub-Station (PSS) of 33/230 KVA capacity identified to be located in Ottudanpatti village, which in turn would be connected to the 230/400 KV Grid Sub-Station (GSS) located in Vadakkuvandanam village under Kadambur Gram Panchayat (GP). Total length of transmission line would be around 8 km. Survey work for transmission line is completed.

MEIPL has signed a lump sum turnkey contract with GE for development of this proposed project. GE will be responsible for construction of WTG and other sub contractors are responsible for constructing pooling substation and laying of transmission line. Post construction, GE will be responsible for long term operation and maintenance of the site.

ARCADIS India has been appointed by MEIPL 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 and operation 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 present 252 MW Wind Power project has been undertaken in accordance with International Finance Corporation's (IFC) Performance Standards (PS) on Social and Environmental Sustainability, 2012, Environmental and Social Policy Statement, 2017 of OPIC; ADB SPS, 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.

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 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 MEIPL 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.

This ESIA study included the reconnaissance survey of the site, environmental monitoring, data analysis, public consultations and discussions with other relevant stakeholders, assessment of 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 implementation and operation of the proposed project. The document has been made to comply with the requirements of IFC Performance Standards, ADB Safeguards, IFC EHS guidelines, 2007 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.

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.).

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).

- **Investigation of Project Components:** After getting the exact locations of different project components such as proposed WTG components, PSS, GSS, proposed transmission line, the environmental and biodiversity expert visited all the project component locations along with the MEIPL 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. dry agricultural or barren, private or government, whether assigned by local/ state government to some vulnerable communities, whether a reserved forest land etc. All the afore mentioned 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.
- **Sampling for Environmental Baseline:** The baseline environmental sampling and monitoring was conducted in the month of August 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.

- **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 wildlife sanctuary 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 ten 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.

- **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.
- **Consultation with concerned Government offices:** Visit to respective government departments viz revenue department, health department, panchayat office, Offices of Sub Register office etc has been undertaken to collect information for the proposed project site and the stakeholders involved with the project.
- **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.
- **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. The Environmental & Social Impact Assessment (ESIA) has been taken into consideration for the following:
 - Applicable National Regulations;

- ADB Safeguards;
 - IFC's Performance Standards;
 - Environmental and Social Policy Statement, 2017, OPIC
 - Outcomes of the community consultation
 - Baseline environmental monitoring;
 - IFC General EHS Guidelines.
 - IFC Environmental, Health, and Safety Guidelines for Wind Energy (published on August 7, 2015)
- **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, ADB safeguards 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. Any significant change in the proposed activities may result in variation of interpretations. Presented information and fact has been analyzed and inferences have been drawn through the professional judgement. Limitations for the ESIA study is that detail Bird and Bat study was not in the scope of the ESIA study. Impacts on birds and bat need to be ascertained with the help of seasonal bird and bat studies.

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.

As informed by the project proponent (MEIPL) all the security personnel for the present 252 MW Wind Power Project will be deployed from the local populace through private sub-contractor. This would add to the employment benefit of the local population.

1.6 ESIA Team

Arcadis has mobilized a diverse team of multidisciplinary experts for conducting the ESIA study. A number of these experts have 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 in 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 PROJECT DESCRIPTION

2.1 Introduction

M/s Mytrah Energy India Private Limited (MEIPL) is developing the proposed wind power plant in Thoothukudi District of Tamilnadu. 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

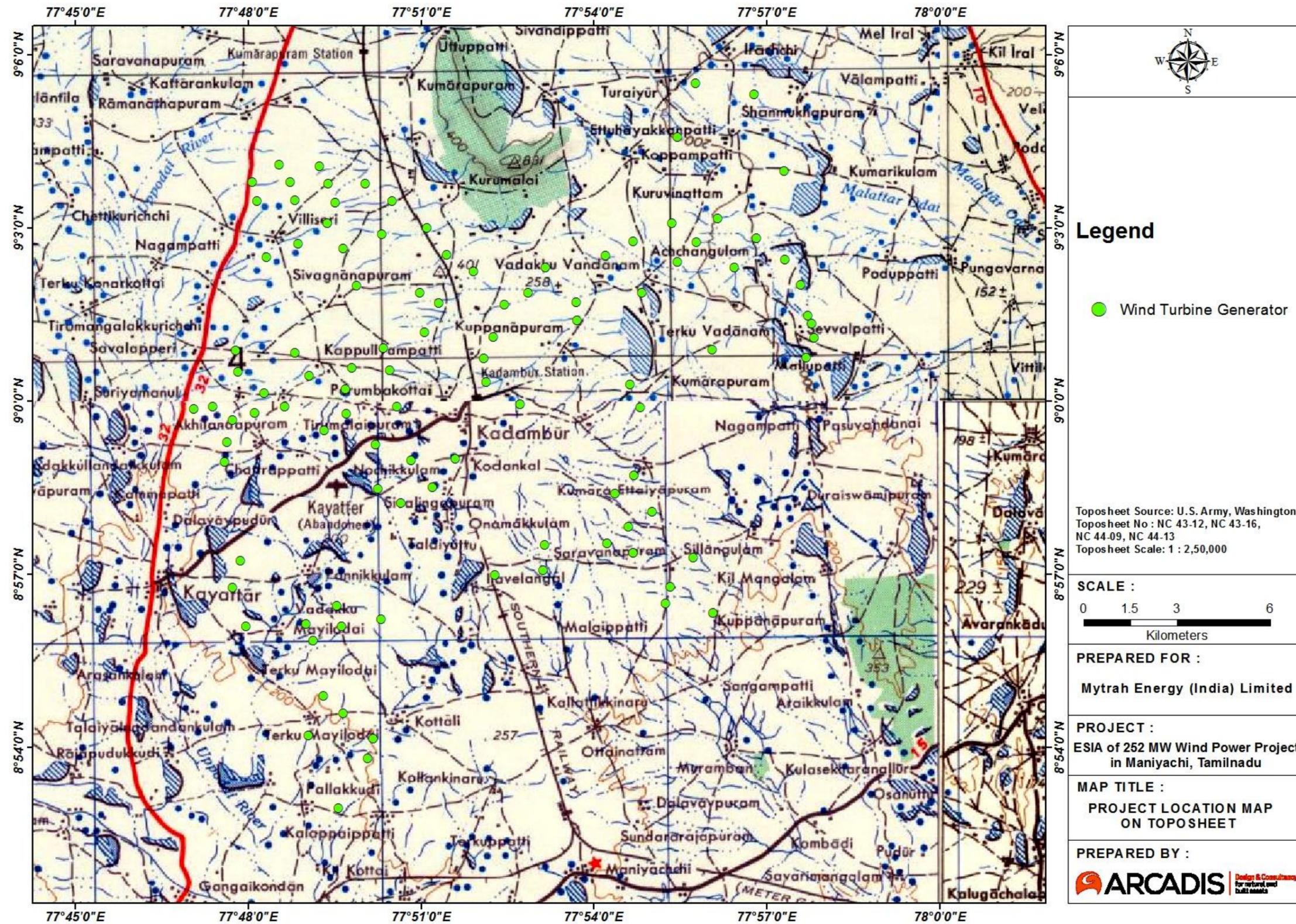
Project Owner	M/s Mytrah Vayu (Sabarmati) Pvt. Ltd.
Location of Site	Tehsil: Kayathar, Kovilpatti, & Ottapidaram District: Thoothukudi, Tamilnadu
Broad Geographical Coordinates of the site	8°53'7.96"N, 77°47'32.83"E and 9° 4'58.81"N, 77°56'21.39"E
Project Capacity	252 MW
WTG make	GE
WTG model	GE -2.4-116 MW
Hub Height	94 m
Rated Capacity (MW)	2.4 MW
Rotor diameter	116 m
Cut in wind speed	4 m/s
Cut-out wind speed	14 m/s
Swept area	10568 m ²
Type of tower	Tubular steel tower
Frequency	50 Hz
Location of Pooling sub-station	Ottudanpatti village
Capacity of pooling sub-station	33/230 KVA
Location of Grid sub-station	Vadakuvandanam village

Access road route will be developed as per the requirement. The WTG locations on SOI toposheet are shown in **Figure 2-1**.

As informed by MEIPL the project activities is entrusted to different sub – contractors as follows:

- Construction of Poolong Sub-station- Kshema Power and Infrastructure Company Pvt. Ltd
- EHV Line - Kshema Power and Infrastructure Company Pvt. Ltd
- DP yard – Prolac GE
- WTG Foundation – Annai Construction
- 33 KV Transmission line – Excelltech and Aerodynamics

Figure 2-1: Location of the WTGs on Toposheet



2.2 Project Location

The project consists of 105 WTG's each with 2.4 MW installed capacity and is located in 30 villages falling in Kaythar, Kovilpatti & Ottapidaram tehsil of Thoothukudi district in Tamilnadu. The project location map is provided in **Figure 2-2**.

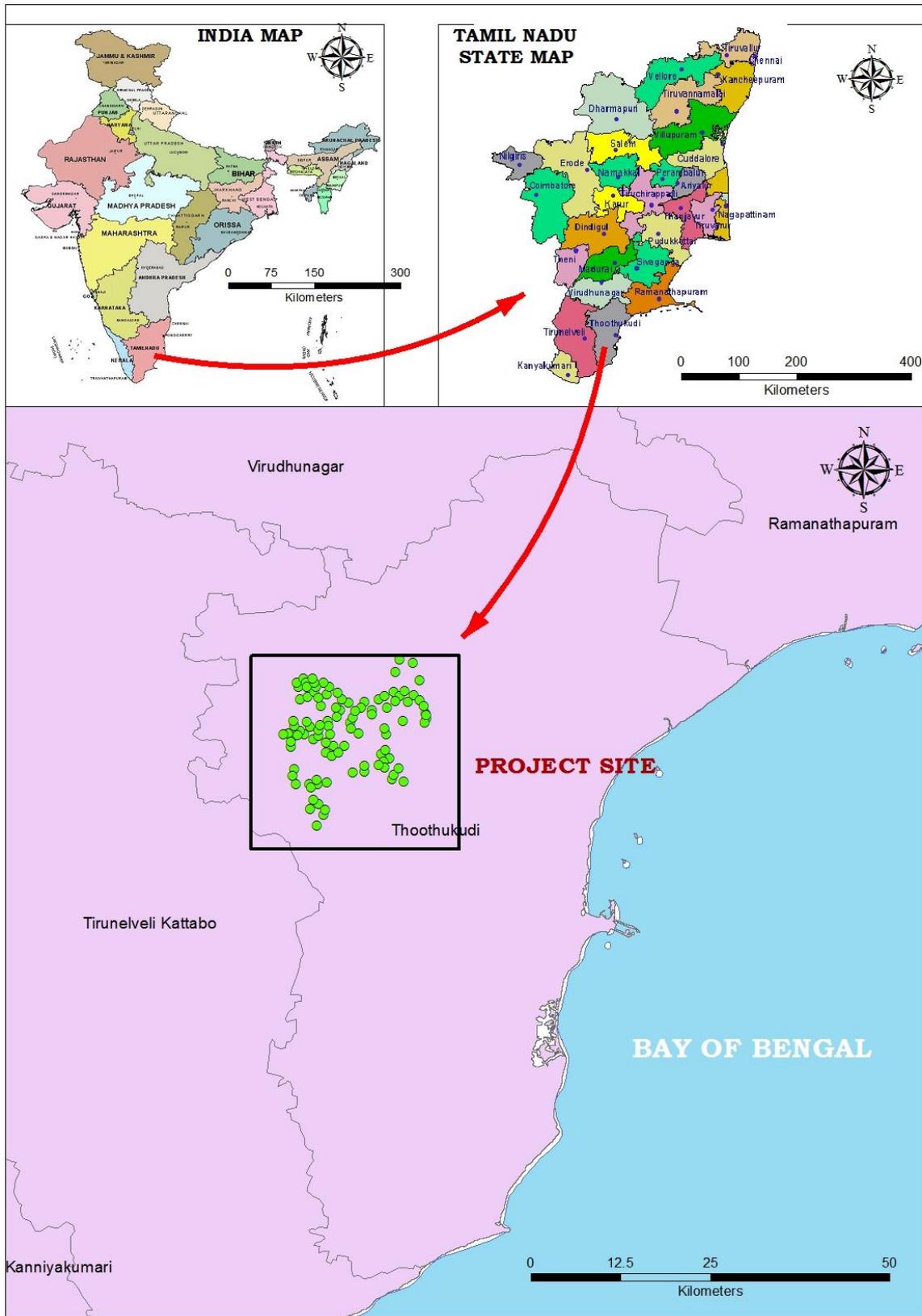
2.3 Project Phase and Status of Permits

The proposed wind power plant will consist of 105 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 Tamilnadu 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	Approval from TANGEDCO	No approval from TANGEDCO is required as it is a CTU conected project.
3	Land Allotment letter	No Government land is being procured in this project. Only private land based on mutual consent is being procured.
4	Permission from Forest department	No forest land is involved in this project. However, Vallanadu WLS and Gangaikondan spotted deer sanctuary is at 17.5 km and 8.6 km, respectively from the project area. Though renewable energy projects is a permissible activity within ESZ, it is adviceable to obtain an NOC from Forest Department/WLS office.
5	NOC from Airport Authority of India	Tuticorin airport is the nearest airport at a distance of 26 km. As per AAI directions, any structure with height more than 150 m and distance less than 20 km from airport will require NOC. Since, height of WTG in proposed project is 152 m but the distance of nearest WTG (WTG No MAN NEW 3) from airport is 26 km therefore NOC is not required. Kayatar Air strip which was used during World War II is presently abundant and being used for drying agricultural crops by the farmers. Hence NOC from AAI is not required.

Figure 2-2: Project Location Map



2.4 Project Features

Wind potential at the site: The wind velocity at project site varies from about 11.4-20.6 km/hr. The site has a good wind resource potential as per the monitoring carried out by various CWET monitoring stations.

Topography: The landscape has almost flat terrain. The elevation range of the study area lies between 150 and 304 feet.

Substation proximity: The 230kV D/C transmission line of around 8 km length will connect the pooling substation (PSS) of 33/230 KVA capacity in Ottudanpatti village under Kadambur Gram Panchayat (GP) to the 230/400 KV grid substation(GSS) located in Vadakuvandanam illage.

Transmission line route planning: A total of 21 towers are planned of to evacuate power from 105 WTG's , which will run a total length of around 8 km.

Geological and soil conditions: In general, black soil and red loam soil types are found in the Kovilpatti and Kayatar Tehsils of Thoothukudi District.

Water availability and quality: Water bodies such as ponds and lakes are existing in the area. However, MEIPL will procure water from the authorised tankers.

Land availability: All the lands being procured for the project are private land. No government land is involved in the project.

Climatic³ parameters like temperature, wind speed, rainfall, etc.: The climate of the district can be defined as hot and dry climate which is highly suitable for dryland crops. The average temperature ranges in the district is 23°C - 42°C

2.5 Project Settings

All the 105 locations were visited in this project. The key physical features of the project site have been described below:

Majority of 105 WTG's are proposed on flat terrain with dry agricultural land in its surrounding.

Tuticorin airport is approximately 26 km away from the site. As per the guidelines, "No objection" for height clearance is not required from Airport Authority of India (AAI) if the height of the structure is less than 150m above ground level⁴ and distance is beyond 20 km Visual Flight Rules airport.

The hub height of GE model 2.4 MW is 152 m (including the rotor blade length). Besides, the project site is located at a distance of 26 km; hence NOC for height clearance is not required from AAI⁵.

Kayatar Air strip which was used during World War II is presently abundant and being used for drying agricultural crops by the farmers. Hence NOC from AAI is not required.

One police shooting range (reportedly, it is closed now) is located near Valanadu wild life Sanctuary. The shooting range is approximate 1.5 km away from the project area.

Gongaikondan Sanctuary and Vallanadu sanctuary exist at approximate distance of 8.6 km and 17.5 km respectively from project site therefore project falls under eco sensitive zone (by default 10 km radius). Tamilnadu State Government has submitted the proposal to define the extent of eco sensitive zone for this sanctuary and it is under consideration by MoEFCC therefore by default 10 km radius area

³ *Groundwater Information Booklet, Thoothukudi district, 2013*

⁴ <http://nocas2.aai.aero/nocas/#>

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

is the eco sensitive zone at present. However, renewable energy projects are permitted within the eco sensitive zone.

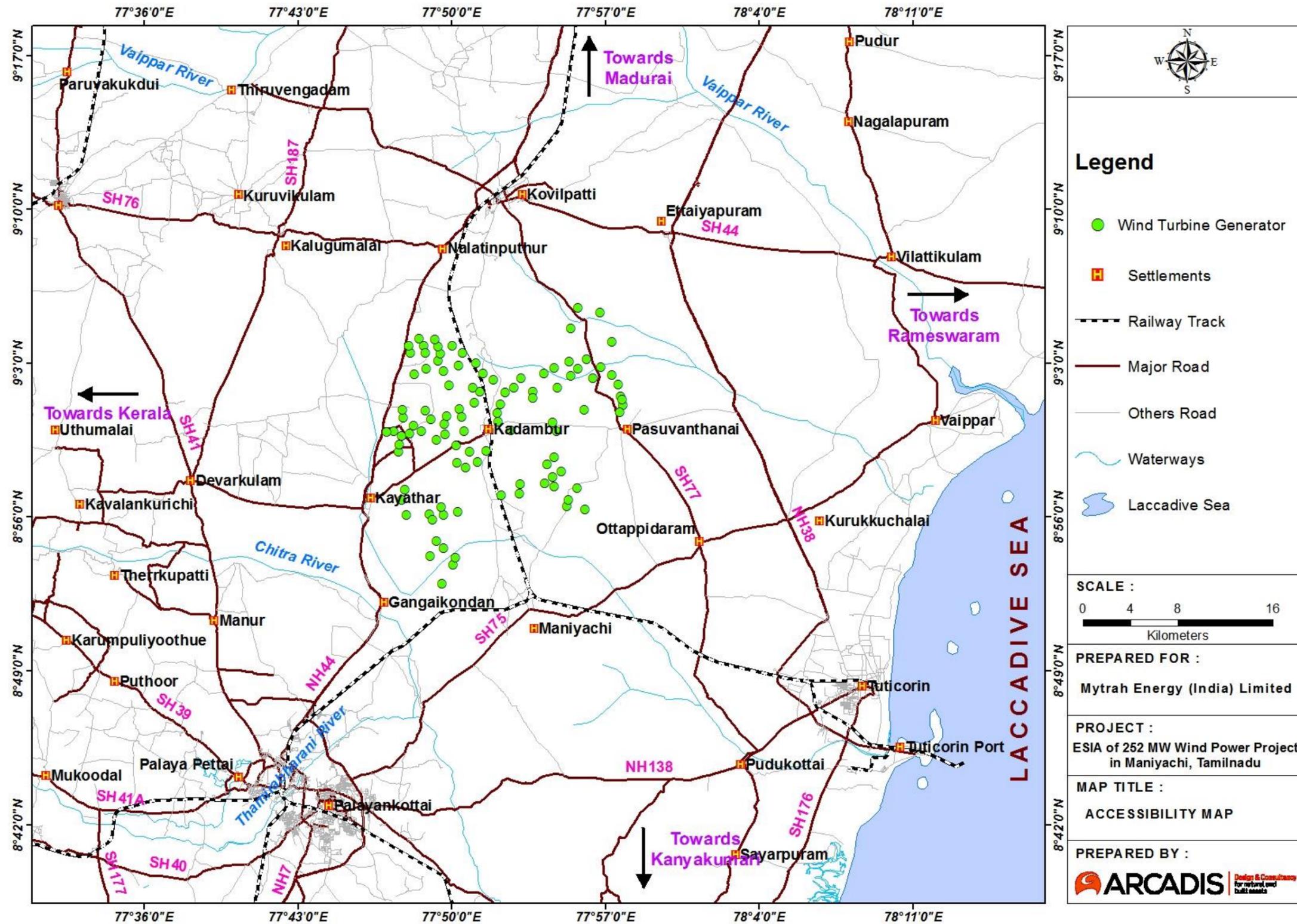
Kurumalai R.F. exist near the project site in north direction. However, none of the WTG is planned on forest land.

The project area has wind farm of other developers such as Gamesha and Suzlon. Apart from renewable energy projects, the area also has other industrial estate such as SIPCOT.

The site is located in a low high risk zone as per Seismic zone map of India and has susceptibility of earthquakes.

The detailed WTG site settings has been given in **Appendix D**. The proposed site is accessed through State Highway SH-77 and NH44, which further connects the wide project site through various villages Kadambur, Kayathar and Pasuvanathanai village. **Figure 2-3** below shows the accessibility of the project site.

Figure 2-3: Accessibility Map of the Project Area



2.6 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 GE 2.4-116 and has a hub height of 94 m. The rated capacity of each wind turbine is 2.4 MW. The blade length of the wind turbine is 58 m with the rotor consisting of 3 rotor blades made of high quality epoxy glass fibre/carbon fibre. The GE 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 of 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 vane 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.

2.7 Project Activities

2.7.1 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 wind monitoring mast have been installed by National Institute of Wind Energy in Kayathar, Thoothukudi Districts. in the region.

Micro siting: *The micro siting of the 105 WTG's has been finalised.* 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 7 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 land purchase process has been initiated.

Construction Phase

Site Preparation and access road development or strengthening: No construction was initiated during the time of site visit (August 2017). The activities involved during the construction phase are site preparation, clearing of vegetation, levelling of land, compaction of soil, trenching, cable laying, excavation, foundation and crane pad construction. Assessment on access road to the WTG's could not be undertaken as it was not finalized during the time of site visit (August 2017).

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 252 MW capacity with an individual WTG capacity of 2.4 MW. The project site will be connected through a 230kV D/C Transmission Line to the pooling substation (PSS) of 33/230 KVA capacity which in turn would be connected to the 230/400 KV grid substation(GSS).

Transmission Line: Power will be evacuated via a 8 km (approximately) long 230 Kv transmission line. A total of 21 towers have been planned for power evacuation. Necessary metering and protection will be provided to ensure acceptable billing and safety to equipment and work force. TANGEDCO is the government agency responsible for electricity distribution in the state. The approach route identified for the transmission line will be based on a criterion to reduce the environmental and socioeconomic footprint of the transmission line. The shortest feasible route after considering these factors Will be 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.

2.8 Resource Requirement

2.8.1 Land

Type of Land: All the 105 WTG's will be in private land only. Out of 105 WTG locations land for 66 locations are already procured. A sample sale deed of land procured is attached in **Appendix S**. The procurement of land for the rest 39 WTG's is under process. The topography of the project site is almost flat.

Land requirement: On average 4.2 Acre of land is required for each WTG location. It is assumed, around 441 Acres of land is required for 105 WTGs. Additionally around 15 Acres Land is already procured separately for Pooling Sub station (PSS). Additional Land is also required for transmission line, for which land has already been identified.

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 2-3: 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	Pooling substation land area
Around 441 Acres for 105 WTG (4.2 Acre for each WTG)	Around 441 Acres	One time compensation	About 15 acres private land Location: Ottudanpatti village under Kadambur village

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. Land required for access road is leased for a period of 12 months as per the requirement. 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.

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. ROW width of 35 m 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). Similar agreement would be made for operation and maintenance.

Land for Pooling substation: Private land has been identified and procured to connect the evacuated power from wind power plant to grid substation

Land Purchase Procedure: As per consultation with MEIPL representative, it is known that all 105 WTGs will fall on private land. Further, private land would also be required on a ROW basis for erecting transmission tower.

As mentioned Land required for the present project 252 MW wind power has been procured from private land sellers on willing seller- willing buyer basis through two land aggregating companies, viz. 'Mahamudra Realtors' and 'Kailash Associates'. Details of the land status has been given in **Appendix U**.

As understood during ESIA study and information derived from MEIPL there is no formal or informal users in the procured land.

Private land procurement procedure

The private land procurement procedure adopted by MEIPL has been detailed below in steps.

STEP 1: Title Clearance

STEP 2: ATS & Sale deed

Land Due Diligence

MEIPL appoints a third-party consultant for conducting land diligence and verify all the legal compliances related with land

MEIPL provides land related information available with the OEM to the third-party consultant for independent review of revenue records/land ownership records. After verification of land records and seeking clarification from revenue department, consultant submits due diligence report to MEIPL.

Based on the inputs of due diligence report, MEIPL team takes decision to finalize the land location with OEM

MEIPL, through the facilitation of land aggregator, finalize the land procurement on the basis of willing to sell and buy basis.

Provision of Land procurement/ acquisition in Tamilnadu

There is no wind policy in Tamilnadu (the latest one is Tariff order on wind energy, dated 31/03/2016). A separate land policy is being followed in the state for wind power project. According to the land policy, developer must select and purchase a suitable land in the wind potential area. After purchasing of land, an application must be submitted by developer to TNEB for obtaining consent letter for wind power generation. The application can also be submitted through TEDA along with following information:

Topo sketch of land making the proposed location of WTG (taking into consideration of nearby WTG areas)

Ownership record for the land. Land documents with original ownership record for verification.

Village map sketch

2.8.2 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 70 KL per WTG to build foundation of tower and 13.5 KLD for domestic water use considering 300 workers during peak hours. Maximum percentage of local employment would be undertaken.

In operational phase water will be used for the domestic use of project staff at the site, which is estimated to be around 3.6 KLD considering 15-20 technical persons present on site in shift and about 15-20 security personnel per shift.

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 2-4**

Table 2-4: Water Requirement During Construction and Operation Phase

Phase	Activity	Max. Consumption
Construction	Civil works water requirement as reported by MEIPL	70KL/ WTG location
	Curing water requirement for foundation	7500KL for 105WTG's
	Domestic use – drinking and washing by 300 workers staying onsite (during peak construction phase)	13.5KLD*
Operation	Domestic use – site personals and Security guards	3.6 KLD*

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

2.8.3 Manpower Requirement

About 300 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.

2.8.4 Waste Water Treatment and Disposal System

During construction phase, soak pit and septic tank shall be constructed in the constructed site to dispose the waste water. Waste water generation during the operation phase is limited to the waste water from the toilets.

2.8.5 Logistic Arrangement

Labour Accomodation: As informed by MEIPL there would be no Labour camp in site. There are strategy to involve local peole as unskilled labouers through sub –contractor during construction period. Accomodation for skilled personnel, migrated from outside, will be arranged in closely located area through rented accomodaton. The rented accomodatons will be equipped with the basic facilities like beds, kitchen, toilets, fans, drinking water and power supply. The rented accommodation 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**).

Transportation Route of Equipment: WTG material including Blade, nacelle assembly, hub assembly and tower section will be transported from Tuticorin port to Kayathar through Madurai road. The material will be transported from kayathar to storage yard through existing Pasuvanathanai Road. Highest length of material i.e. blade will be about 56.9 m.

Sl. No.	Material	L-m	Type of Vehicle
1.	Blade	56.9	Extendabale Trailer
2.	Nacelle Assembly	8.84	Hydraulic Axles
3.	Hub Assembly	3.45	Semi low bed
4.	Tower Base section	18.03	Penta Axle trailer
5.	Tower Middle Section-B	17.75	Quad Axle Trailer

Sl. No.	Material	L-m	Type of Vehicle
6.	Tower Middle Section-A	25.91	Quad Axle Trailer
7.	Tower Top Section	29.46	Highbed Quad Axle Trailer

A detail transport survey has been conducted for transport of material from port to kayathar and Kayathar to the Storage yard.

The most of the transport route from Port to Kayathar will be normal pass except at few locations where EB line to be heightened above 6.5 m and chopping of tree branches at few places for free passage of the WTG material to the site.

The findings of the route survey from Port to kaythar is summarized as below:

- Minimum compact road width of 6 Meter required on normal road, location road width 8 m required.
- All EB line clearance should be 6.5 m and HT line 9 m required.
- All the Tree Branches & Thorn Bushes in En-routes is to be cleared.
- For Tower vehicle –need levelled for Tuticorin (Tirunelveli road junction)
- For Blade vehicle –need development for Tuticorin (Tirunelveli road junction) and Tirunelveli junction.

The transport route of WTG material from Kayathar to the storage yard will follow existing Pasuvanathanai road. Presently, two storage yard options one in East side and other in West side has been identified. However, as per the survey findings Pasuvanathanai and Nagampatti village will need bypass for East side phase. Besides there will also require upgrade of few of existing village road and in some locations EB line will require to be heightened above 6.5 m.

The findings of the route survey from Kaythar to storage yard is summarized as below:

- All turning to be developed.
- Need East side one storage yard and West side one storage yard.
- storage yard not yet finalized.
- Pasuvanathanai and Nagampatti village need bypass for East side phase.

2.8.6 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.

2.8.7 Implementation Schedule for the Project

As information provided by MIPL the project is scheduled to commence in November, 2017 and targeted to complete construction and comminsioning by July, 2018.

2.9 Analysis of Alternatives

Tamilnadu has recorded significant growth in sector of renewable energy over the past decade. Tamilnadu has 13.2% of India’s installed renewable capacity. The geographical position of Tamilnadu provides competitive advantage to the state to tap renewable energy potential. Thoothukudi district has annual average wind speed 11.4 - 20.6 kmph. This good wind speed supports the wind power project in the district. As per TEDA, Tamilnadu has achieved 7597 MW wind power capacity upto 8th Feb 2016.

2.9.1 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 Tamilnadu state at 100 m above ground level is 33800 MW. The cumulative wind power installed capacity operational at the end of fiscal year 2016 is 7613 MW⁶. The percent of wind power utilized is 22.53 % as of date 31.03.2016.

2.9.2 Power Demand- Supply Position of Tamilnadu

As on 31st March 2016, total electricity capacity of Tamilnadu State was 24,433 MW and it included contribution from thermal, hydro and renewable energy sectors. This total capacity also included the contribution of electricity generated in the state and given by Center. Details of electricity capacity in Tamilnadu State is provided in the **Table 2-5**.

Table 2-5: Installed Capacity (MW) as on 31.03.2016

S.No.	Sector	Thermal	Hydro	Hydro RE	Other RE	Total
1	State	5176	2185	123	17	7501
2	Central	5464	0	0	0	5464
3	IPP + CPP	1839	0	0	9629	11468
4	Total	12479	2185	123	9646	24433

Source: Power for All - Tamilnadu⁷

Tamilnadu is considered as a state with 100% rural electrification. The state has established the wind power projects with installed capacity of 7613 MW.

Demand Projection of Tamilnadu by 2022

As per 18th Electric Power Survey, CEA, peak electric load has been estimated by 2022 is 26,330 MW. Various studies reveals that state possesses a huge potential of 8,10,000 MW from renewable energy sources as a comparison to a projected demand of less than 55,000 MW at an average CAGR of 6% between now and 2050. The result shows that huge untapped natural resources which can replace conventional forms of energy generation.

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 CO₂

⁶ <http://mnre.gov.in/file-manager/UserFiles/State-wise-wind-power-potential-utilized.pdf>

⁷ http://www.powerforall.co.in/AccessFolder/PFA_Document/1_PFA_Tamilnadu09012017.pdf

and SO₂ 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.

2.9.3 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 CO₂, CH₄, N₂O) 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 2-6**.

Table 2-6: Comparative Analysis of Various Power Generation Options

S.N	Alternative Power Source	Average Lifecycle GHG Emission (tonnes CO ₂ e/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

2.9.4 Alternate Location for the Proposed Project

The wind velocity in the district varies from about 11.4-20.6 km/hr. 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 wind mast installed by MEIPL in the project site. Availability of large area of non-agricultural land further adds to the feasibility of the project in the area.

2.9.5 Alternate Routes for Transmission Lines

The route of transmission line has been identified considering the following:

- 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 and forest land 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.

3 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 3-2**.

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	Tamilnadu Pollution Control Board (TPCB)	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 7 th 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).	<i>Not Applicable</i>
2	The Water (Prevention & Control of Pollution) Act 1974	Tamilnadu Pollution Control Board (TPCB)	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 7 th 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).	<i>Not Applicable</i>
3	Forests (Conservation) Act, 1980 and Rules 1981	Principal Chief Conservator of forests, Forest Department, Thoothukudi	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.	<i>Not Applicable</i> <i>As per the demarcated reserve forests (RF) on toposheet, Kurumalai RF exist near the project area. However, none of the WTG’s fall within the boundaries of this RF Therefore no forest permission is required.</i>
4	The Environmental (Protection) Act 1986 and Rules	MoEF&CC CPCB TPCB	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.	<i>Applicable during construction & operation Phase</i>

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
5	Environmental Impact Assessment (EIA) Notification 2006	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.	<i>Not Applicable.</i>
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.	<i>During construction phase and if required during operation phase. As this project is wind energy project and does not emit pollution therefore air quality monitoring is not required in operational phase.</i>
7	Noise (Regulation and Control) Rules 2000 amended in 2010	TPCB	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.	<i>During construction phase and if required during operation phase. As the operating wind farm generates noise which may exceeds the prescribed noise standards therefore noise monitoring is recommended to be carried out during operational phase.</i>
8	Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules 2016	TPCB	<p>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. MEIPL 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.</p> <p>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.</p>	<p><i>Applicable during construction and operation phase</i></p> <p><i>During construction phase, DG sets will be used for the civil work. Oil for DG sets should be stored in enclosed containers. Reportedly MEIPL/subcontractor will shall all non-biodegradable waste generated like plastics to the authorised recyclers.</i></p> <p><i>The operation phase of the proposed project will result in generation of few quantities of hazardous waste, mostly in the form of waste/used oil. MEIPL need to obtain consent from TPCB 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</i></p>

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
				<i>surface in a designated area with adequate secondary containment, with adequate labelling and before it is disposed to an TPCB approved vendor.</i>
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.	<i>DG sets to be used during construction phase will adhere to prescribed CPCB noise level limits and noise control measures.</i>
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.	<i>Applicable during construction phase MEIPL should ensure through its contractors during the construction phase that basic amenities are provided to the labours. MEIPL 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</i>
11	Workmen's Compensation Act, 1923 & Rules 1924	Tamilnadu 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.	<i>Applicable during construction and operation phase MEIPL 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</i>

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
				<i>framework for calculating amount of compensation and wages.</i>
12	The Contract Labour (Regulation and Abolition) Rules, 1971	Tamilnadu 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 12 months, 20 or more workmen. It does not apply to 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.	<i>Applicable during construction and operation phase All vendors or contractor employed by MEIPL 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 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. MEIPL 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.</i>
13	Minimum Wages Act, 1948	Tamilnadu 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.	<i>Applicable during construction and operation phase</i>
14	The Child Labour (Prohibition and Regulation) Act, 1986	Tamilnadu 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.	<i>MEIPL should ensure that no child labour is engaged at site for construction or operation works either directly or by the sub-contractors. MEIPL should include a clause in the subcontractor agreements prohibiting employment of child labour</i>

S. N	National Environment, Health & Safety Regulation	Agency Responsible	Requirement	Applicability
15	Companies Act, 2013	Ministry of Corporate Affairs	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.	MEIPL need to comply with the requirement as stated in the law.
16	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 ⁸ . In addition to this, structure located out of 20km as per Visual Flight Rules, also does not requires NOC.	Tuticorin airport is the nearest airport at a distance of 26 km. As per AAI directions, any structure with height more than 150 m and distance less than 20 km from airport will require NOC. Since, height of WTG in proposed project is 152 m but the distance of nearest WTG (WTG No MAN NEW 3) from airport is 26 km therefore NOC is not required. Kayatar Air strip which was used during World War II is presently abundant and being used for drying agricultural crops by the farmers. Hence NOC from AAI is not required.

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:

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	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	ARCADIS has been appointed by MVSPL to undertake ESIA study to identify the environment and social risks that may arise due to the project and recommend mitigation	MEIPL has developed an Environmental and Social Management System for its wind and solar projects at corporate level. MEIPL is required to adhere the requirements as per management system

⁸ <http://nocas2.aai.aero/nocas/#>

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
Management Systems	potential impacts, to include issues identified in Performance Standards 2 to 5	<p>measures for the same as provided in Chapter 7.</p> <p>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.</p> <p>PS 1 is therefore applicable for the proposed project.</p>	<p>developed as the project site and needs to fulfil the following requirements:</p> <p>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.</p>
	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 7 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 7 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 environmental and social performance	Organizational structure with roles and responsibilities of the team within the organization is defined in Chapter 7	
	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 program 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	

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	<p>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</p>	<p>System of monitoring with periodic audits will be established</p>	
<p>PS 2: Labour and Working Conditions</p>		<p>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).</p> <p>The proposed project will involve employment of direct and contracted workers during construction and operation phases.</p> <p>As informed by MEIPL there would be no Labour camp in site. There are strategy to involve local people as unskilled labourers through sub –contractor during construction period.</p> <p><u>PS 2 is therefore applicable for the proposed project.</u></p>	<p>Accommodation for skilled personnel, migrated from outside, will be arranged in closely located area through rented accommodation. The rented accommodations will be equipped with the basic facilities like beds, kitchen, toilets, fans, drinking water and power supply. The rented accommodation 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).</p> <p>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.</p>
	<p>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</p>		<p>MEIPL Energy has HR policies at the corporate level. EPC contractor should inform their employees their rights under national labour and employment laws.</p>
	<p>Document and communicate to all employees' conditions and terms of employment.</p>	<p>Applicable during construction and operation phase</p>	<p>The contractors (Kshema Power and Infrastructure Company Pvt. Ltd and Excelltech and Aerodynamics) should hire local labour during construction phase of the project.</p>

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
			<p>MEIPL should engage labours through contractors as such the contractors would be supervised by MEIPL so that the engagement of workers is in accordance to applicable rules and regulations.</p> <p>MEIPL should provide adequate provisions such as access to clean water, sanitary facilities and other necessary facilities at the construction sites.</p> <p>As a decided strategy local people will be hired as unskilled labourers, there will not be any requirement for labour camp. Skilled personnel, hired from outside places would be accommodated in rented arrangements in the nearby areas.</p> <p>The rented arrangements is suggested complied with ILO guidelines and standards as mentioned in</p>
	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 MEIPL at the corporate level. The same will be implemented during construction and operation phase supervised under MEIPL.
	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	MEIPL has an QSHE policy (Appendix F). 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 wastes like	<p>Private land is identified for all WTG's proposed, land for about 66 locations is already procured and for the remaining it is in process. Land for other facilities will also involve private land, which would be obtained through a negotiated settlement. Water for project construction phase will be sourced from tanker water suppliers and drinking water supply would be through packaged drinking water.</p> <p>The project, is expected to contribute to significant GHG avoidance beginning in FY2018-19. No</p>

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
		<p>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.</p> <p><u>PS 3 is therefore applicable for the proposed project.</u></p>	<p>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.</p> <p>MEIPL should implement measures during construction: for management of excavated earth and construction rubble; and minimization of fugitive dust emissions. Further, MEIPL 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.</p> <p>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.</p> <p>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. Sewage shall be sent to septic tank followed by soak pit in both during construction and operation phases.</p>

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	<p>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.</p>	<p>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.</p>	<p>MEIPL through its contractors should ensures sprinkling of water to reduce dust in the air. Besides, MEIPL should also ensure use of vehicles having valid PUC certificates.</p>
	<p>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 focus on areas that are considered core business activities.</p>	<p>During construction and operation phase.</p>	<p>MEIPL 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.</p>
<p>PS 4: Community Health, Safety and Security</p>		<p>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. <u>The PS 4 is therefore applicable for the proposed project.</u></p>	<p>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.</p>
	<p>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.</p>	<p>During Construction and Operation Phase</p>	<p>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.</p>

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	Design, construct, operate and decommission of Structural elements or components in accordance with good industrial practice to reduce impact on community health & safety.	During Construction and Operation Phase	An occupation health safety plan has been formulated (Chapter 7) of this report. All steps to reduce the impact on the health and safety of the community to minimal will be taken.
	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	<p>PS 5 is applicable when there is physical and/or economic displacement due to acquisition of land for the project.</p> <p>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</p>	<p><u>PS5 is not applicable for this proposed project.</u></p>	<p>Only private lands are being procured in the proposed wind power project on willing to sell- buy principle through two land aggregator companies, viz. 'Mahamudra Realtors' and 'Kailash Associates'. It has been informed by the project proponent and land aggregators both, that all the lands being procured are dry lands (locally called Punjai). So far observed during field visit and consultation with the land sellers, local community and panchayat, no direct or indirect livelihood dependency is related to the project area; hence, impact in terms of economic and physical displacement is not expected. PS 5 is not applicable for this project</p>
	Avoidance or at least minimization of involuntary resettlement by exploring alternative project designs balancing environmental, social and economic costs and benefits; and by acquiring land through negotiated Settlements.	Not applicable	No resettlement of people is required.
	Compensation and benefits for displaced person as per Performance Standard	Not applicable	No locals will be displaced. Land required for all facilities is being purchased on mutual buyer and seller basis.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
	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	MEIPL should implement its framed grievance redressal framework (Appendix G) 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 responsive to changing conditions and the results of monitoring throughout the project's lifecycle.	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. <u>PS6 is applicable to the project</u>	Few WTGS are falling within Eco sensitive Zone of Vallanadu Wildlife Sanctuary and Gangaikondan Spotted Deer Sanctuary. The project site will be developed in a "Modified habitat". Agricultural land/culturable wastes are procured for the development of this project. From the natural vegetation point of view, the project profile area found to be insignificant. Wildlife such as common mongoose, Indian hare, common small reptiles were sighted. A few raptors were also sighted. Koonthankulam bird sanctuary is located at 60-70 km from the project profile area. However, it is also known as an "Important Bird Area" and many winter migratory birds visit this sanctuary in December. A few seasonal water bodies were also located within the project profile area. Although, development of /use of Renewable Energy Sources in the ESZ area is permitted as per the guidelines issued by MOEF&CC (F. No-1-9/2007 WL-I(pt) on 9th February 2011; but considering the presence of migratory birds in Koonthankulam bird sanctuary, black bucks in Vallanadu and spotted deer in Gangaikondan Spotted Deer Sanctuary, PS-6 is applicable to this project. And in this connection a robust mitigation measures will be recommended in the ESIA report. Hence, Short term/long term bird & bat monitoring is recommended.

Title of Performance Standard	Performance Standard (PS) requirements in brief	Applicability to project (Compliance)	Actions Taken/Requirements
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 is in Thoothukudi district and does not fall in any notified tribal area of Tamil Nadu state ⁹ . It was informed that, no tribal land has been procured for this project and its associated utilities. Considering the adverse effect of proposed project on tribal people in any form, PS 7 is not applicable
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 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.	This PS is applicable when tangible forms of cultural heritage, unique natural features or tangible objects that embody cultural values and certain instances of intangible forms of culture are impacted or are proposed to be used for commercial purposes. <u>Hence, PS8 is not applicable.</u>	It was observed during site visit that in Kottali village, one old temple known as Krishna Kovil located more than 1 km from the nearest WTG location. As information gathered through community, this temple is about 50 -80 years old. No other culturally significant site exists in the project area. No ASI recognised heritage site is located within study area. As understood there may not be any direct impact on this due to the project activity but such chances cannot be ruled out. Although PS-8 is not applicable, however, Chance find Procedure could be applied.

⁹ <http://tribal.nic.in/Content/StatewiseListofScheduleAreasProfiles.aspx>

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 7-1 .
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 7.4.8 .
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 7-1 .
b)	Contouring and minimizing length and steepness of slope	Refer mitigation measures for soil and water under Table 7-1 .
c)	Re-vegetating areas promptly	Refer mitigation measures for Ecology under Table 7-1 .
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 7-1 .
III	Road Design	
a)	Limiting access road gradients to reduce runoff-induced erosion	Refer mitigation measures for soil and water under Table 7-1 .
b)	Providing adequate road drainage based on road width, surface material, compaction, and maintenance.	Refer mitigation measures for soil and water under Table 7-1 .
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 Table 7-1 .
b)	Avoiding open burning of solid waste	Refer mitigation measures under Table 7-1 .
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 7.4.8 .

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
4	SOLID WASTE	
a)	Minimizing generation of solid waste	Refer mitigation measures in Section 7.4.3 .
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 Table 7-1 and Section 7.4.3 .
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 7.4.5 under Occupational safety under Table 7-1 .
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 7.4.5 .
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 7-1 .
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.	Tuticorin airport is the nearest airport at a distance of 26 km. As per AAI directions, any structure with height more than 150 m and distance less than 20 km from airport will require NOC. Since, height of WTG in proposed project is 152 m but the distance of nearest WTG (WTG No MAN NEW 3) from airport is 26 km therefore NOC is not required. Kayatar Air strip which was used during World War II is presently abundant and being used for drying agricultural crops by the farmers. Hence NOC from AAI is not required.
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.

S.N	Relevant Requirements as Stated in EHS Guidelines	Section in ESIA Report where Addressed
f)	Public Access	During construction phase, safety tape on the roadsides should be displayed during work in progress. The WTG location should also be fenced to prohibit public access to the turbines.
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 7.4.8 for minimizing the same.
h)	Blasting operations	Blasting operations would not be required for construction of access roads as WTG locations are not located on hilly ridges and rocky undulating terrain. The terrain is flat with soft soil.
8	OPERATION PHASE	
a)	Visual Impact	The landscape should be studied in detail while siting the WTG locations, access roads and transmission line so that it does not impact the landscape of the area.
b)	Operational Noise	Wind turbines generate mechanical and aerodynamic sources. Curtailing turbine operations above the wind speed at which turbine noise becomes unacceptable. Adherence to national or international acoustic design standards for wind turbines
c)	Bird/ Bat mortality and flight disturbance	During operation phase the local and migratory bird habitat study should be conducted, based on geographical location and topography of the area. Short term/long term bird and bat study shall be undertaken. Collision risk modelling should also be conducted. Proper measures should be considered in the pre-planning phase to reduce the cut-in wind speeds to further prevent potential bat collisions.
d)	Shadow Flicker and Blade Glint	In case of worst case scenario, the duration of shadow flicker should not exceed 30 hours per year and 30 minutes per day. Wind turbines should be programmed to shut down at times when shadow flicker limits are exceeded.
e)	Occupational Health and Safety - Working at Heights	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.
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.

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, OPIC Environmental and Social Policy Statement, 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 7 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.	Private land identified for all WTG’s in proposed project. Private land identification and purchase directly and indirectly undertaken through Land Aggregator 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.

Equator Principle	Applicability	Project Information/Application
Principle 7: Independent review	An independent social or environmental expert, not directly associated with MEIPL 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 MEIPL and financing agency as well as contractors and technology suppliers	E&S Covenants should be embedded within the contracts drawn between MEIPL 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 external experts to verify its monitoring information which would be shared with EPFIs.	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
	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 Environmental and Social Policy Statement (ESPS) of Overseas Private Investment Corporation (OPIC)

Environmental and Social Policy Statement (ESPS) addresses OPIC's commitments regarding environmental and social dimensions of sustainable development and provides the general environmental and social requirements that OPIC applies in evaluating prospective projects and monitoring on-going OPIC-supported projects. These environmental and social requirements apply to all projects supported by OPIC.

This Policy Statement adopts, as a standard for the environmental and social review process, the International Finance Corporation's (IFC) Performance Standards on Social and Environmental Sustainability and Industry Sector Guidelines and any subsequent revisions to those standards.

As referred in sections 3.2, 3.3 and 3.4 of the report, the present ESIA study of 252 MW wind power project also need to comply with the guidelines and safe guards mentioned in the Performance Standards.

3.6 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 private land for all proposed 105 WTG's. No revenue government land will be procured. Further, land identified for procurement are free from any physical structures and do not cause resettlement. 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, 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.	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. 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 Policy	Objective	Project Details
ADB's Social Protection Strategy (2001)	<p>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:</p> <p>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</p> <p>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;</p> <p>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).</p>	<p>MEIPL has developed ESMS for all its project 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.</p>
ADB policy on Public Communication policy	<p>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, 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.</p>	<p>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 concern but also help to address the comment in time bound manner.</p>
ADB policies on 2010 on Gender mainstreaming guidelines	<p>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</p>	<p>Not Applicable.</p>
ADB policies on participation guides	<p>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.</p>	<p>Stakeholder participation in this project has been ensured through stakeholder discussion and project disclosure.</p>

3.7 Categorization of Projects

3.7.1 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 our 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 private land for all proposed WTGs. The land to be purchased for the project is mostly 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 Thoothukudi district does not fall in any notified tribal area of Tamilnadu. The project is categorized as **Category C** project.

3.7.2 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.

3.7.3 OPIC Categorization

OPIC categorizes all projects and Subprojects as Category A, B, C or D based on environmental and social factors. OPIC may apply an additional classification of Special Consideration to projects that have heightened potential for adverse project-related social risks related to the involvement of or impact on Project Affected People including Workers.¹⁰

Category A projects are considered high risk. Projects considered high risk are those that discharge high levels of contaminants (including **Greenhouse Gases**) into the environment in the absence of adequate pollution controls, as well as those projects that are considered high risk in the absence of sound environmental and social management are Category A projects .

Category B projects are likely to have limited adverse environmental and/or social impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures. Category B projects are considered medium risk. For these reasons, the scope of OPIC's environmental and social assessment for Category B projects is narrower than that required for Category A projects. Examples of Category B projects may include small to medium scale housing developments in urban areas, restaurants, and light manufacturing.

Category C projects are likely to have minimal adverse environmental or social impacts. Examples of Category C projects may include financial services, telecommunications projects not involving new physical infrastructure, bid bonds and data processing.

Category D is reserved for initial approval of guaranties to Financial Intermediaries, which will make investments in or provide financing to projects or enterprises ("Subprojects") engaged in activities within Categories A, B or C. Subprojects, originated by the Financial Intermediaries screened as Category D.

These projects are subsequently screened and subjected to the full scope of OPIC's environmental and social assessment process including public disclosure and consultation, Greenhouse Gas emission accounting, and conditions and monitoring requirements as

¹⁰ Source: *Environmental and Social Policy Statement, 2017*

warranted by the nature and scope of the Subproject and its environmental and social risks and impacts..

Projects may be classified as Special Consideration based on an assessment of the severity of possible social risks, and their relevance to a project.

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

4 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 August, 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 spread over in Ottapidaram and Kayathar tehsil. Kayathar tehsil is the newly formed tehsil after restructuring in Kovilpatti and Ottapidaram tehsils. 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 (10 km around the WTG location).

4.2 Baseline Conditions

4.2.1 Climate and Meteorological Conditions

The climate of Thoothukudi district is characterized as hot and dry and it is suitable for dryland crops. The humidity in the area is high and it prevails throughout the year in the range of 60 – 70%.

Temperature:

The mean maximum temperature ranges from 29.5°C – 40.5°C. The highest temperature was recorded between the May and August months while the lowest one was in December and January.

Rainfall:

The district receives the rain under the influence of both southwest and northeast monsoon. Northeast monsoon is the main contributor to the rainfall in the district. Rainfall data collected over the period of 1901 – 2001 shows that district receives annual rainfall 625.8 mm. The rainfall is minimum central eastern part of the district (around Arasadi and Thoothukudi).

The climatological data for IMD station Thoothukudi is given in following table in **Table 4-1**.

Table 4-1: Climatological Table of Thoothukudi

Month	Max Temp (Deg.C)	Mini Temp (Deg.C)	Humidity (%)	Wind Spd. Kmph	Rainfall (MM)
January	28.1	21.7	78	20.6	15.8
February	29.0	22.7	77	19.3	18.9
March	30.6	24.5	75	15.8	36.3
April	32.4	26.0	73	12.4	58.6
May	34.8	26.7	64	13.0	26.3
June	35.6	26.5	60	17.0	3.9
July	34.9	26.2	59	18.1	11.3
August	34.7	26.1	59	17.3	7.0
September	34.1	25.7	61	15.0	14.7
October	32.0	24.6	72	11.4	154.4
November	29.7	23.5	80	13.6	180.1
December	28.4	22.4	80	18.1	98.5
Total /Average	32.0	24.7	70	16.0	625.8

Source: Climatological Tables

The monthly mean rainfall distribution of Thoothukudi district for the ten-year period (1992-2002) has been presented in **Figure 4-1** below.

Figure 4-1: Monthly Mean Rainfall Distribution (1992 – 2002)

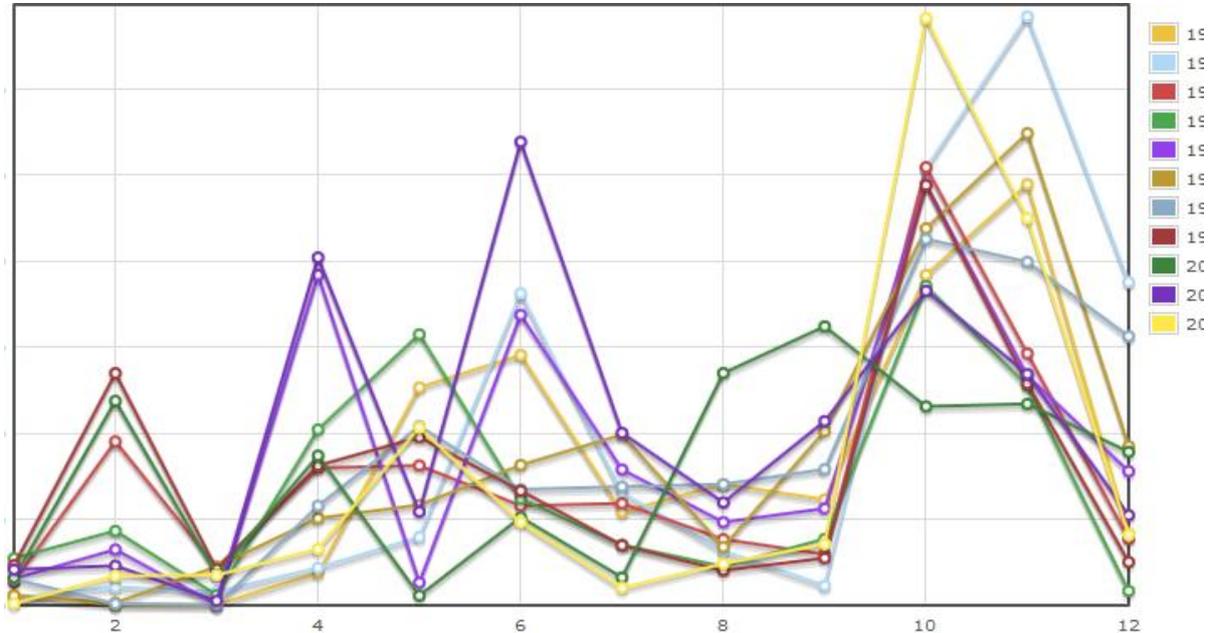


Table 4-2: Monthly Rainfall Distribution of Thoothukudi District

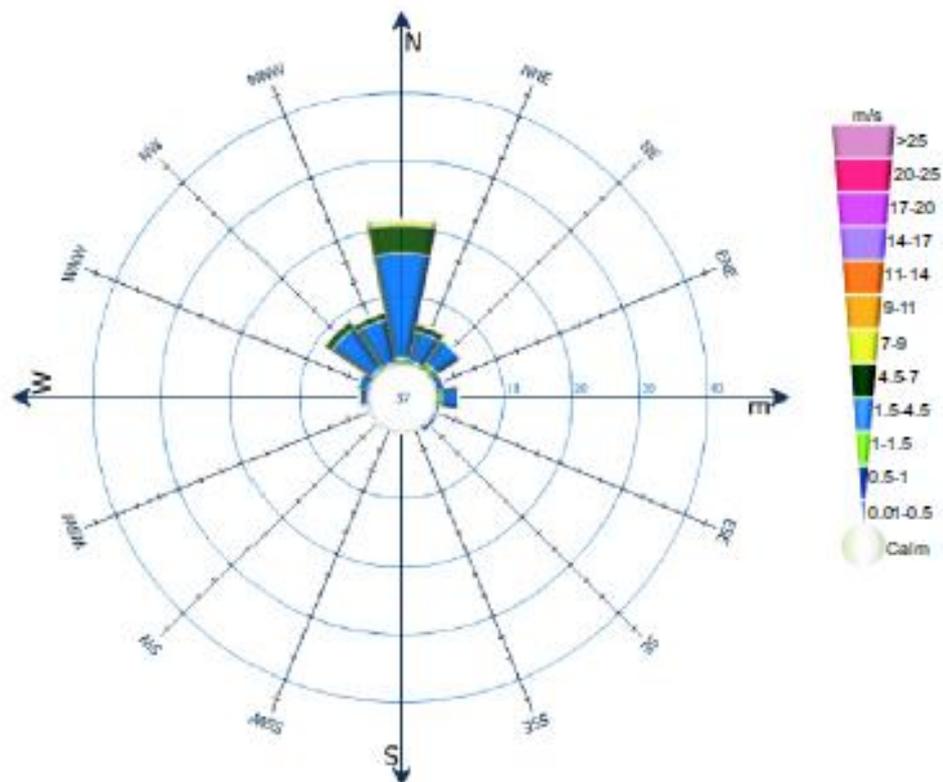
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1992	6.16	0.33	0.31	19.00	126.69	145.54	54.29	70.44	61.51	192.10	244.90	41.84
1993	4.38	10.70	7.87	21.83	39.81	181.37	65.52	31.60	11.48	254.08	342.38	187.93
1994	13.93	95.29	21.94	79.82	81.30	57.90	59.25	38.42	29.67	254.71	146.42	38.66

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1995	27.37	43.28	5.96	102.23	157.56	61.99	35.25	22.52	38.67	185.65	127.64	8.39
1996	15.46	32.46	0.31	192.12	13.25	168.87	78.97	48.34	56.31	244.82	133.41	77.94
1997	5.62	1.51	22.53	50.66	58.38	81.58	99.21	33.94	101.38	219.18	274.52	92.50
1998	15.27	0.96	0.31	57.88	104.13	67.43	69.00	70.42	79.15	212.94	199.72	156.41
1999	23.32	134.96	21.01	81.28	97.76	66.61	34.88	20.26	27.46	244.28	128.95	25.19
2000	16.06	118.86	17.82	87.04	5.63	51.18	16.22	135.01	162.18	115.64	117.13	89.24
2001	20.79	23.00	2.65	202.21	54.43	269.47	100.23	59.78	107.08	182.84	134.42	52.35
2002	1.06	17.14	17.56	32.83	103.35	48.34	10.20	24.20	35.62	341.43	225.20	40.90

Wind Speed:

The wind velocity in the district varies from about 11.4 – 20.6 km/h. 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 south to north direction. The annual wind rose is presented in **Figure 4-2**.

Figure 4-2: Annual Wind Rose for Thoothukudi (IMD Pune 1971-2000)



4.2.2 Topography

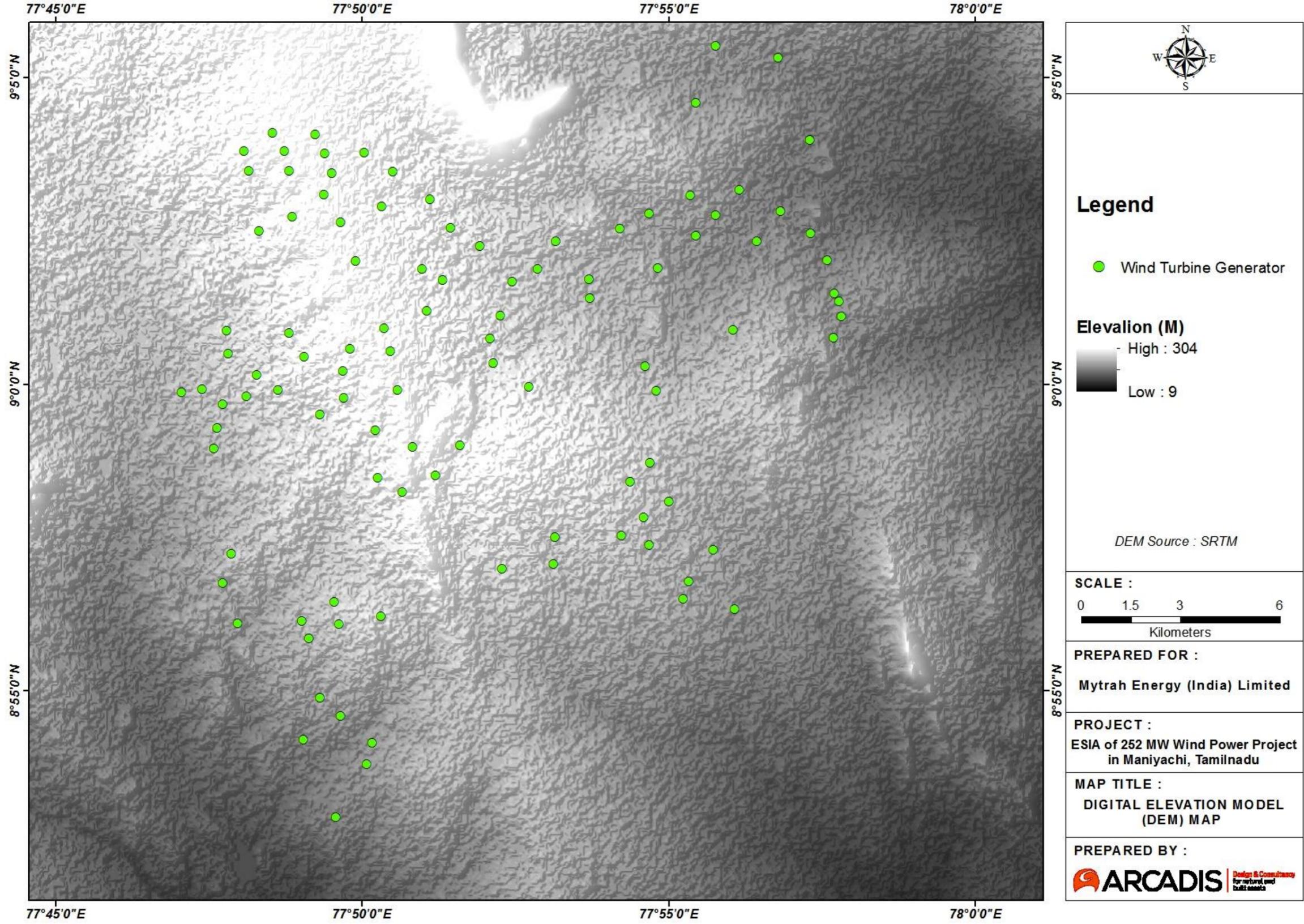
The landscape is flat terrain. The elevation range of the study area lies between 150 and 304 feet. Some of the site pictures are shown in phot below.

Topography of the Project Site



The site is spread in a vast area. Taking a reference from the center point, all the 105 WTGs are covered within a radius of 15 km. An elevation map has been prepared covering all the WTGs. The Digital elevation map of the project site is shown below in **Figure 4-3**. The elevation difference in the project site is between 150 – 304 feet above sea level.

Figure 4-3: Digital Elevation Map of the Project Area

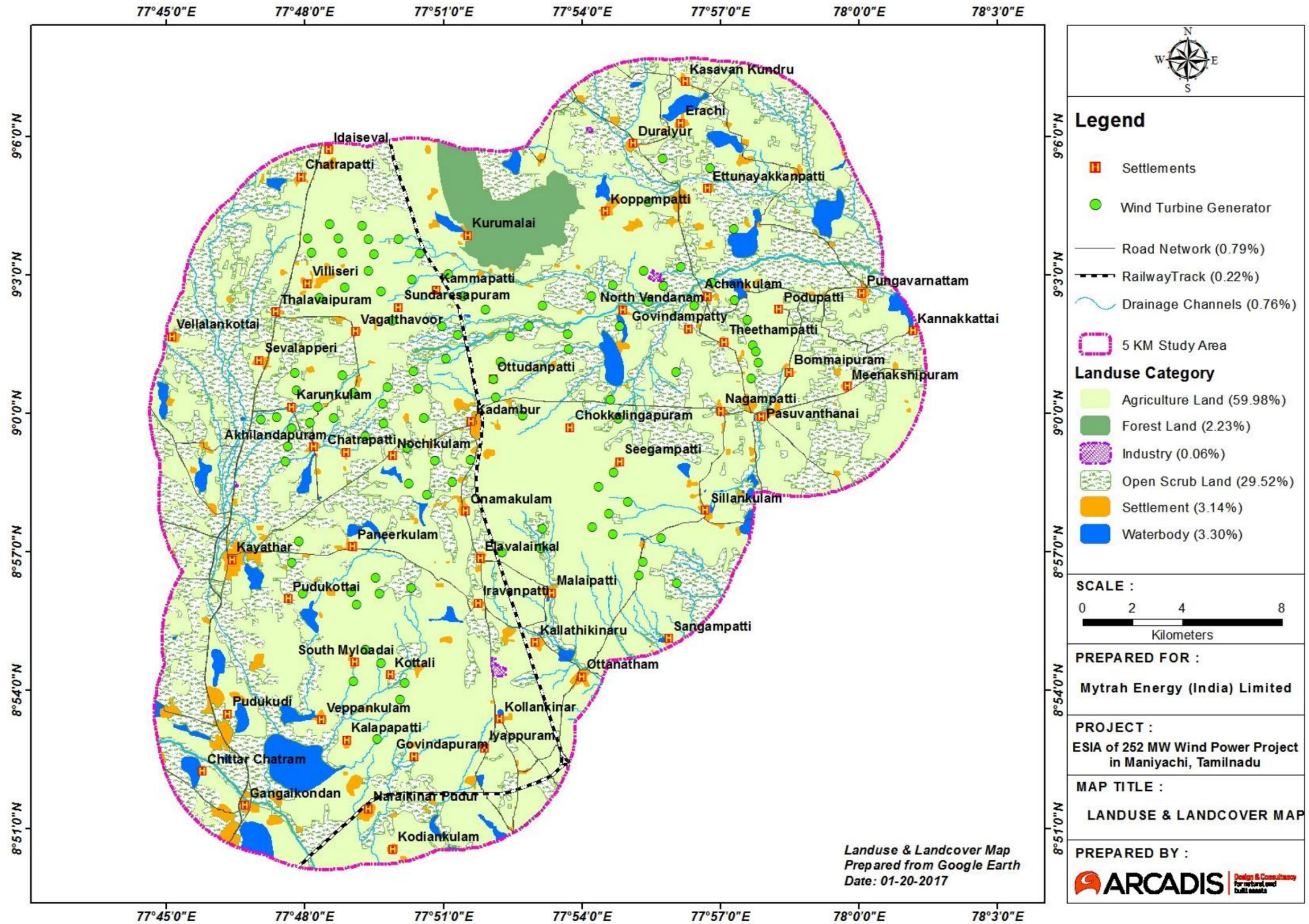


4.3 Landuse Analysis

The land-use and land-cover of the study area 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, map preparation was undertaken by preparing a grid of the site area and taking a reference point in middle of site and covering all 105 WTGs within 15 km radius from reference point. The aim is to provide a clear view of the land use of the entire site.

Land use of the proposed project site is mainly a mix of agricultural land and dry land. Land use map showing a radius of 15 km of the project site is provided in **Figure 4-4**. The land use at the project site comprises mostly of agricultural land (59.98%) followed by open scrub land (29.52%). Other land use in the project study area is characterized by i) forest land (2.23%) ii) Industry (0.06%) iii) Settlement (3.14%) iv) Water Body (3.30%).

Figure 4-4: Land Use Map of the Project Area



4.4 Soil

The soil found in Thoothukudi district can broadly be grouped into five types. The common soils types and locations in district is presented in **Table 4-3**.

Table 4-3: Soil Types in Study Area

S.No.	Types of Soil	Places in District
1	Red Loam	Udangudi, Kayatar , Sattankulam
2	Lateritic soil	Srivaikundam, Tiruchendur
3	Black soil	Kovilpatti , Kayatar , Vilathikulam, Thoothkudi, Ottapidaram
4	Sandy coastal alluvium	Tiruchendur
5	Red sandy soil	Udangudi, Sattankulam, Srivaikundam, Karungulam, Ottapidaram , Vembar

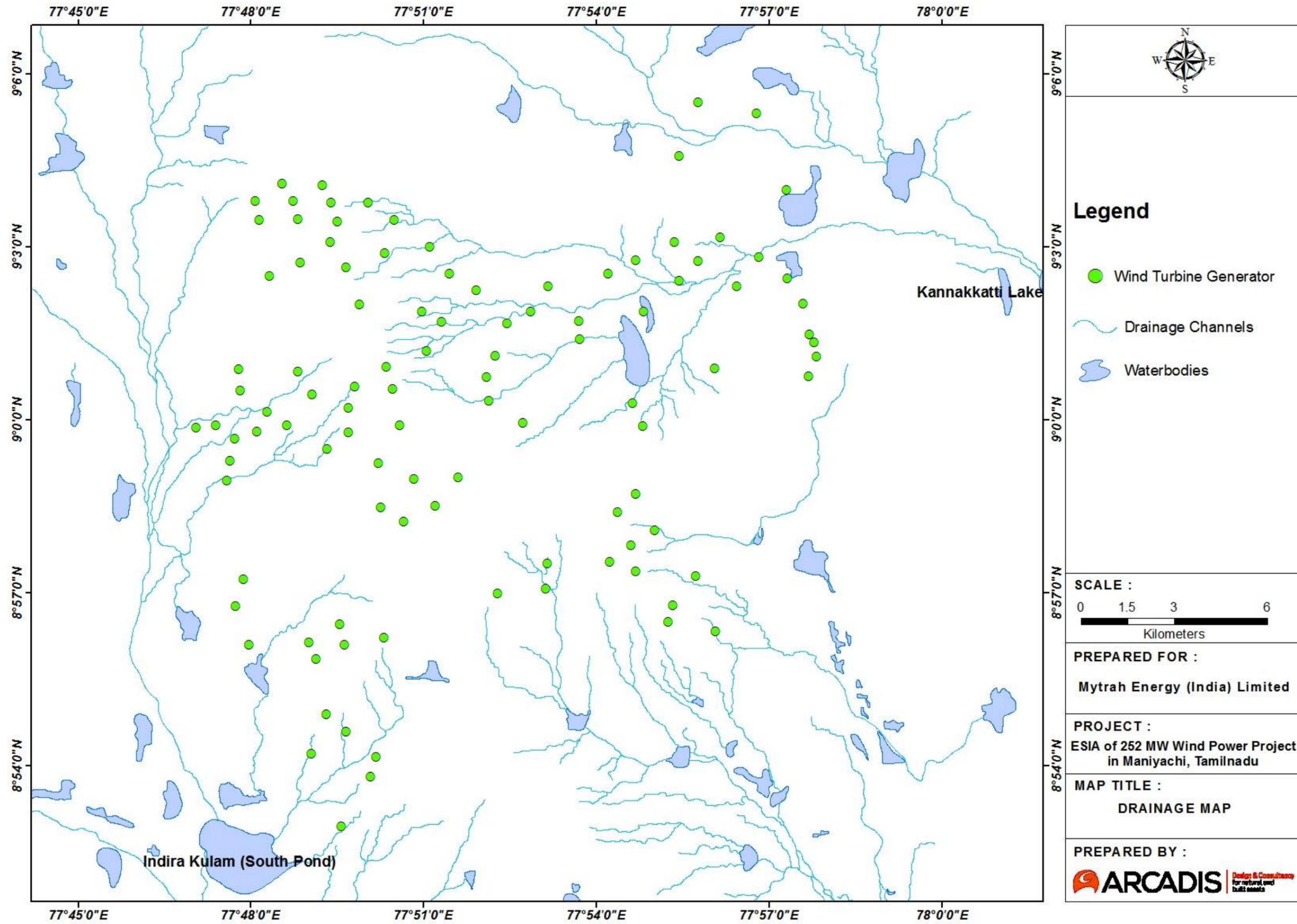
Source: Records of the Office of the Directorate of Economics and Statistics, Chennai

The soil types in project area are red loam, black soil and red sandy soil. Black soil is the major soil types observed in the project area. The soil types in the area supports crop plantation such as paddy, cumbu, black gram, green gram, cotton, groundnut, sunflower, chilli etc.

4.5 Drainage

Study area is interspersed with seasonal water bodies. The drainage network in the district comprises rivers originated from western Ghat and upland of Tamilnadu. Drainage of the area flows towards the Bay of Bengal. The area of Maniyachi where project site is located, falls under the Chittar – Kallar Rivers watershed. A drainage map has been prepared on the basis of watershed atlas for Thoothukudi District and presented in Figure-4-5. Apart from the rivers, many seasonal ponds and lakes are also available in the project site area. Kannakkati lake and Indirakulam pond are the two large water bodies observed near the project site.

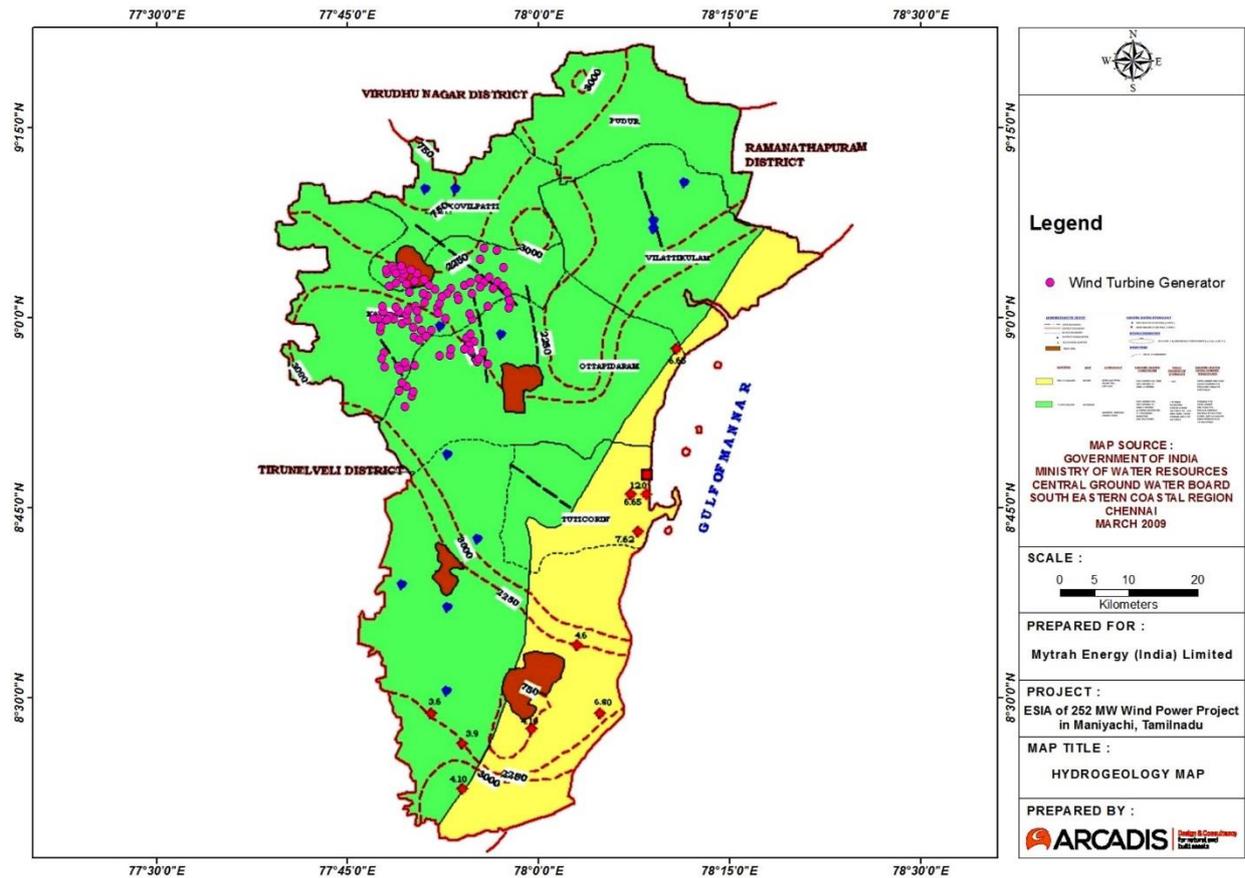
Figure 4-5: Drainage Map of the Study Area



4.6 Hydrogeology

As per CGWB report 2009, district has porous and fissured formations. Types of aquifer available in district are unconsolidated and weathered and fractured crystalline rocks. Sand stone and clays of recent to sub recent and tertiary age comprise the porous formation. The recent formation comprising mainly sands, clays and gravels and are confined to major drainage courses in the district. Ground water is in confined condition in these formations.

Figure 4-6:Hydrogeology Map of the Study Area



4.6.1 Ground Water Resources

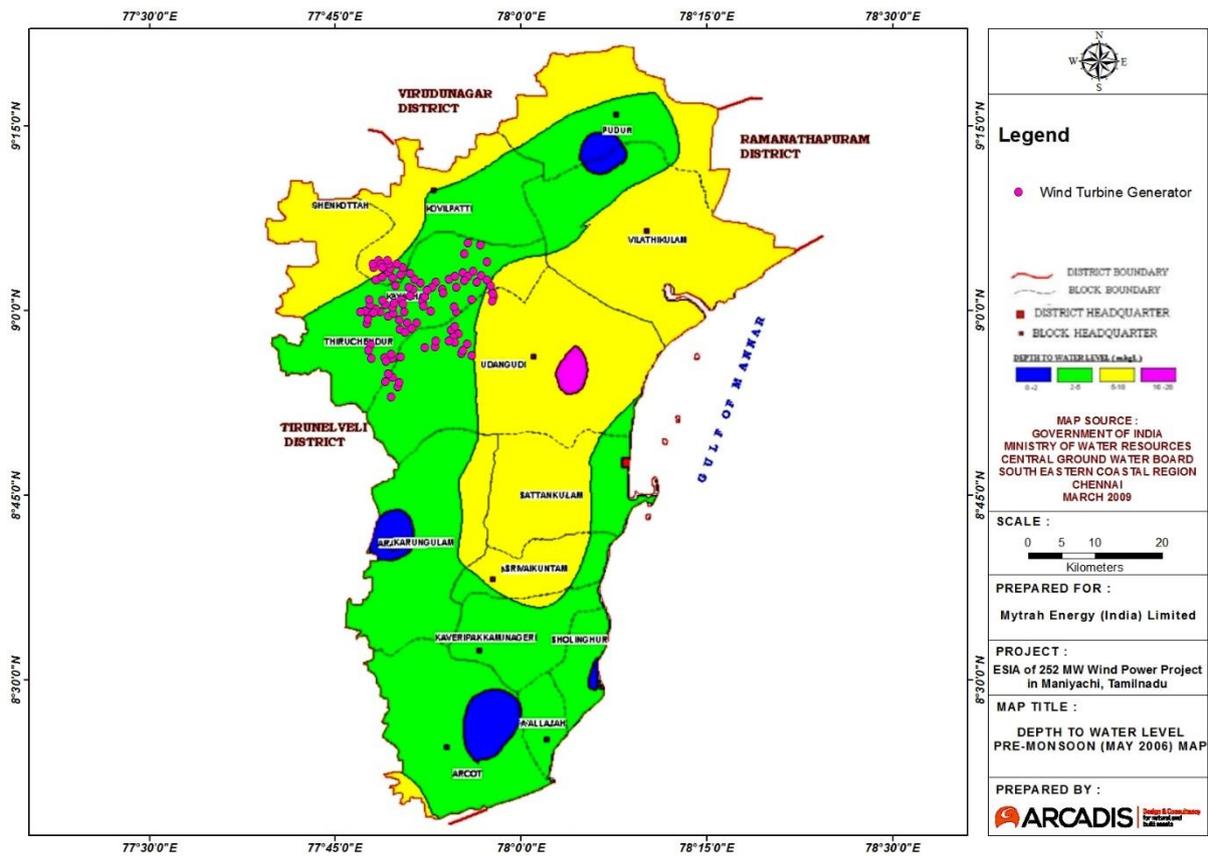
The district has been categorized by CGWB into four categories based on the estimation of ground water resources. The categories are over exploited, critical, semi critical and safe. Blocks where the project sites are located falls under over exploited category. Details of categorization is presented in the Table below:

Blocks	Category of Block
Kovilpatti	Over Exploited
Ottapidaram	Over Exploited
Alwarthirunagari	Safe
Karungulam	Semi Critical
Ettayapuram	Over Exploited
Sathankulam	Over Exploited
Srivaikundam	Safe
Tiruchendur	Semi Critical
Thoothukudi	Over Exploited
Udangudi	Over Exploited
Viltthikulam	Over Exploited

Overall ground water development of the district is 87%. Existing gross draft for all the uses in Kovilpatti and Ottapidaram blocks are 16.82 and 28.29 M. cu.m. Net ground water availability for future irrigation development in Kovilpatti and Ottapidaram blocks are Nil (-2.85) and Nil (-8.27) respectively.

Depth to water level map of pre-monsoon and post monsoon period and annual fluctuation of water level are prepared with data of CGWB. The water level map of the district of pre-monsoon 2006 (May) is as follows.

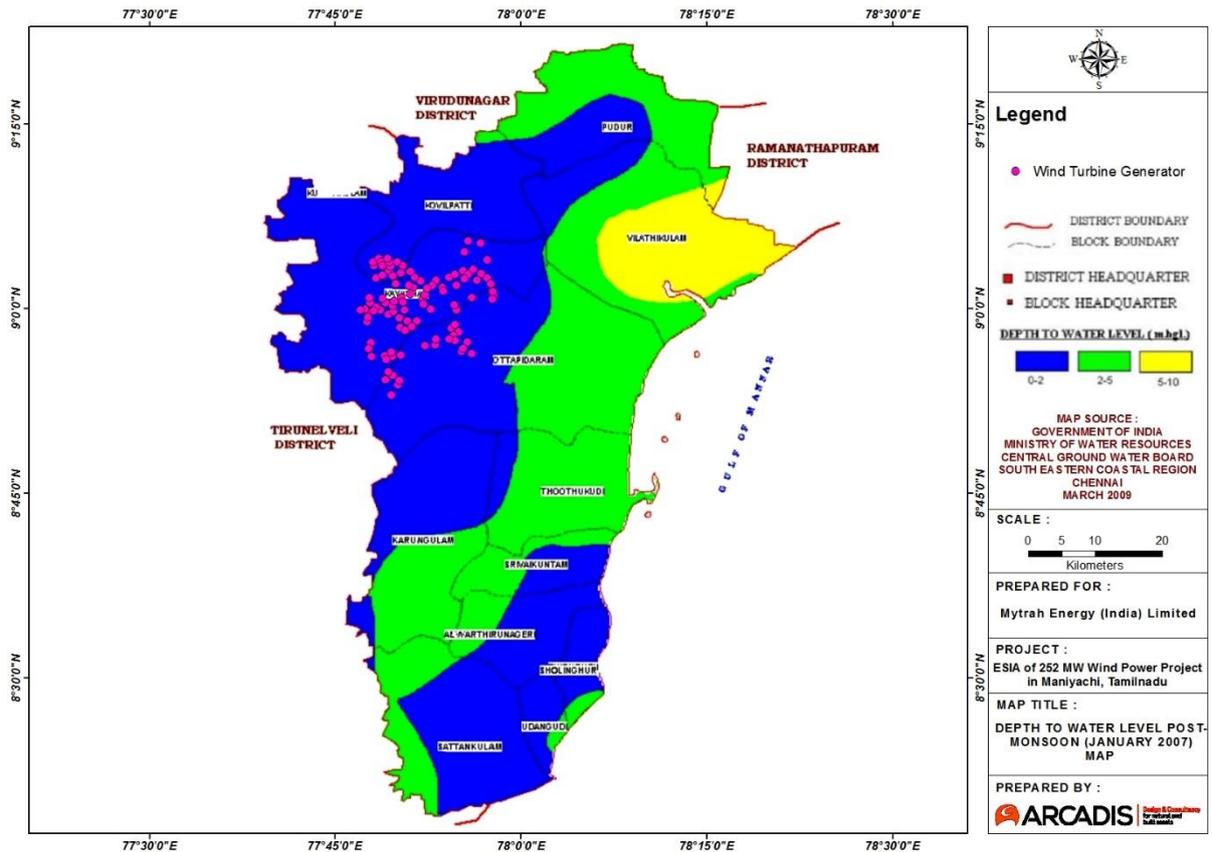
Figure 4-7: Pre- Monsoon Depth to Water Level Map for the Project Area



Source: Groundwater information booklet, CGWB, Thoothukudi district, 2009

Depth to Water Level : As per CGWB, the depth to water level in general varies from 2 mbgl to 5 mbgl in the area during the pre-monsoon period (May 2006) (Figure 4.8) and from 0 mbgl to 2 mbgl during the post-monsoon period (Jan 2007) as shown in **Figure 4-8**.

Figure 4-8: Post- Monsoon Depth to Water Level Map for the Project Area.



Source: Groundwater scenario of Thoothukudi district, CGWB, 2009

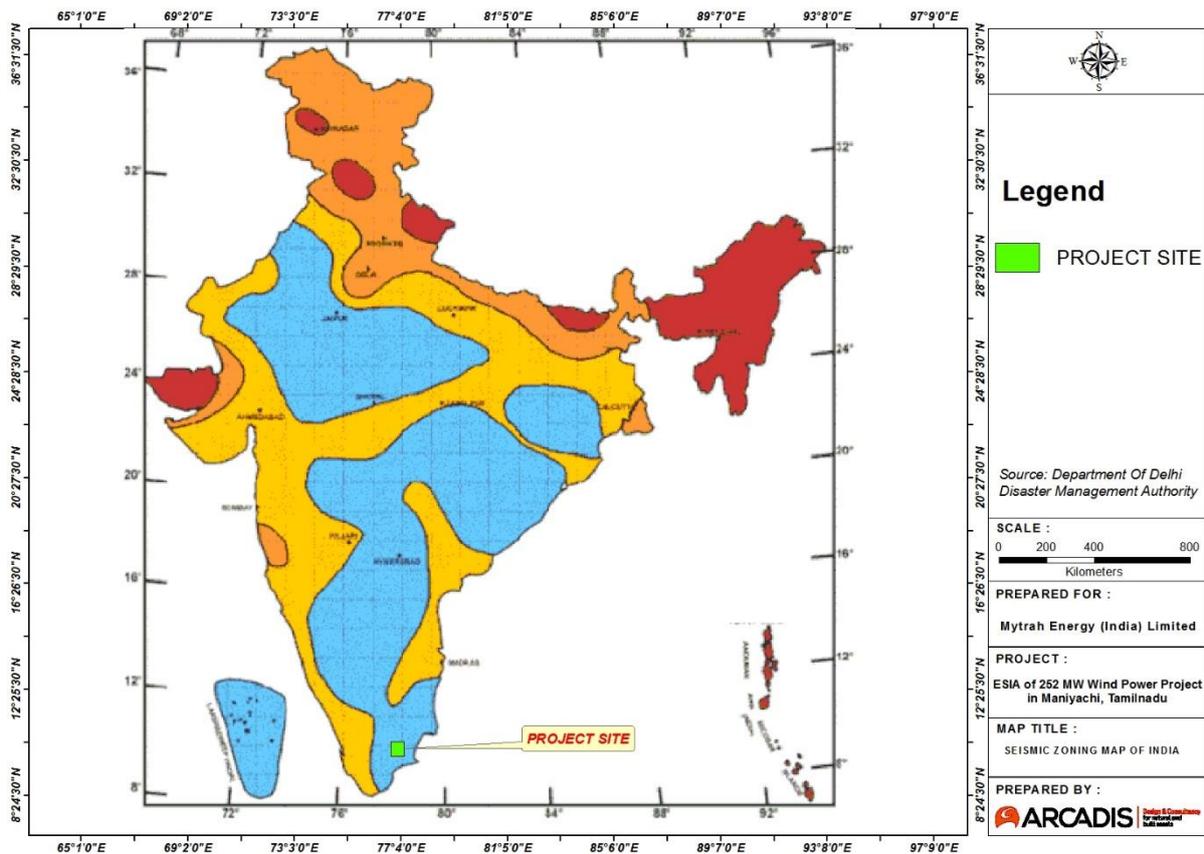
4.6.2 Groundwater Quality

The ground water in Thoothukudi District is in phreatic aquifers. Ground water is colorless, odorless and slightly alkaline. The electrical conductance of ground water in phreatic zone is found in the range of 280 μ S/cm - 12020 μ S/cm. As per CGWB study, 50 percent of samples collected from the district shows water is suitable for drinking and domestic use. With respect to concentration of electrical conductivity and sodium absorption ratio, it is observed by CGWB that ground water has potential to cause high to very high salinity hazard and medium to high alkali hazard, when used for irrigation.

4.7 Seismic Hazard

The proposed project is situated in **Zone II: Intensity VI (strong risk)** zone of getting affected due to earth quakes as per the Seismic Zones of India Map IS 1893 – 2002, BIS. WTGs shall be designed in such a way to withstand the earthquake.

Figure 4-9: Seismic Map



4.8 Flood

Thoothukudi district is prone to flood hazards. In year 2015, total 13,415 persons got evacuated from the district due to flood. Disaster management record shows that 22,520 houses were affected due to flood in year 2015. Disaster management plan of Thoothukudi district categorize flood as natural disaster.

4.9 Cyclone

Cyclone is another category of natural disaster which is prevailing in this district. According to the Vulnerability Atlas of India 2006, published by Building Materials and Technology Promotion Council (BMTPC), the Thoothukudi District is in moderate damage risk zone for winds and cyclone hazards. In the past 115 years, two to four cyclonic storms including severe cyclone storms have crossed one degree latitudes in this area. The probable maximum wind speed is 64 m/s in the area. Whereas, probable maximum storm surge varies between 6.0 m on the eastern coast of Kanyakumari to 4.5 m for the northern coast of Thoothukudi.

Name of the Taluk	Cyclone Prone Area
Toothukudi	Therespuram Inigo Nagar
Ottapidaram	Tharuvaikulam Pattinamaruthur
Tiruchendur	Punnakayal
Srivaigundam	Palayakayal

Source: Disaster Management Plan, Thoothukudi District

4.10 Tsunami

Coastline of Thoothukudi district is vulnerable to Tsunami hazard. Tsunami of December 2004 also affected this district. However, impact was less as compared to Kanyakumari. As per Disaster Management Plan, Thoothukudi District, Ottapidaram tehsil is one of the Tsunami affected tehsil. Pattanamaruthur and Tharuvaikulam are the revenue villages in Ottapidaram tehsil. These two villages were affected during Dec 2004 Tsunami accident. Number of population affected in Pattanamaruthur and Tharuvaikulam villages are 810 and 6050 respectively.

4.11 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.

4.11.1 Ambient Air Quality

Ambient air monitoring was carried out at three locations for 24 hours (8-hourly sampling for gaseous pollutants (CO) and 24-hourly sampling for particulate matter) with a frequency of twice per week. The monitoring was conducted for one week in the month of August 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 to north. The details of the monitoring locations are given below in **Table 4-4**.

Table 4-4: Ambient Air Monitoring Locations

Station Code	Villages
AQ1	Pannirkulam village
AQ2	Ottutanpatti village
AQ3	Lakshmipuram village

Concentrations of all the ambient air quality parameters (PM₁₀, PM_{2.5}, SO₂, NO_x and CO) at all three 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 (PM₁₀) monitored for the project site at three locations was found in the range of 33.51 to 42.35 µg/m³ i.e. well below the CPCB permissible limit of 100µg/m³. Concentration of Particulate Matter (PM_{2.5}) monitored was in the range of 20.14 to 24.16 µg/m³ i.e. below the CPCB permissible limit of 60 µg/m³. Sulphur dioxide and Nitrogen Oxide too were recorded well below the CPCB permissible limit of 80µg/m³. Carbon monoxide too was reported well below the permissible limit of 2mg/m³. The results have been shown in **Appendix H**

4.11.2 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. Pannirkulam village, Ottutanpatti village, Lakshmpuram village and Maniyachi 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, state highway 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 53.2 – 54.5 dB (A) and average night time noise level ranges between 42.5 – 44.4 dB (A). It is found that day time and night time noise levels are within the CPCB limits specified for Residential and commercial area as per **Noise Pollution (Regulation and Control) Rules, 2000**. The noise monitoring results have been shown in **Table 4-5**.

Table 4-5: 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	Pannirkulam village	Residential	53.2	55	42.5	45
N2	Ottutanpatti village	Residential	54.1	55	43.2	45
N3	Lakshmpuram village	Residential	53.6	55	42.8	45
N4	Maniyachi	Commercial	54.5	65	44.4	55

4.11.3 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 4-6**. The physiochemical results of surface water is provided in **Appendix I**

Table 4-6: Surface Water Monitoring Location Details

Station Code	Sampling Location	Current Use
SW-1	Paneerkulam Village (Pond)	Washing/Bathing
SW-2	River near Vadakarai village	Washing/Bathing

Two surface water locations were monitored for their physiochemical and bacteriological characteristics. The pH was observed in the range of 7.11 to 7.84. The surface water samples taken from Pannirkulam pond and River near Vadakarai village have Dissolved Oxygen (DO) levels as 5.2 and 4.2 mg/l respectively and Biological Oxygen demand (B.O.D) levels viz. 5.5 mg/l and 57 mg/l respectively. Moreover, the bacteriological examination of the surface water sample of Pannirkulam pond show Total Coliform 68 MPN/100ml and 3.12 x 10³ MPN/100ml was analyzed in River near Vadakarai village.

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.

4.11.4 Ground Water

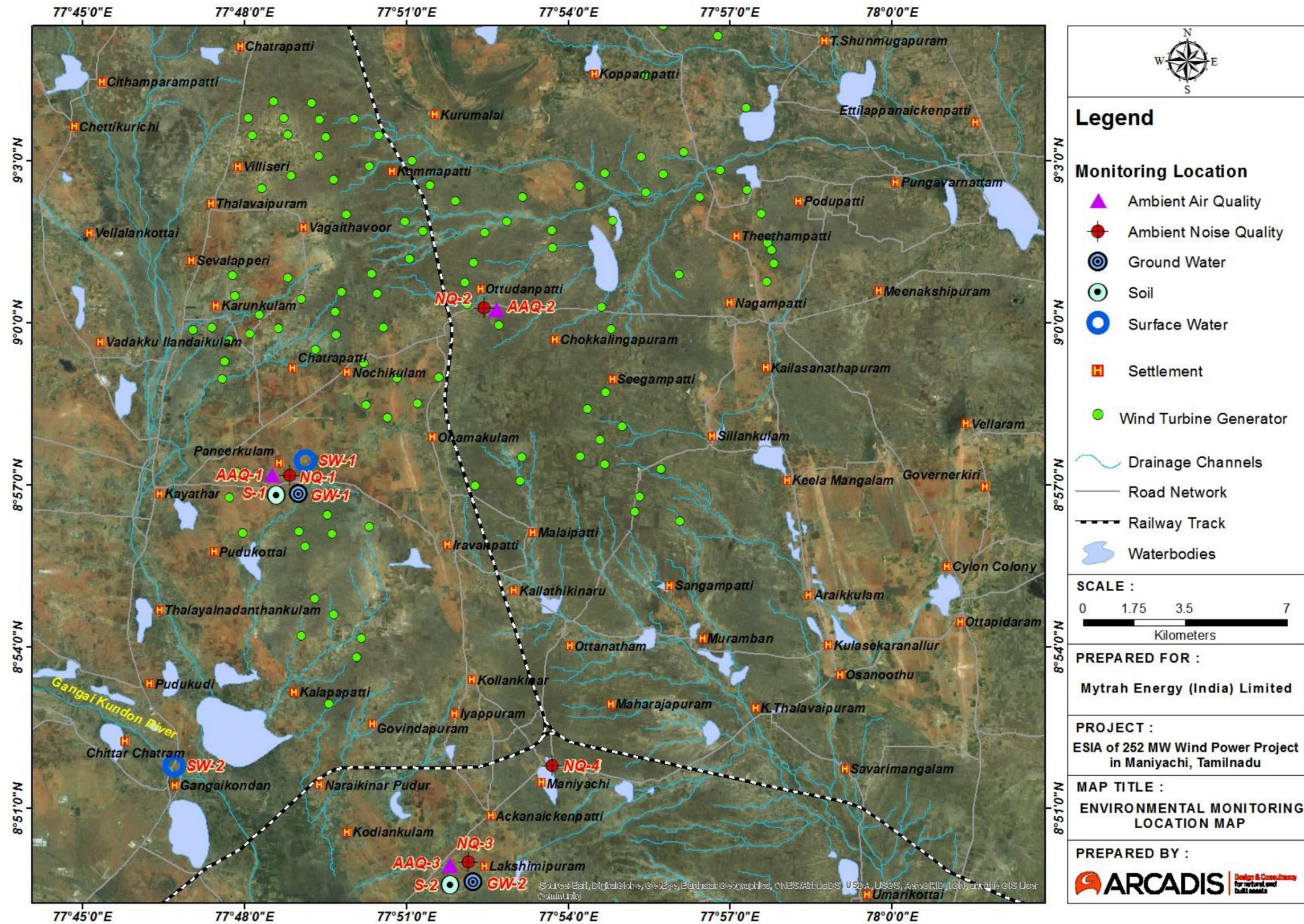
Results of physical & chemical analysis of ground water samples from two locations were studied to have an idea of the quality of ground water in the study area. Sampling stations are presented in the **Table 4-7** given below:

Table 4-7: Ground Water Monitoring Location Details

Station Code	Sampling Location	Source	Current Use
GW-1	Pannirkulam village	Borewell	Drinking
GW-2	Lakshmipuram village	Borewell	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 J**. Physio-chemical analysis of groundwater samples show pH i.e.7.26 to 7.74 in both locations respectively. Both groundwater samples collected from showed Total Dissolved Solids (TDS) (887 mg/l and 1568 mg/l respectively) i.e. above the BIS 10500 2012 acceptable limit of 500mg/l but within the permissible limit of 2000 mg/l. Total Hardness concentration in Pannirkulam village & Lakshmipuram village (412.0 mg/l & 980 mg/l respectively) was found below the permissible limit in Pannirkulam village and above the limit in Lakshmipuram village. Permissible limit of BIS 10500: 2012 is 600 mg/l. Fluoride concentration in Pannirkulam village and Lakshmipuram village was found to be 0.16 mg/l and 0.29 mg/l i.e. below the BIS acceptable limit. **Figure 4-10** shows the monitoring locations for ambient air, surface water, noise level and groundwater quality monitoring conducted.

Figure 4-10: Monitoring Location Map



4.12 Ecological Environment

Ecology & biodiversity study was carried out during middle of August 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, research papers/research articles etc) were collected and discussion with residents and forest officials of the area was also held to gather more information on the ecological sensitivity/critical habitats located in the project area. This information further enabled 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 and findings, impacts were predicted/assessed and subsequently mitigation measures were 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.

4.12.1 Methodologies for Ecological Surveys

Desktop Review

A desktop review was conducted to determine the land use and land cover (Toposheet, 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, existing critical habitats, scrubs/vegetative cover and waterbodies around the project area and other factors were searched/collected and selected for ecological survey in and around of such habitats.

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 middle of August 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 project area was recorded through undertaking primary baseline phytosociological analysis; and referring 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, assemblage of birds in the waterbodies during peak winter in India, pressure on the local natural resources, presence of any Schedule I species in the project area.

Flora Survey

No forest area falls within the project development area. Some patches of thorny prosopis juliflora and other shrubs were observed in the abandoned patta lands given to the landless farmers. Mostly the agricultural or culturable wastelands were procured for the development of wind turbines. Looking at the presence of scrubs/ephemeral (understory layer), the Floral survey, a total of 6 quadrats of 5 x 5 m were marked randomly in 6 locations within the project profile area. The main objective of the assessment was to qualitatively assess phytosociological scenario of the project area irrespective of type of the vegetation existed at that time.

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:

$$H = - \sum P_i \ln P_i$$

Where, H' = Shannon index of diversity

S= Number of individuals of one species

$$P_i = \frac{S}{N}$$

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 was carried out. Each WTG locations were visited to find out the presence of faunal species in and around the project site. The faunal survey focused mainly on three groups viz. mammals, avifauna and herpetofauna of the project area.

Exclusive for birds, Vantage point (VP) surveys was conducted at 10 locations covering the entire project profile including the transmission routes. The VP survey was undertaken in the early morning, and prior to the sunset to keep a record on the bird species. In general, the movement of birds are high in the early morning and before the sunset. The VP survey locations were selected after concluding the reconnaissance survey, upon the flight pattern of different birds, rich representation of bird species, conducive habitat of bird species and most importantly the potential to significant impact from collision etc. The VP location map is shown in **Figure 4-11** and map showing vegetational survey locations is shown in **Figure 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, formal discussion with forest department officials and information gathered from

senior residents of the villages were further used to gather information and support primary observations.

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 were 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 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.

Detailed Methodology- Line Transect Survey

Walkover Transect or Line Transect Method: This method involves recording varied 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 undertaken to record birds, 10m on both side of the transect line is considered as the survey area for each transect. A total of about 10 line transects (coordinates are presented in **Table No. 4-8**) 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 conducted survey: 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. 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 flying movement pattern within the core study area and identifying birds at collision risk were analysed. 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 was using the site.

During each session of study, two field observers were involved in collecting the data. At each vantage point survey was carried out for 140 mins.

Method of Data Collection: During each watch, two hierarchical recording methods were used to record data; (i) focal animal sampling for target species and (ii) activity summaries for secondary species.

These are as follows:

(i) Focal animal sampling- The area in view was scanned until a target species (flying in the collision risk zone) was detected at which point it was followed until it ceased flying or was lost from view. The time the target bird was detected and the flight duration were recorded.

(ii) Activity summaries - Each species survey was sub-divided into 5-minute periods, at the end of which the number and activity of that species was observed & recorded. Observation of target species had taken 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 provides an excellent and preferably an uninterrupted view of the study area. Being a huge project, the core study area is also vast, 10 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 land having little vegetation.

Table 4-8: Coordinates for Line Transect Survey

Line Transect	Latitude	Longitude
Line1	9° 2'46.75"N	77°49'26.28"E
Line2	9° 3'9.22"N	77°52'15.58"E
Line3	9° 2'0.43"N	77°51'43.09"E
Line4	9° 1'25.60"N	77°49'30.54"E
Line5	9° 1'31.62"N	77°48'17.95"E
Line6	9° 1'25.91"N	77°54'25.04"E
Line7	8°58'29.45"N	77°50'25.03"E
Line8	8°53'48.23"N	77°52'21.98"E
Line9	8°53'17.63"N	77°48'20.11"E
Line10	8°49'47.33"N	77°46'25.82"E

Figure 4-11: Vantage Point Location Map

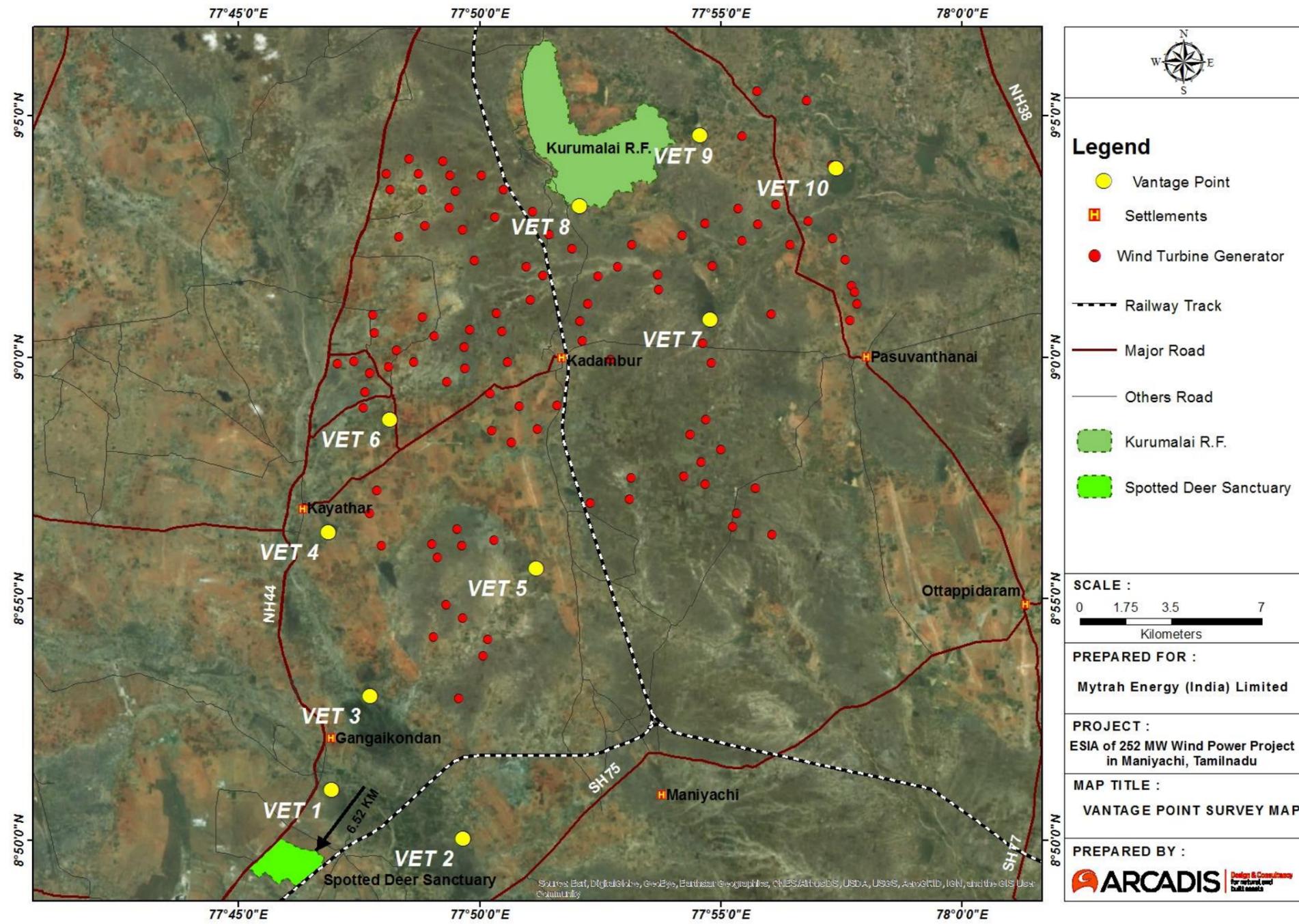
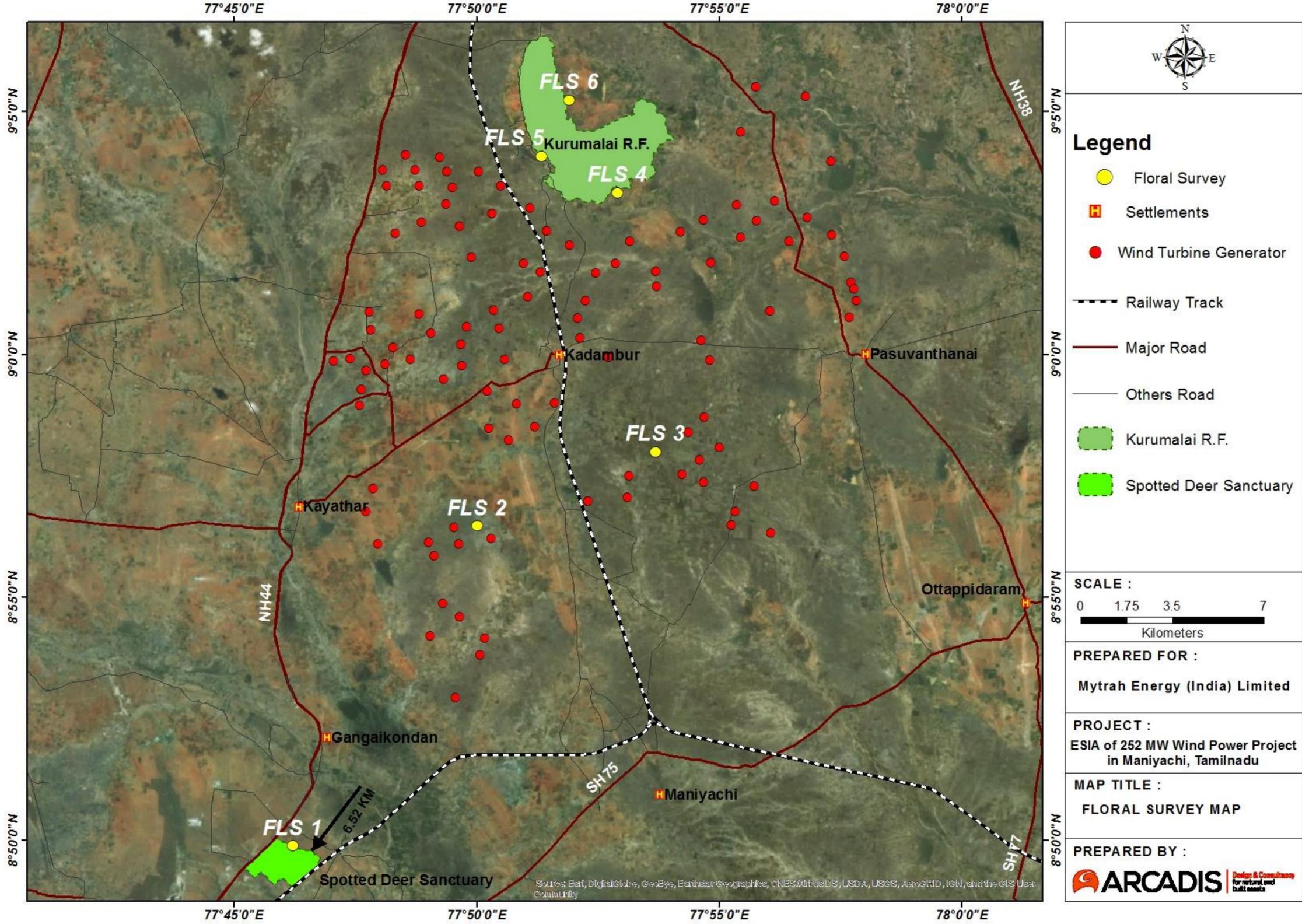


Figure 4-12: Map Showing Vegetational Survey Locations

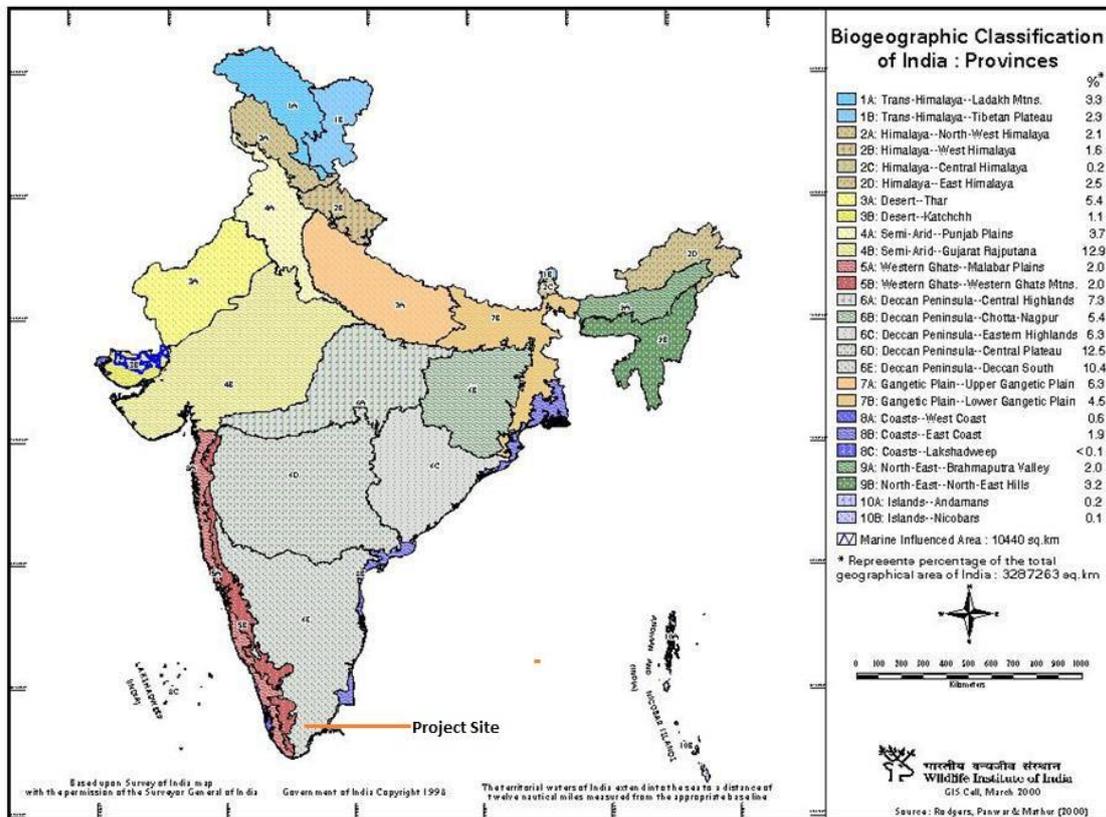


4.12.2 Habitat Survey

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 – 6E-Deccan Peninsula- Deccan South (**Figure 4-13**). 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 Critical¹¹ 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 4-13: Biogeographic Zones of India



¹¹ **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.

Types of Habitats in the Study Area

Scrub Land: This type of vegetation is extensively found in non-cultivated lands, particularly revenue lands/patta land located within the study area. These type of land gets grown by prosopis juliflora and local villagers make charcoal by burning the well grown logs of these plants.

Tall trees were generally found absent or sparsely distributed. Solid wood thorny trees like *Acacia nilotica*, *Prosopis juliflora*, *Morinda tinctoria*, *Commiphora berryi*, *Catunaregam spinosa*, *Azima tetracantha*, *Opuntia sp*, *Cassia auriculata* etc. were commonly observed in the natural scrublands. A plenty of *Borassus flabellifer* (palm tree) were observed along the bunds of the agricultural fields.

In general, type 6A/C2/DS1 – Southern Thorn Scrub forest as per Champion & Seth 1968 is found in the study area. These forests contain spare and stunted growth of species like *Acacia nilotica*, *Prosopis juliflora*, *Morinda tinctoria*, *Commiphora berryi*, *Catunaregam spinosa*, *Azima tetracantha*, *Opuntia sp*, *Cassia auriculata* and thorny bushes etc along with other ground cover represented by *Calotropis gigantea*, *Ziziphus sp*, *Croton bonplandianum*, *Capparis sepiaria*, *Cassia auriculata*.

Agricultural Field: Agricultural fields are mainly used for growing Ragi (finger millet), pulses, sesame, cotton, ladies finger, chilly, groundnut and curry leaves etc. Thorny bushes dominated by prosopis juliflora grow on its own in the abandoned agricultural filed/culturable wastes.

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

Floral Diversity

To estimate floral diversity, quadrat samplings were carried out at 6 locations where 6 quadrates were laid down of each of 5 x 5 sqm in size at each location. 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 4-9: Floral Diversity

Sampling Location	Shannon Diversity Index Value= H
Vegetational Survey Location-1	3.41
Vegetational Survey Location-2	3.02
Vegetational Survey Location-3	2.94
Vegetational Survey Location-4	3.71
Vegetational Survey Location-5	3.38
Vegetational Survey Location-6	3.16

The Shannon Diversity index (H) of the vegetations exist in the project profile area (assemblage of trees/shrubs and ephemerals) ranges from 2.94 to 3.71. The values were found highest around the Kurumalai Reserved Forest. Three locations were selected in and around the Kurumalai R.F. The floral diversity shows more than average values because of the presence of ground cover. Tree diversity was found to be poor and dominated by a few tree species such as *Morinda tinctoria*, *Acacia nilotica* and *Prosopis juliflora*. No RET (Rare, Endangered, Threatened) floral species was recorded from the vegetational survey.

The list of flora and phytosociological values are given in **Appendix R**.

Wildlife Habitat

The project will be developed in a “Modified Habitat” and in this connection dry agricultural lands/ or culturable wastes have been procured. As mentioned before, typical thorny vegetation grows on its own in the abandoned agricultural lands/patta lands providing a habitat of nesting and perching to some of the resident birds. Small reptiles also find a suitable habitat in those places. There are two wild life sanctuaries i.e. Vallanadu and Gangaikondan Spotted Deer Sanctuary existed in the area. Vallanadu Sanctuary and Gangaikondan sanctuary are located at 17 km and 8.6 km respectively from the nearest WTG MAN 126. As per the Wildlife Act 1972, project falls under Eco sensitive zone (ESZ) (by default 10 km). However, renewable energy projects are considered as permitted category and recommended to be promoted, even within the ESZ area. Koothankulam Bird Sanctuary is located at 70 km from the project area.

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

Vallanadu Wildlife Sanctuary

Vallanadu Wildlife Sanctuary is created for the protection of blackbucks. Located on an isolated hillock in Vallanadu Village of Srivaikundam Taluk, it is the southernmost place in India where a natural population of blackbuck exists. The wildlife sanctuary covers about 16.41 square kilometres of area. Other than blackbucks, this sanctuary is the home of various wild animals and birds. The forest with its wildlife attract thousands of tourists every year.

Both evergreen and deciduous trees can be found in this sanctuary. Due to drought like conditions and excessive heat plant growth is stunted here. The waxy leaves of the plants help to retain moisture in the plants.

Consultation with one of the senior forest officials has revealed that a revised ESZ boundary of Vallanadu Wildlife Sanctuary (from 0 meter to 2.5 km radius of the Wildlife Sanctuary boundary at various sides) has been submitted in the office of PCCF for necessary acceptance and approval. Once it gets approved at department level, the proposal will be forwarded to the state for further necessary action. The final approval will be made from Ministry of Environment, Forest and Climate Change (MOEFCC), New Delhi. As on date, default 10 km radius from the Wildlife sanctuary boundary is considered as the ESZ area of this sanctuary.



Vallanadu WLS Eastern Boundary- Fenced



Eastern Boundary of WLS along the NH-7A



Surrounding Features

Vegetation of this sanctuary is *Acacia planifrons* and *Euphorbia antiquorum* and in some cases, *Commiphora berryi* dominated the sites. The VBS however had complex mixed vegetation types, very dense scrub in most places where one can hardly enter while hill tops had some tall trees with dense undergrowth and open areas had some grasses. Overall in past studies, it has been recorded more than 350 species of plants which belonged to 70 families. The dominant species were *Acacia horrida* tree, *Ziziphus oenoplia* a straggling shrub and *Pavonia odorata* an undershrub. *Caralluma bhupinderiana* of *Asclepiadaceae* was recently discovered from VBS. Species such as *Euphorbia balakrishnani*, *Crotalaria globosa* and *Dalbergia coromandeliana* which are endemic to Tamil Nadu are found here. More than 15 exotic species have been detected in past studies, of which *Parthenium hysterophorus*, *Acanthospermum hispidum* and *Ageratum conyzoides* were common. Interestingly *Typha angusta*, a wetland plant is found in small stream at southwest side of the sanctuary. Nearly 30% of the VBS is planted with thorny tree *Acacia mellifera*.

Flora: The sanctuary is a South Deccan Plateau dry deciduous forest. The thorny hardwood and xerophytes: *Dalbergia horrida* (see *Dalbergia*), *Dichrostachys cinerea*, *Vachellia horrida*, *Acacia planifrons*, *Albizia amara*, *Zizyphus* sp. and a few *Azadirachta indica*, *Dodonia viscosa*, *Carissa carandas*, *Pterolobium hexapetalum*, *Euphorbia*, *Acalypha fruticosa* and *Ocimum tenuiflorum* form the undergrowth.

Fauna: Blackbuck, spotted deer, macaque, jungle cat, monkey, wild cat, hedgehog, pangolin mongoose, black naped hare, scaly anteater, viper and rattle snake live here.

Avifauna: Nightjar, Peafowl, heron, stork, grey partridges, jungle crow, common quails, pied crested cuckoo, crested-hawk eagle, black-winged kite, curlew, lapwing, nightjar, sparrows, horned owl, and nearly 100 other species of birds are found in the area

Gangaikondan Spotted Deer Sanctuary

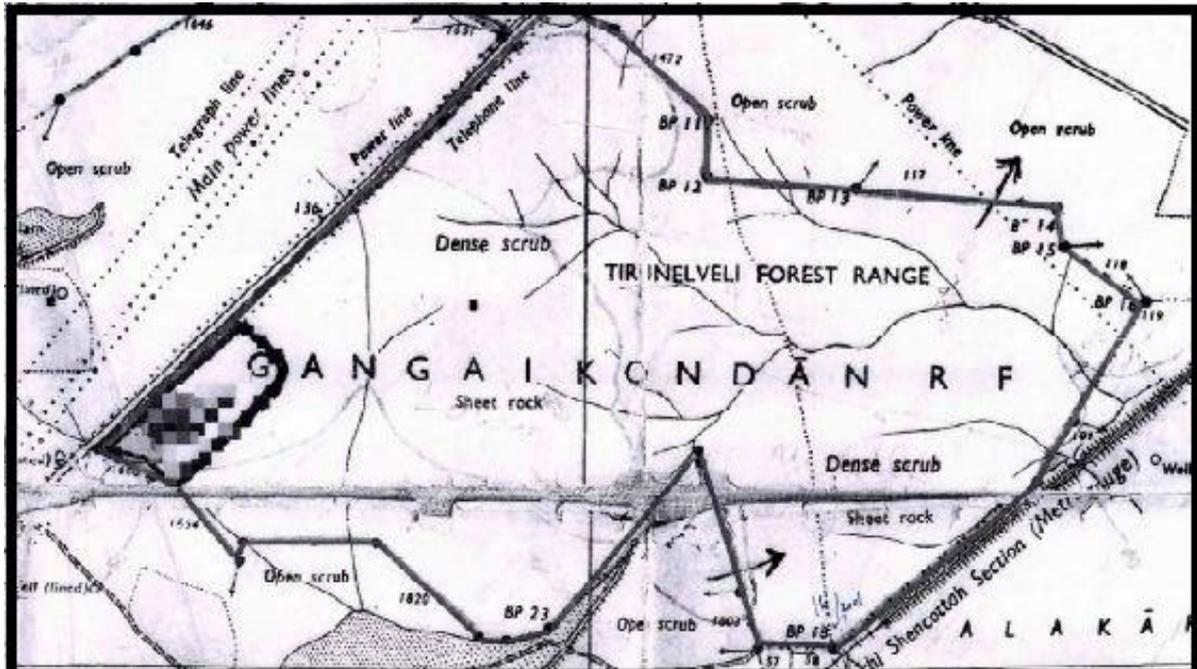
Going back to history, Tirunelveli Wildlife Preservation Association during the year 1976 had taken an initiative to form 'Deer Park' on a leased forest land of 500 acres in Gangaikondan Village in Tirunelveli Division vide G.O.Ms.No.406, Forests and Fisheries Department dated: 11.05.1976. And later, Tamil Nadu government had declared as a Spotted Deer Wildlife Sanctuary in October 2013.

The entire area is a dry and the predominant species observed in the area are *Prosopis juliflora*, *Acacia* species of *A. leucocephala* and *A. nilotica*. The other species such as *Borassus flabelifer*, *Carissa carandas*, *Leucaena leucocephala*, *Catunaregam spinoa*, *Zizyphus oenoplia* and *Jatropha glandulifera* also exist in this Reserved Forest area. The boundary of this deer sanctuary is well fenced and the wildlife.

Regarding ESZ of Gangaikondan Spotted Deer Sanctuary, we had discussed at length with one of the Range Officers in Tirunelveli. It was learnt that, a revised ESZ boundary of Vallanadu Wildlife Sanctuary has been submitted in the office of PCCF for necessary acceptance and approval. Once it gets approved at department level, the proposal will be forwarded to the state for further necessary action. The final approval will be made from Ministry of Environment, Forest and Climate Change (MOEFCC), New Delhi. As on date, default 10 km radius from this Wildlife sanctuary boundary is considered to be as the ESZ area.

Consultation with locals and forest department official revealed that, common mongoose, Indian palm squirrel, Indian hare, spotted deer are reportedly found in this sanctuary.

Figure 4-14: Boundary Map of Gongaikondan Spotted Deer Sanctuary



Gangaikondan Spotted Deer Sanctuary



Tirunelveli-Madurai Highway Pass Through Along the North-Western Boundary

Table 4-10: List of Plants Recorded in Gangaikondan Spotted Deer Sanctuary

S.No	Name	Family
	Herbs	
1.	<i>Capparis zeylanica</i>	Capparaceae
2.	<i>Cissus quandrangulais</i>	Vitaceae
3.	<i>Hemidesmus indicus</i>	Periplocaceae
4.	<i>Tylophora indica</i>	Asclepiadaceae
5.	<i>Achyranthes aspera</i>	Amaranthaceae
6.	<i>Aerva javanica</i>	Amaranthaceae
7.	<i>Ageratum conyzoides</i>	Asteraceae
8.	<i>Aloe vera</i>	Liliaceae
9.	<i>Aristida setacea</i>	Poaceae
10.	<i>Argyreia nervosa</i>	Convolvulaceae
11.	<i>Barleria prionitis</i>	Acanthaceae
12.	<i>Boerhaavia diffusa</i>	Nyctaginaceae
13.	<i>Chloris barbata</i>	Poaceae
14.	<i>Cynodon dactylon</i>	Poaceae
15.	<i>Euphorbia resinifera</i>	Euphorbiaceae
16.	<i>Lepidagathis cristata</i>	Acanthaceae
17.	<i>Rostellularia prostrata</i>	Acanthaceae
18.	<i>Themeda triandra (kangaroo grass)</i>	Poaceae
19.	<i>Vernnonia cinerea</i>	Asteraceae
	Shrubs	
20.	<i>Canthium parviflorum</i>	Rubiaceae
21.	<i>Catunaregam spinoa</i>	Rubiaceae
22.	<i>Dodonea viscosa</i>	Sapindaceae
23.	<i>Jatropha glandulifera</i>	Euphorbiaceae
24.	<i>Phyllanthus reticulatus</i>	Euphorbiaceae
	Trees	
25.	<i>Acacia leucocepholea</i>	Mimosaceae
26.	<i>Acacia nilotica</i>	Mimosaceae
27.	<i>Borassus flabelifer</i>	Arecaceae
28.	<i>Carissa carandus</i>	Apocynaceae

S.No	Name	Family
29.	<i>Leucaena leucocephala</i>	Mimosaceae
30.	<i>Prosopis juliflora</i>	Mimosaceae

Table 4-11: List of Fauna Recorded in Gangaikondan Spotted Deer Sanctuary

S.No	Common Name	Scientific name	WLPA, 1972
Mammals			
1.	Indian Grey Mongoose	<i>Herpestes edwardsii</i>	Schedule II
2.	Indian Palm squirrel	<i>Funambus palmarum</i>	Schedule IV
3.	Rabbit	<i>Lepus nigricollis</i>	Schedule IV
4.	Spotted Deer	<i>Axis axix</i>	Schedule III
5.	Black Drongo	<i>Dicrurus macrocercus</i>	Schedule IV
6.	Common Babbler	<i>Turdoides caudatus</i>	Schedule IV
7.	Common Crow	<i>Corvus splendens</i>	Schedule V
8.	Common Myna	<i>Acridotheres tristis</i>	Schedule IV
9.	Greater Coucal	<i>Centropus sinensis</i>	Schedule IV
10.	House Sparrow	<i>Passer domesticus</i>	Schedule IV
11.	Indian Peafowl	<i>Pavo cristatus</i>	Schedule-I
12.	Indian Robin	<i>Saxicoloides fulicata</i>	Schedule IV
13.	Purple Sunbird	<i>Cinnyris asiaticus</i>	Schedule-IV
14.	Red-vented Bulbul	<i>Pycnonotus cafer</i>	Schedule IV
15.	Red-wattled Lapwing	<i>Vanellus indicus</i>	Schedule IV
16.	Spotted Dove	<i>Streptopelia chinensis</i>	Schedule IV
Reptiles			
17.	Common skink	<i>Mabuya carinata</i>	-
18.	Dhaman /Rat snake	<i>Ptyas mucosa</i>	Schedule II
19.	Garden calotes	<i>Calotes versicolor</i>	-
Insects-Butterflies			

S.No	Common Name	Scientific name	WLPA, 1972
20.	Blue tiger	<i>Tirumala limniacae</i>	-
21.	Common emigrant	<i>Catopsilia pomona</i>	-
22.	Common grass yellow	<i>Eurema hecabe</i>	
23.	Common tiger	<i>Danaus genutia</i>	
24.	Common grass dart	<i>Taractrocera maevius</i>	-
25.	Common jezebel	<i>Delias eucharis</i>	-
26.	Common mormon	<i>Papilio polytes</i>	-
27.	Common sailor	<i>Neptis hylas</i>	-
28.	Dark grass blue	<i>Zizeera knysna</i>	-
29.	Indian cabbage white	<i>Pieris canidae</i>	-
30.	Lemon pansy	<i>Junonia lemonias</i>	-
Insect-Odonates (dragon flies)			
31.	Common Club tail -	<i>Ictinogomphus rapax</i>	-
32.	Green Marsh Hawk	<i>Orthetrum sabina</i>	-
33.	Ground Skimmer	<i>Diplacodes trivialis</i>	-

Koonthankulam Bird Sanctuary

Koonthankulam Bird Sanctuary or Kunthankulam is a 1.2933 km² “Protected Area” declared as a sanctuary in 1994. It adjoins the tiny village of Koonthankulam in Nanguneri Taluk of Tirunelveli district, Tamil Nadu. It is also known as an “Important Bird Area (IBA)”.

This sanctuary is actively protected and managed by the Koonthankulam village community. The local people take a keen interest in protecting this sanctuary. Birds coming to villagers' backyards are protected vehemently and regarded as harbingers of luck. The excreta of birds and silt from the tanks is collected by villagers in summer and applied as fertilizer to their fields. All villagers protect the birds, their nests and fledglings. Fallen chicks are taken care of in the rescue centre till they can fly on their own. Anyone disturbing the nests are punished by shaving their head, or making a public procession on a donkey. The Indian festival Diwali is not celebrated here because the sound of crackers would drive away the winged visitors. An interpretation centre, watch tower, children's park and dormitory are open for public use throughout the year.

It has been reported that more than 43 species of resident and migratory water birds visit here every year. More than 100,000 migratory birds start coming by December and fly away to their northern homes by June or July after they lay and hatch eggs and the young ones mature enough to fly with the older ones.

Migratory birds such as Bar-headed goose, Common sandpiper, Common teal, Coot, Green sandpiper and Pintail from Siberia region; Greater flamingo from northern part of India and White stork from Central Asia visit this sanctuary during peak season.

The team has visited this sanctuary during mid-week of August and the tank was found dry. Dialogue with locals it was learnt that water gets filled up from the rain water during return monsoon northeast monsoon- from October to December) and by the local irrigation department.



Koonthamkulam Bird Sanctuary as Seen During August 2017



Surrounding Features

Several species of birds have been observed breeding in Koonthamkulam during past studies. Among them Painted Stork was the predominant species. This is the largest reserve for breeding water birds in South India. Migratory birds start coming by December end and fly away to their northern homes by June or July after they lay eggs, hatch them and the young ones grow old enough to fly with the older ones. About 43 species of birds visit this calm but congenial village for breeding. The birds called Painted strokes are coming from North India and East European Countries to this place. Similarly the flamingoes which flew in mainly from the Rann of Kutch have hatched and reared their young ones in the village. More than 100,000 migratory birds start coming by December and fly away to their northern homes by June or July after they lay and hatch eggs and the young ones mature enough to fly with the older ones. The birds like painted stokes, pondheron, Bar-headed Goose, Common Sandpiper, Common Teal, Green Sandpiper are noticed. The migratory birds from other countries visiting the place include bar-headed goose, Siberia, Common sandpiper, Siberia Common teal, Siberia Coot, central Siberia Green sandpiper, Siberia Greater flamingo, northern India pintail, Siberia White stork;

In this Bird Sanctuary, most of the nests were found on *Acacia nilotica* and *Barringtonia acutangula*. In Koonthamkulam, Painted Stork, Little Egret, Intermediate Egret, arid Indian Pond Heron preferred *Prosopis Juliflora*, while Indian Cormorant, Spot-billed Pelican and Darter used *Acacia nilotica*. Many of the birds breeding, preferred *Acacia niloflea*. Totally 1583 nests belonging to five families, namely Aideldoe, Pelecanidae, Cionilidae, Phalacrocoracidae and Threskiarhithidae were followed for assessing breeding success in past studies. In Vedanthangal, Black-headed Ibis and Spot-billed Pelican showed the highest breeding success (100%) during 2007-08, while the same species had the least success (58.5%) during 2009-10. In Koonthamkulam, Spot-billed Pelican and Painted Stork had the highest success rate, while Intermediate Egret had the least. Among the species of birds studied in this Bird Sanctuary, Little Cormorant was the most successful breeder. Oriental White Ibis is the most common nesting species among them, and its most established heronry is Koonthamkulam. The Black

Ibis seems to prefer the southern districts for nesting. Nests of birds such as the Darter, Asian Open bill Stork and Oriental White Ibis have also been found.

Among the international migratory birds, no endangered species were observed as per IUCN Red data book. However, among the local species, following four (4) species were identified as near threatened or critically endangered:

- Grey or Spottedbilled Pelican
- Spoonbill
- Darter or Snake Bird
- Painted Stork

Faunal Diversity

Mammals: Mammalian species like Indian common Mongoose (*Herpestes edwardsii*), squirrel (*Funambulus palmarum*) and Indian hare (*Lepus nigricollis*) were directly sighted from the study area. The scrubs in general found to be suitable habitats for Indian Jackal and wild boar. Existing of such mammalian species in those scrub jungles/thorny vegetative area were ruled out by the villagers during consultation.

Herpetofauna: Species like common garden lizard (*Calotes versicolor*), Spotted house gecko (*Hemidactylus macalatus*), keeled grass skink (*Mabuya carinata*) and a dead Rat snake (may have killed by local farmers) were sighted during the primary survey. A list of faunal species observed/ reported from the study area is given in table below.

Table 4-12: List of Faunal Species Recorded or Reported in the Study Area

S.N.	English Name	Scientific Name	Occurrence	WPA Schedule/ IUCN Status ¹²	Reported or Recorded
1	Common Mongoose	<i>Herpestes edwardsii</i>	Frequent	II/LC	Recorded
2	Striped Squirrel	<i>Funambulus palmarum</i>	Common	IV/LC	Recorded
3	Indian Hare	<i>Lepus nigricollis</i>	Common	IV/LC	Recorded
4	Garden Lizard	<i>Calotes versicolor</i>	Common	IV/LC	Recorded
5	Spotted house gecko	<i>Hemidactylus macalatus</i>	Common	IV/LC	Recorded
6	Keeled grass skink	<i>Mabuya carinata</i>	Common	IV/LC	Recorded
7	Indian rat Snake	<i>Ptyas mucosa</i>	Common	II/Not yet been assessed	Recorded

Avifauna: During primary survey 58 bird species were identified and recorded from the project profile area. Out of these 58 birds, 4 bird species belong to Schedule-I category and three were raptors. Out of these three raptors, Montagu’s harrier is a migratory bird, while Oriental honey buzzard is widespread in its distribution. The third raptor Brahminy kite was found frequently in the project profile area. All these raptors were found flying above 30-100 meters from above the ground. The rest of the birds found flying about 20-25 meters above the ground. As far as this project is concerned, in terms of the wind turbine model (considering the hub height and blade length) , birds fly above 60m from the ground can

¹² Vulnerable; NT-Near Threatened, LC-Least Concern (IUCN Ver. 3.1), Schedule – I, IV, V (Indian Wildlife Protection Act -1972)

be considered vulnerable to get hit by the wind turbines because of flying within the “Probable Collision Risk Zone” of a WTG.

Available Bird and Bat species in Tirunelveli and Thoothukudi District

As per the published literature titled, “Conserve Bats in the International year of Bats in India” by Dr. J. Tagore Derose, it is recorded that Nineteen bat species (3 species of frugivorous bats, 16 species of insectivorous bats) belonging to seven families are available in this area. Three genus of the megachiropteran family *Pteropodidae* *Rousettus*, *Pteropus* and *Cynopterus* are very common in their distribution. Among the microchiropteran genus, the members of *Megadermatidae* (one species), *Emballonuridae* (three species), *Rhinopomatidae* (one species), *Hipposideridae* (Three species) and *Molossidae* (one species) are distributed. The genus of the Vespertilionidae family has the maximum of seven species representation with wider distribution.

Further, as per an Environmental Impact Assessment study for a proposed coal based power plant in the same Taluk, the following avifauna has been recorded/observed.

Sr. No	Technical Name	Common Name	Wild Life Conservation Status as per Wild Life Protection Act-1972
1	<i>Phalacrocorax niger</i>	Little cormorant	Schedule-IV
2	<i>Ardea purpurea manilensis</i>	Eastern Purple heron	Schedule-IV
3	<i>Ncticorax nycticorax</i>	Night heron	Schedule-IV
4	<i>Ardea grayii grayii</i>	Paddy Bird	Schedule-IV
5	<i>Egretta garzetta</i>	Little Egret	Schedule-IV
6	<i>Bubulcus ibis</i>	Cattle Egret	Schedule-IV
7	<i>Haliastur Indus</i>	Brahmy Kite	Schedule-IV
8	<i>Milvus migrans</i>	Pariah Kite	Schedule-IV
9	<i>Eudynamis scolopaceus</i>	Koel	Schedule-IV
10	<i>Coracias benghalensis indica</i>	Southern Indian roller	Schedule-IV
11	<i>Acridotheres tristis tristis</i>	Common myna	Schedule-IV
12	<i>Corvus splendens portogatus</i>	Ceylon house crow	Schedule-IV
13	<i>Passer domesticus indicus</i>	Indian House sparrow	Schedule-IV
14	<i>Orthotomus sutorius</i>	Tailor bird	Schedule-IV
15	<i>Aythya ferina</i>	Common pochard	Schedule-IV
16	<i>Nettapus cormanadalincicus</i>	common teal	Schedule-IV
17	<i>Peridu asiatica</i>	Jungle bush quail	Schedule-IV
18	<i>Burhinus oediceuenus</i>	Satone Curlew	Schedule-IV
19	<i>Streptopelia chinensis</i>	Spotted dove	Schedule-IV
20	<i>Psittacula cyanocephala</i>	Parakeet	Schedule-IV
21	<i>Contropus sinensis</i>	Crow Pheasant	Schedule-IV
22	<i>Passer domesticus</i>	House Sparrow	Schedule-IV

Table 4-13: List of Avian Species Recorded in the Study Area

S.No.	Common Name	Scientific Name	IUCN status	Schedule- I	Schedule-IV	Sighting of occurrence in study area
1.	Ashy crowned Sparrow Lark	<i>Eremopterix griseus</i>	LC		IV	Frequent
2.	Asian Palm swift	<i>Athene brama</i>	LC		IV	Frequent
3.	Barn Swallow	<i>Hirundo rustica</i>	LC	Not Yet Scheduled		Frequent
4.	Baya Weaver	<i>Ploceus philippinus</i>	LC		IV	Rare
5.	Black Drongo	<i>Dicrurus macrocercus</i>	LC		IV	Frequent
6.	Black Winged Stilt	<i>Himantopus himantopus</i>	LC		IV	Confined to water bodies
7.	Blue Rock Pigeon	<i>Columba livia</i>	LC		IV	Frequent
8.	Brahminy Kite	<i>Haliastur indus</i>	LC	I		Frequent
9.	Brahminy Starling	<i>Sturnus pagodarum</i>	LC		IV	Frequent
10.	Cattle Egret	<i>Bubulcus ibis</i>	LC		IV	Frequent
11.	Chestnut headed bee eater	<i>Merops leschenaulti</i>	LC		IV	Rare
12.	Common Babbler	<i>Turdoides caudata</i>	LC		IV	Frequent
13.	Common Hoopoe	<i>Upupa epops</i>	LC		IV	Rare
14.	Common Iora	<i>Aegithina tiphia</i>	LC		IV	Rare
15.	Common Myna	<i>Acridotheres tristis</i>	LC		IV	Frequent
16.	Common peafowl	<i>Pavo cristatus</i>	LC	I		Frequent
17.	Common Sandpiper	<i>Actitis hypoleucos</i>	LC		IV	Confined to water bodies
18.	Common Tailorbird	<i>Orthotomus sutorius</i>	LC		IV	Frequent
19.	Common Wood shrike	<i>Tephrodornis pondicerianus</i>	LC		IV	Frequent
20.	Crested Lark	<i>Galerida cristata</i>	LC		IV	Frequent
21.	Eurasian collared dove	<i>Streptopelia decaocto</i>	LC		IV	Frequent
22.	Golden backed Woodpecker	<i>Dinopium benghalense</i>	LC		IV	In Wooded areas
23.	Great Egret	<i>Ardea alba</i>	LC		IV	Frequent
24.	Green bee eater	<i>Merops orientalis</i>	LC	Not Yet Scheduled		Frequent

S.No.	Common Name	Scientific Name	IUCN status	Schedule- I	Schedule-IV	Sighting of occurrence in study area
25.	Grey Francolin	<i>Francolinus pondicerianus</i>	LC		IV	Undisturbed and dense ground cover area
26.	Grey Shrike	<i>Lanius excubitor</i>	LC		IV	Frequent
27.	House crow	<i>Corvus splendens</i>	LC		IV	Frequent
28.	House sparrow	<i>Passer domesticus</i>	LC		IV	Frequent
29.	Indian Robin	<i>Saxicoloides fulicatus</i>	LC		IV	Frequent
30.	Indian Roller	<i>Coracias benghalensis</i>	LC		IV	Frequent
31.	Indian Silverbill	<i>Lonchura malabarica</i>	LC		IV	Frequent
32.	Intermediate Egret	<i>Ardea intermedia</i>	LC		IV	Frequent
33.	jungle babbler	<i>Turdoides striata</i>	LC		IV	Frequent
34.	Jungle crow	<i>Corvus levaillantii</i>	LC		IV	Frequent
35.	Large Grey Babbler	<i>Turdoides malcolmi</i>	LC		IV	Frequent
36.	Laughing dove	<i>Spilopelia senegalensis</i>	LC		IV	Frequent
37.	Little Cormorant	<i>Microcarbo niger</i>	LC		IV	Frequent
38.	Little Egret	<i>Egretta garzetta</i>	LC		IV	Frequent
39.	Montagu's Harrier	<i>Circus pygargus</i>	LC	I		Rare
40.	Oriental Honey Buzzard	<i>Pernis ptilorhynchus</i>	LC	I		Rare
41.	Paddyfield pipit	<i>Anthus rufulus</i>	LC		IV	Frequent
42.	Painted Stork	<i>Mycteria leucocephala</i>	NT		IV	Confined to waterbodies
43.	Pied Bushchat	<i>Saxicola caprata</i>	LC		IV	Frequent
44.	Pied wagtail	<i>Motacilla alba</i>	LC		IV	Frequent
45.	Pond Heron	<i>Ardeola grayii</i>	LC		IV	Frequent
46.	Purple Sunbird	<i>Nectarinia asiatica</i>	LC		IV	Frequent
47.	Red Naped Ibis	<i>Pseudibis papillosa</i>	LC		IV	Frequent
48.	Red Rumped Swallow	<i>Hirundo daurica</i>	LC	Not Yet Scheduled		Frequent

S.No.	Common Name	Scientific Name	IUCN status	Schedule- I	Schedule-IV	Sighting of occurrence in study area
49.	Red Vented Bulbul	<i>Pycnonotus cafer</i>	LC		IV	Frequent
50.	Red Wattled Lapwing	<i>Vanellus indicus</i>	LC		IV	Frequent
51.	Rose Ringed parakeet	<i>Psittacula krameri</i>	LC		IV	Frequent
52.	Rosy Starling	<i>Sturnus roseus</i>	LC		IV	Rare
53.	Southern Coucal	<i>Centropus (sinensis) parroti</i>	LC		IV	Frequent
54.	Southern Grey Shrike	<i>Lanius meridionalis</i>	NA		IV	Frequent
55.	White Breasted Waterhen	<i>Amauornis phoenicurus</i>	LC		IV	Waterbodies/swampy area
56.	White Browed Wagtail	<i>Motacilla madaraspatensis</i>	LC		IV	Frequent
57.	White Throated Kingfisher	<i>Halcyon smyrnensis</i>	LC		IV	Frequent
58.	Red Wattled Lapwing	<i>Vanellus indicus</i>	LC		IV	Frequent

4.12.3 Aquatic Ecosystem

The study area has many small and big waterbodies. The project site is also drained by a perennial river. 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/checkdams. Seasonal fluctuation of water level (mostly during December) 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.

Aquatic Faunal Diversity

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

Table 4-14: 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

4.13 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 project SPV of Mytrah namely Mytrah Vayu (Sabarmati) Pvt. Ltd. related project site location, land details and company policies. 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 K**). Secondary data includes Census 2011, information available on the Tuticorin official website, district statistical handbook, and other available data on official government websites.

4.13.1 Methodology

The social assessment is primarily based on the analysis of the secondary data obtained from the Census -2011, district portal website and primary consultation with community & different level stakeholder 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:

- Consultation with local representatives of project proponent;
- Field observation for profiling the study area villages;
- Consultation with land aggregator;
- Consultation with local sub-registrar office;
- Consultation with all level stakeholders in the study area villages (e.g. Panchayat Members, Village Heads, Teachers, Youth Group, Farmers, Health Worker, ICDS Workers etc).

4.13.2 Study Area

The project area villages are spread over in Ottapidaram & newly formed Kayathar taluks of Thoothukudi district in Tamilnadu. Till the time site visit in August, 2017, there were total 22 villages and 1 Nagar Panchayat area falling in the project area.

Consultation and socio economic study was carried out in 20 sample villages and 1 Nagar Panchayat area, taken as study area located within 5-20 km of the proposed project sites. Kayathar and Kovilpatti are the nearest big towns of the study area villages.

It is important to mention here that the major part of the study area is falling under newly formed Kayathar taluk (formed on May, 2017). Kayathar taluk was formed by restructuring Kovilpatti and Ottapidaram taluks.

Based on the primary consultation the list of study area with administering taluks is given in **Table 4-15**.

Table 4-15: List of Study Area Villages

Sl. No.	District	Taluk	Panchayat	Village/ Town
1	Thoothukkudi	Kayathar	Therku Mylodai	Therku Mylodai
2			Kalappaipatti	Kalappaipatti

Sl. No.	District	Taluk	Panchayat	Village/ Town
3			Akhilandapuram	Akhilandapuram
4			Kudiraikulam	Kudiraikulam
5			Ilavelangal	Ilavelangal
6			Achangulam	Achangulam
7			Vadaku Vandanam	Vadaku Vandanam
8			K.Kumarapuram	K.Kumarapuram
9			Kurumalai	Sundaresapuram
10			Thennampatti	Thennampatti
11			Kottali	Kottali
12			Kappulingampatti	Kappulingampatti
13			Koppampatti	Koppampatti
14			Thirumalaipuram	Thirumalaipuram
15			Sivagnanapuram	Sivagnanapuram
16			K.Chidambarapuram	K.Chidambarapuram
17			Keelakottai	Keelakottai
18			Panneerkkulam	Panneerkkulam
19			Kadambur Nagar Panchayat	Kadambur
20			Kuppanapuram	Ottudanpatti
21		Ottapidaram	Malaipatti	Malaipatti

4.13.3 Demography

The demographic profile in terms of total population, number of households, household size and sex-ratio of the selected villages/ town surveyed in study area are discussed in the section below. The average house hold size in the study area is around 4. Of the study area villages, Akhilandapuram has the highest population (3101) while K.Kumarapuram has the lowest population (262). Whereas Kadambur being a Nagar Panchayat Area has more population (4155) than even Akhilandapuram.

As per the Census, 2011 in the study area the female population is higher than the male. The average gender ratio in the study area is 1007. The average gender ratio in the study area is 1007. Details of the study area population is given in **Table 4-16**.

Table 4-16: Study Area Villages Population & Gender Ratio

Study Area	Total Population	Male	Female	Sex Ratio
Malaipatti	1427	686	741	1080
Kudiraikulam	1206	641	565	881
Ilavelangal	1475	744	731	983
Kottali	771	396	375	947
Thennampatti	1568	759	809	1066
Achangulam	1682	847	835	986
Akhilandapuram	3101	1525	1576	1033
K.Chidambarapuram	1494	741	753	1016
K.Kumarapuram	262	130	132	1015
Kadambur (NP)	4155	2075	2080	1002

Study Area	Total Population	Male	Female	Sex Ratio
Kalappaipatti	1738	849	889	1047
Kappulingampatti	1401	684	717	1048
Keelakottai	1807	901	906	1006
Koppampatti	1424	716	708	989
Ottudanpatti	563	290	273	941
Panneerkulam	1695	867	828	955
Sivagnanapuram	1439	708	731	1032
Sundaresapuram	1179	613	566	923
Therku Mylodai	2807	1384	1423	1028
Thirumalaipuram	673	316	357	1130
Vadakku Vandanam	491	253	238	941
Total	32358	16125	16233	1007

Source: Census, 2011

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

As per census 2011, in the study area there is almost nil ST population. Out of the entire study area only Kadambur town has 4 ST person. Regarding scheduled caste (SC) population, Ottudanpatti village has maximum share percentage i.e. 77.62% of the total village population. Details of the study area SC & ST population percentage with respect to the total population is appended herein **Table 4-17**.

Table 4-17: Study Area SC & ST Percentage

Study Area	Scheduled Caste (%)	Scheduled Tribe (%)
Tehsil- Ottapidaram	41.52	0.13
Malaipatti	36.37	0.00
Kudiraikulam	24.96	0.00
Ilavelangal	51.46	0.00
Kottali	10.38	0.00
Thennampatti	22.26	0.00
Tehsil- Kovilpatti	21.55	0.42
Achangulam	52.14	0.00
Akhilandapuram	37.50	0.00
K.Chidambarapuram	31.53	0.00
K.Kumarapuram	0.00	0.00
Kadambur (NP)	29.92	0.10
Kalappaipatti	63.41	0.00
Kappulingampatti	45.47	0.00
Keelakottai	77.42	0.00

Study Area	Scheduled Caste (%)	Scheduled Tribe (%)
Koppampatti	39.89	0.00
Ottudanpatti	77.62	0.00
Panneerkulam	0.06	0.00
Sivagnanapuram	23.70	0.00
Sundaresapuram	38.93	0.00
Therku Mylodai	46.63	0.00
Thirumalaipuram	39.67	0.00
Vadakku Vandanam	45.42	0.00

Source: Census, 2011

4.13.5 Status of Women in Study Area Villages

Following the Census, 2011, the average literacy rate of female both at district and mandal level is found much lower than the male. The scenario is almost the same in the study area villages. Only around 43.59% of the total literate population are female. The highest female literacy is seen at Kalappaipatti (around 81.98% of total female population above the age of 6 years) and the lowest being at Thennampatti (around 29.27% of total population above 6 years age) village. Census, 2011 states that around only 65.06% of the total female population (above the age of 6 years) in the study area are literate.

Census, 2011 indicates that around 46% of the total working population in study area villages and the only Nagar Panchayat area Kadambur are female. Kalappaipatti has the highest percentage (52.79%) of female. It is then followed by Achangulam (40.33%) and Kadambur (38.38%).



Women in action at cultivation



Consultation with Women

Agriculture is the main livelihood resource in the study area. Aligned with the gender ratio, a notable part of the agricultural labour-force in the study area are women. As observed in the study area, women play a significant role in agriculture and allied activities including crop production, livestock production, post-harvest operations etc. As observed, involvement of women in farming activities is a common feature in the study area villages.

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

During consultation with women it was observed that women are entirely responsible for household chores and additionally engaged as agriculture labour, harvesting, feeding the cattle, and taking care of livestock etc. Female labours are engaged in cultivation, sowing, weeding, plant protection, grading, kitchen gardening, cleaning of grains, harvesting, feeding the cattle, irrigating fields, taking care of livestock, growing vegetables etc. However, it indicates that women need to be empowered through proper education and financial independence.

4.13.6 Literacy

Study Areas Villages: Within the study area, Kalappaipatti has the highest literacy percentage (around 85.66% of total population above the age of 6 years). The lowest literacy rate is seen at Kappulingampatti village (around 62.40% of total population above the age of 6 years). As mentioned earlier, the female literacy (65.06%) is quite low in comparison with their male counterpart (82.98%). Details of the study area literacy scenario is given in **Table 4.18**.

Table 4-18: Study Area Literacy Scenario

Study Area	Literacy % - Total Poputaion (without below 6 years age)	Literacy % - Male (without below 6 years age male Poputaion)	Literacy % - Female (without below 6 years age female Poputaion)
Malaipatti	77.64	86.14	69.68
Kudiraikulam	78.45	89.81	65.70
Ilavelangal	73.13	80.50	65.37
Kottali	66.76	75.91	56.93
Thennampatti	67.08	60.23	29.27
Achangulam	73.17	81.41	64.63
Akhilandapuram	75.83	86.08	65.99
K.Chidambarapuram	76.16	86.19	66.57
K.Kumarapuram	73.53	85.00	61.86
Kadambur (NP)	77.37	86.11	68.75
Kalappaipatti	85.66	89.56	81.98
Kappulingampatti	62.40	74.41	51.11
Keelakottai	79.82	85.96	73.86
Koppampatti	71.05	77.64	64.47
Ottudanpatti	68.15	79.53	56.20
Panneerkulam	78.44	83.79	72.83
Sivagnanapuram	73.04	83.18	63.58
Sundaresapuram	82.22	90.88	72.62
Therku Mylodai	70.20	79.23	61.42
Thirumalaipuram	79.15	90.39	69.67
Vadakku Vandanam	82.88	92.11	73.15

Source: Census, 2011

4.13.7 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 paddy, bengal gram (locally called cholam), ragi, curry

leaves etc. and commercial crops like cotton, chilly, sugarcane and groundnut. etc. Quiet a notable percentage of the population are involved in cow/goat rearing in the project area villages. A notable portion of the agricultural work force are involved as agricultural – labourer also. 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).

Wages in Agriculture

As per Tamilnadu State Govt. notification vide no. G.O. (2D) No.3, dated: 23.01.2015 the minimum wage for labourers engaged in harvest of paddy and similar other crops (reaping, carrying to threshing floor, threshing, winnowing, measuring etc.) is INR 146.00/ 6 hours/ day. As information procured from the local community in the study area the minimum wage ranges from INR 150- 250/ day depending on time spent and nature of work.

Apart from agriculture, the other form of economic activities is tailoring, shop keeping and small trading in the local village markets. Quiet a notable percentage of the population are involved in cow/goat rearing in the project area villages. Milk selling, goat trading etc. is also a source of livelihood in the project area villages. No big industries were observed in the area.

4.13.8 Agriculture and Irrigation in the Study Area

As per Census, 2011 about 41.84% of total population and around 75.22% of total working population in the study area are dependent on agriculture as their main livelihood resource. The study area has partly red sandy and few area black soil suitable for cotton agriculture and horticulture crops. Main crops cultivated are paddy, bengal gram (locally called cholam), cumbu, ragi, varagu, curry leaves etc. and commercial crops like cotton, chilly, curry leaves and groundnut. etc.

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. In many areas irrigation is noticed through bore wells (ground water). 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 being adversely affected.



Cotton Cultivation



Curry Leaves Cultivation

4.13.9 Vulnerability

During consultation with community and panchayat members, it was observed that, vulnerable groups e.g. BPL families, landless family, physically handicapped, widow etc. are present in the study area villages and in the only Nagar Panachayat area Kambadur as shown in **Table 4-19**. Government provides pension to those who comes in vulnerable group especially for widow and physically handicapped person.

Table 4-19: Village-wise Vulnerable Group in the Study Area

Study Area Villages	Vulnerable Groups		
	No. of physically handicapped person	No. of landless families	No. of women headed Households
Achangulam	12	20	50
Akhilandapuram	50	50	100
Ilavelangal	7	0	50
K.Chidambarapuram	7	200	5
K.Kumarapuram	5	6	25
Kadambur (TP)	25	0	0
Kalappaipatti	40	50	50
Kappulingampatti	10	50	20
Keelakottai	60	200	100
Koppampatti	20	120	70
Kottali	25	12	50
Kudiraikulam	7	0	12
Malaipatti	5	10	30
Ottudanpatti	7	10	5
Panneerkkulam	15	25	7
Sivagnapuram	15	60	10
Sundaresapuram	3	0	7
Thennampatti	15	80	40
Therku Mylodai	15	30	15
Thirumalaipuram	30	50	40
Vadakku Vandanam	6	2	10

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.

So far information derived from the project proponent and the land aggregator companies none of the land owners belong to any vulnerable community or marginal farmers / women. The project proponent may also be required to focus on providing employment opportunity to the vulnerable community members and also the implementation of community development programmes under CSR activity for them.

4.13.10 Amenities and Infrastructure

Education

It is noted that all villages in the study area and the only Nagar Panchayat area Kambadur have access to primary education, though secondary schools are restricted to a few villages only. Higher secondary schools and colleges for under graduate studies are not located within the village and students travel to Kayathar or Kovilpatti town for the same.



R C Middle School, Panneerkkulam



Pry School, Ottudanpatti Village

The sample schools observed during field study have a few problem areas. Though the schools have overhead tanks and bore wells, safe potable drinking water is not available. Hence, drinking water is carried from home by the students. The schools also don't have sufficient proper sitting arrangements (e.g. chairs & benches) for all students. The project proponent may address these issues in their CSR activities.

Health

Access to health services is limited only to some of the study area villages. Out of 20 villages and 1 town area only Kadambur town have a primary health centre (PHC). As observed, the PHC works as a life line for most of the villages in the study area. A few villages in the study area have Health Sub Centres. ANM visits at least once per week in most of the study area villages. In emergency cases, people travel about 10 to 15 km away to avail Kayathar and Kovilpatti government hospitals. Both Kayathar and Kovilpatti also have a few private hospitals. 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.

Fully functional Mobile Medical Unit (MMU) was noticed to provide services in the study area during the study.

MMU have been provided in all 385 blocks of Tamilnadu under NRHM and are functioning since February 2009 under the control of the PHC Patient Welfare Societies. Each Mobile Medical Unit covers at least 25 to 30 remote villages which are being visited on fixed days every month. Services rendered by Mobile Medical Units especially routine immunization/dropout immunization are being strictly monitored. The other routine services (Ante Natal Care, Post Natal Care, Family Welfare Services, Lab Services, Adolescent Care, Referral Services and Counseling Services) rendered by the MMU team are linked with the Village Health and Nutrition (VHN) day if the MMU visits the village on the same day.¹³

¹³ Source: <http://www.nrhmtn.gov.in/mmu.html> (website of National Health Mission Tamilnadu, Dept. of Health & Family Welfare)



Consultation with Doctors at Primary Health Centre in Kadambur Village



Mobile Medical Unit in the study area (Panneerkkulam village)

Drinking Water

It was informed by both Panchayat Samiti and community that piped water supply system through reservoirs (overhead tanks) exists in all the study area villages. Water is supplied through taps at central locations of different localities.



Overhead tank, Panneerkkulam Village



Piped water connection below OHT

Some of the study area villages are facing serious water scarcity. As revealed during consultation ground water depth is more than 300 ft. to 500 ft. in the consulted area villages.

It was observed during field visit that laying of pipe line from Thamirabarani (also called Tamraparni) river has been started to meet the need for drinking water in the study area. As informed by the Panchayat Members that the work is aimed to be completed by 2018 and the pertinent problem of water scarcity may be resolved.



Laying of water pipe line from Tamraparni river

Source of Fuel for Cooking

A little section of the population in the surveyed villages use fire wood, cow dung, and crop residue as fuel for cooking. Majority of the study area populace use LPG as cooking medium. Among the study area villages K. Chidambarapuram, Sundaresapuram, and Vadakku Vandanam has the highest number of LPG users (i.e. 100%).

Electricity

Households of all study area villages and the Nagar Panchayat area Kambadur 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

Auto-rickshaw, Private and Govt. Buses are the major mode of transportation in the study area. Self-owned motor cycles and bicycles are frequently used private transport for the villagers.



Transportation facilities in study area

Sanitation

Majority of households of the study area have their own sanitation facilities in form of sanitary latrines in the study area villages. Though very little percentage of the study area practice open defecation in a stray manner, major portion of the study area is declared as ODF (Open Defecation Free) villages by the government.



Open defecation free board in the study area

4.13.11 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 4-20**.

Table 4-20: Village Wise Common Property Resources

Study Area Villages	Community Property Resources (CPR)				
	Religious Place	Sacred place	Community Hall	Community Pond	Cremation Ground
Achangulam	Y	N	Y	Y	Y
Ahilandapuram	Y	N	Y	Y	Y
Ilavelangal	Y	N	Y	Y	Y
K.Chidambarapuram	Y	N	Y	Y	Y
K.Kumarapuram	Y	N	Y	Y	N
Kadambur (TP)	Y	N	Y	Y	Y
Kalappaipatti	Y	N	Y	Y	Y
Kappulingampatti	Y	N	Y	Y	Y

Study Area Villages	Community Property Resources (CPR)				
	Religious Place	Sacred place	Community Hall	Community Pond	Cremation Ground
Keelakottai	Y	N	Y	Y	Y
Koppampatti	Y	N	Y	Y	Y
Kottali	Y	N	N	N	Y
Kudiraikulam	Y	N	Y	Y	Y
Malaipatti	Y	N	Y	Y	Y
Ottudanpatti	Y	N	N	N	Y
Panneerkulam	Y	N	Y	Y	Y
Sivagnanapuram	Y	N	Y	Y	N
Sundaresapuram	Y	N	N	Y	Y
Theethampatti	Y	N	Y	Y	Y
Therku Mylodai	Y	N	Y	Y	Y
Thirumalaipuram	Y	N	N	Y	Y
Vadaku Vandanam	Y	N	N	Y	Y

Source: Primary Consultation

4.13.12 Archaeological Sites

No structures listed as archaeological site by Archaeological Survey of India (ASI) is present in the study area.

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 L**.

4.13.13 Cultural Heritage in Study Area

Krishna Kovil Temple, Kottali

As observed during ESIA study, there is no cultural heritage site present within 10 km radius of any proposed WTG locations. Only Kottali village has one old temple structure, namely ‘Krishna Kovil’. As information gathered through community consultation the temple is tentatively about 50- 80 years old. But no proper history of the temple could be ascertained from the consultation. No other old cultural heritage site was observed during ESIA study in the project area. Present finalised WTG locations are located more than 1 Km from the temple. As understood there may not be any direct impact on this due to the project activity.



Krishna Kovil Temple at Kottali village

5 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.

5.1.1 Community & Institutional Consultation

Village profiling and community consultation has been carried out in twenty one villages located in the proposed project area. Stakeholder consultation included discussion with village panchayats, Anganwadi, educational institute 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 M**.

Table 5-1: Consultation with Different Stakeholders

Stakeholder type	Name & Designation	Department/Address	Date
Panchayat Samity	Bhakya Selvi, Maniya Sewan Mandhira Mourty, Bhakya Selvi Maniya Sewan, Mandhira Mourty Kani Thai, Subbuthai	Thennampatti, Kathali Kapulingampatti, Koppampatti, Thirumalaipuram	18/08/2017 & 19/08/2017
	Alban Semani Vishwasalkovi Chenadurai, Sakkiama, Karthik Muthu, V. Muthu Pandiya	Sivagnanapuram, K Chidambarapuram, Keelakottai, Achangulam Vadakku	
	M Durai, Rama Laxmi, Ettu Raj SVSP Nagarajan, SVSP Kulandhai Raja, Nagarasjan	Vandanam, Sunderswarapuram Panneerkkulam Kadambur Nagar Panchayat Ottudanpatti	
	Shanmugeiya, SVSP Nagarajan Mari Muthu,	Vadakku Mailodai Kalappaipatti Akhilandapuram	
	Jayarama, Thamilmami Aarumuga Pandiyan, Guru Nathan, Chinnana Durai, Murugan (Community & Panchayat Members)	Kudiraikulam Ilavelangal Malaipatti, K Kumarapuram villages.	
	Dr. Raj Kumar (BM) Dr. Priyadarshini (MO)	Kadambur	
	A Jeyarani (HM) S Padma (Asst. Teacher)	Ottudanpatti Village	
	Xavier (HM) S. Vijaya Sagaya Durachi Thomas Santhi	Panneerkkulam	
	Mrs. N Vennila	Panneerkkulam	

Source: Primary consultation

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

demographic profile of the villages. Expectations of local's 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 private dry 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. Land procurement process was in progress during the time of ESIA Study. The locals are also well 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.

View of the Infrastructural Facilities in the Study Area Villages



Hand Pump in the study area



Concretised village road in study area



Anganwadi Centre at Panneerkkulam village



Sanitation- Latrine units in Govt. School, Panneerkkulam

Consultations in the Study Area



Consultation with MEIPL, local office at Tirunelveli town



Consultation with representatives of Land Aggregator



Consultation with Village Head, Panneerkkulam Village



Consultation with Village Head, Ottudanpatti Village



Consultation with representative of sub-registrar at Kadambur sub-registrar office



Consultation with representative of sub-registrar at Kayathar sub-registrar office



Consultation with Panchayat Members at Kadambur Nagar Panchayat



Consultation with Anganwadi worker at ICDS Centre in Panneerkkulam



Consultation with Head Master at Govt. Middle School in Panneerkkulam



Consultation with Headmistress at Govt. Primary School in Ottudanpatti

In line with the CSR Regulations, Mytrah 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 Mytrah is appended herewith in **Appendix N**.

5.1.2 Grievance Redressal Mechanism (GRM)

As per the Performance Standards (PS) of IFC, the guidelines of ADB and OPIC the client should establish a Grievance Redressal Mechanism (GRM) 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 “Grievance Register Format” of the project proponent (MEIPL), as provided in **Appendix G**.

6 ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

6.1 Approach & Methodology

Primary impacts are assessed for a radius of 500m around the WTGs 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 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	

Distribution	Duration	Intensity	Significance
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	HIGH
Buffer area	Short	High	
Buffer area	Long	High	
Widespread	Short	High	
Widespread	Medium	High	
Widespread	Long	Moderate	
Widespread	Short	Low	
Widespread	Short	High	
			NO IMPACT
			POSITIVE IMPACT

Key project related activities of Maniyachi Wind Power project during different 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	-	Storage of Hazardous material onsite	

Pre-Construction Phase	Construction Phase	Operation & Maintenance Phase	Decommissioning Phase
Planning of ancillary facilities like yards, stores, etc.	Generator and Storage of waste, including domestic waste at Construction site	Disposal of hazardous material	
	Waste generation from site	Waste disposal	
	Hazardous waste generation and storage onsite	Addressing the grievances of local people	
	-	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 low impact and cells highlighted in green show positive impact.

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

Resources & Receptors		PHYSICAL ENVIRONMENT									BIOLOGICAL ENVIRONMENT							SOCIO-ECONOMIC ENVIRONMENT							
		Visual Aesthetics	Topography	Air Quality	Noise Impact	Ground water Quality	Surface water quality	Top soil removal/ Soil quality	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			M	M	
	Storage and handling of raw material and debris	L		L		L														L				M	
	Hiring of labour	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							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	
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	

Resources & Receptors		PHYSICAL ENVIRONMENT									BIOLOGICAL ENVIRONMENT							SOCIO-ECONOMIC ENVIRONMENT						
		Visual Aesthetics	Topography	Air Quality	Noise Impact	Ground water Quality	Surface water quality	Top soil removal/ Soil quality	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
	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 (PM₁₀, PM_{2.5}, SO₂, NO_x 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 and intensity of the impact as medium, the impact can be termed as of **Moderate** significance. But, the impact is reversible, and temporary in nature and can be controlled if the following mitigation measures are adopted.

Mitigation Measures:

Vehicles speed to be restricted to 20-30 km/hr on unpaved road.

Material should be covered with tarpaulin sheet during transportation and in storage area

Water sprinkling on unpaved area.

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. Considering the above facts as well as the distribution of impact 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 project 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 soil of the region is reddish brown and black cotton with low fertility. The cation exchange capacity is low in the soil because of low clay content, low organic carbon content and presence of low activity days. During construction phase, activities that cause land disturbance include installation of tower foundations, road preparation, excavation, etc. Excavation will be restricted to WTG footprint area.

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 WTG area and during construction phase only. 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.

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. 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, cotton waste should be properly stored in designated areas and timely disposed to authorized recyclers.

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. 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).

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 200 m. The average noise impact generated due to construction equipment’s located at minimum distance of 50 m, 100 m and 200 m is presented in **Table 6-5**. The predicted noise level on comparing with the CPCB prescribed noise standard limit (night & day time) shows that noise level is not increasing over the prescribed limit beyond 200 m distance. (**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, L_p = sound pressure level (dB) at a distance of R from a noise source radiating at a power level,

L_w = 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 ($\alpha = 0.005\text{dB(A)/meter}$).

Table 6-5: Indicative Noise from Different Equipment's and Vehicles as per WTG Identified

S. N	Type of Vehicle	Description	Typical Sound Power	Noise level dB(A) at receptor distance 50 m from WTG	Noise level dB(A) at receptor distance 100 m from WTG	Noise level dB(A) at receptor distance 200 m from WTG
1	Passenger Vehicle	Passenger Vehicle	85	42.79	36.52	30.00
2	Trucks	10 ton capacity	95	52.79	46.52	40.00
3	Cranes	Overhead and mobile	109	66.79	60.52	54.00
4	Mobile Construction Vehicles	Front end loaders	100	57.79	51.52	45.00
5	Mobile Construction Vehicles	Excavators	108	65.79	59.52	53.00
6	Mobile Construction Vehicles	Bull Dozer	111	68.79	62.52	56.00
7	Mobile Construction Vehicles	Dump Truck	107	64.79	58.52	52.00
8	Mobile Construction Vehicles	Water Tanker	95	52.79	46.52	40.00
9	Stationary construction equipment	Concrete Mixer	110	67.79	61.52	55.00
10	Compressor	Air compressor	100	57.79	51.52	45.00
11	Compressor	Vibratory compactor	110	67.79	61.52	55.0

In the project, 6 receptors were observed within the 200 m from nearest WTGs therefore impact of noise due to construction phase activities is expected on these identified receptors and should be mitigated.

(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 providing personal protective equipment like ear plugs/muffs and job rotation 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 four locations in nearby settlements. Monitored results of ambient noise level for day &

night, were within the applicably CPCB standards for ambient noise set for residential area. High wind velocity in the region also contributed to increase the level of ambient noise. Noise due to various activities during construction phase will further increase in ambient noise level. However, construction activities operation will not continue for long duration. Considering the short duration, localized distribution and moderate intensity, impact has been assessed as **moderate** significance. Following mitigation measures are suggested to control the impact.

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 – Noise 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 GE make GE-2.4-116 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 GE 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

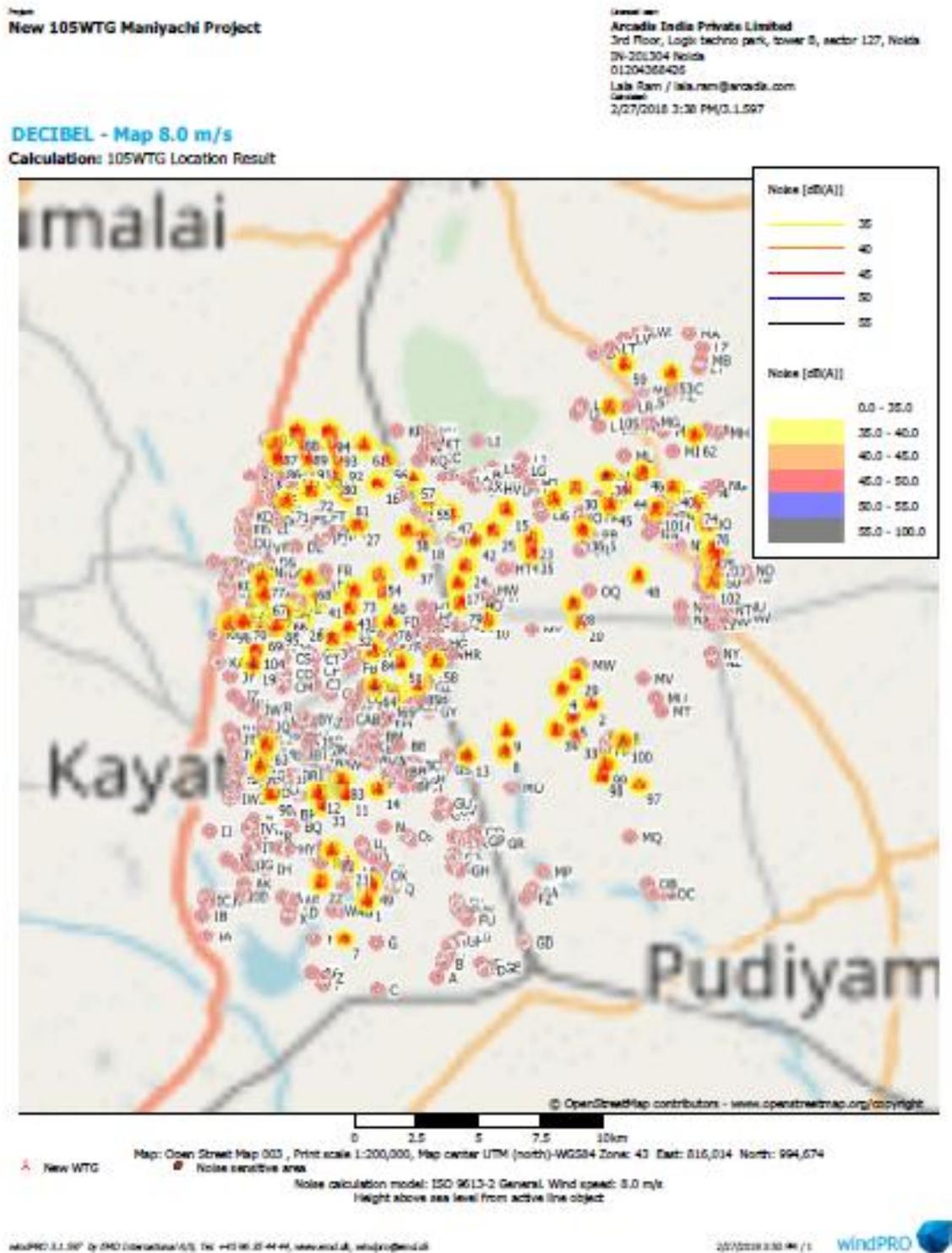
Based on the modelling results, it is interpreted that four of the WTG locations will have noise generated above the CPCB standard for night time i.e. 45dBA set for residential areas. However, none of the locations have been interpreted to cross the CPCB standard for day time i.e. 55 dBA set for residential areas. The identified receptor locations are near WTG MAN 183, MAN 148, MAN 388 and MAN 178. The cumulative noise level were estimated to vary from 45.4 to 49.4 dB (A) near the identified receptor locations where CPCB noise standard exceeds for night time. Noise modelling results detailing the noise level received at the noise receptors w.r.t to the nearest WTG locations is shown in Table 6.7.

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)

Noise Receptor	Distance	Receptor Coordinates		WTG noise level predicted dB(A)	WTG Location
		EASTING	NORTHING		
DM(NR117)	178m	807299	997646	45.4	WTG77(MAN-149)
JO(NR275)	138m	807707	990791	47.2	WTG63(MAN-388)
DK(NR115)	125m	807460	996869	48.0	WTG67(MAN-148)
FD(NR160)	98m	812709	995923	49.4	WTG78(MAN-183)

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 GE turbine.. The noise modelling map has been shown below in **Figure 6.1**

Figure 6-1: Noise Modelling Map



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 flat land. Levelling or filling is not expected to cause change in terms of natural drainage pattern due to alteration in contour level.

Construction Phase:

Levelling would not be required for WTG locations as terrain in the project area is flat. However, construction of access road involves slight 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. It is to be ensured that levelling of project site should 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 for WTG would be 70.0KL. During peak construction phase, about 300 construction workers will be employed. Hence, the total domestic water requirement purpose is 13.5 KLD. 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 Thoothukudi District as “Overexploited” 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 3.6 KLD 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 construction site 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 the study area.

As informed by project proponent labour camp is not required for the present 252 MW wind power project. Migrant skilled personnel may be hired from outside, under contractor during construction work, who will accommodated in rented arrangements with all facilities,, amenities as per ILO & IFC guidelines, as appended in Appendix E. However, at construction site discharge of wastewater due to various human activities is assumed to be generated, which will be treated through propoer statndard arrangements. 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 followed by soak pit; thus no significant

impact is anticipated to surface or groundwater. The impact on groundwater quality during operation phase will have **No impact**.

Mitigation Measures

- After construction phase, the areas acquired for various project activities should be reverted back similar to preconstruction stage.

Operation Phase

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

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. Solid and hazardous waste will be separately stored within the site. Further, hazardous waste will be disposed through TPCB authorized vendor only. 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.

Hazardous waste shall be collected and stored in paved and enclosed area and subsequently sold to authorized 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 piled 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 used for labour accommodation should be reverted back similar to preconstruction stage.

Operation Phase

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

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 level¹⁴. In addition to this, structure located within 20 km as per Visual Flight Rules, also requires NOC. Total height of GE model GE-2.4 - 116 including hub height and rotor blade length is 152 m. However, the project site is located at a distance of 26 km; hence NOC for height clearance is not required from AAI¹⁵.

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.

¹⁴ <http://nocas2.aai.aero/nocas/#>

¹⁵ http://nocas2.aai.aero/nocas/AAI_Links/FAQ_1st_April_2015.pdf

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 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 “**Medium**” 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 6-8: Climate and Disaster Risk Screening

General Project Identification

Date : October 2017
Country and Project Title : India : ESIA study for 252 MW wind power project in Thoothukudi district
Lending or financing Modality : OPIC

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 humid and sub humid plains environment. The region experiences more than 500 mm precipitation/year with an average annual rainfall of 625.8 mm as per IMD Thoothukudi. The project would be established on flat terrain. The area falls in Zone II strong damage risk zone of getting affected due to earth quakes.
Categorise sectoral risk of project (See Appendix P : 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 <i>Zone II strong damage risk</i> zone of getting affected due to earth quakes as per the Seismic Zones of India Map IS 1893 – 2002, BIS. Thoothukudi District experiences flood and cyclone.
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 successfully incorporate, manage and deliver risk management measures to the project	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, cyclone and flood and hence MEIPL team onsite should make coordinated efforts with district disaster risk management authority to take control of the situation, when in time of need.

Risk Assessment Category	Risk Value	Total	Remarks
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 cyclone).
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.
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, MEIPL 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	MEIPL 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 significantly promote risk management measures?	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.
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 private 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 approximate 4.2 acres. The land for access road needs to be finalised. Besides, the land required for transmission line tower construction on ROW basis also needs to be identified. Any issues related to ROW if faced should be deeply investigated, properly compensated so that further issues are not raised in future.

(B) Livelihood Impact

The land parcels identified for the proposed project are private land. Most of the land parcels were fallow land. 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 dairy and other industries in the nearby town areas. 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 and also decided to be deployed through contractors 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

As informed by the project proponent local people will be hired as unskilled labourers. Hence, there is minimum chance of any social impact associated with the engagement of local and migrant labour in the proposed project. Though regarding various possibilities there are chances 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. Considering the project construction phase, 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. Mytrah

energy has laid down policies through which it demonstrates compliance to all of the above factors. Its contractors should.

MEIPL needs to adopt the following measures:

MEIPL 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.

MEIPL 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 MEIPL.

It will be the responsibility of principal employer to get it ensure through its contractors. MEIPL is not going to employ labours directly for the project activity.

MEIPL 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.

MEIPL needs to ensure the compliance of labour law and availability of facilities mentioned there by reviewing muster roll, wages register, attendance register etc. through its contractors.

MEIPL shall conduct internal audits to monitor the performance of contractor.

MEIPL 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 land value amount are 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. As informed by the project proponent (MEIPL) all the security personnel for the present 252 MW Wind Power Project will be deployed from the local populace through private sub-contractor. This would be a positive impact of the project as it would enhance the economic opportunities of the locals.

Mitigation measures:

- Based on need assessment, CSR initiatives should be implemented in the project affected villages.
- MEIPL should undertake a formal consultation with all landowners from whom land is being purchased for WTG and for right of way and make them aware of the project details;
- MEIPL 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 ($\geq 2m$). 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 rented accomodation set up near the project site aea.

Housing space: Adequate housing space for workrers 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.

Sanitation facilities for contract labourers: Proper functional toilets should be 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;
- 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
- MEIPL 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. MEIPL 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

As informed by the Project Proponent, no labour camp will be set at site. Unskilled labourers will be hired from the local populace through contractor. Skilled personnel, who are hired from outside places will be accommodated in rented arrangements near to the project area with all facilities as indicated in ILO guidelines (as mentioned in Appendix E). Hence, the social impact associated with the labour accommodation or setting up labour camp (onsite) is not anticipated. Also there is minimum chance of conflict between labourers and community. The only chance that can be presumed is conflict between labourers and contractors.

The rented accommodation for the skilled personnel with all facilities and standards mentioned in the ILO guidelines (Appendix E). The ILO guidelines standards are as follows:

Housing space: Adequate housing space for labourers 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.

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

Interaction with Local Community

As mentioned earlier that unskilled labourers will be sourced from the local community to avoid any kind of 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.

Mitigation Measures:

- Arrangement of rented accommodations in most amicable way that may lead to direct conflict with local community.
- Ensure availability of all the basic amenities such as kitchen, drinking water, crèches, rest room and adequate toilets in the rented accommodations as per standard guidelines of ILO and as mentioned in IFC and OPIC guidelines.

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	Moderate
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 moderate, the impact can be considered as “**moderate**”

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 6-9** below shows the approximate sensitivity to shadow flicker at different RPM for three blade turbines, according to Stankovik et al.

Table 6-9: 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)¹⁶.

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/year¹⁷) 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

Based on the modelling results, a total of 6 receptors will be impacted cumulatively by 2-3 WTG's. The shadow impact at these receptors was found in the range of 31-47 hr/year; whereas receptor near WTG MAN 159 and MAN 183 is worst effected with shadow flickering of 147 hr/year. The modelling results has been given in **Table 6-100**.

Table 6-10: Shadow Flickering Modelling Results Detailing the Shadow Hours Received at the Sensitive Receptors WRT to the Nearest WTG Locations

Shadow Receptors	Coordinates Shadow Receptor		Shadow hours per year (h/year)	Impacting WTGs	Distance (m)
	Easting	Northing			
OJ(SR401)	807585	1003189	31:28:00	WTG 87 (MAN-421)	401m
				WTG 89 (MAN-423)	1.6km
				WTG9 1 (MAN-424)	1.8km
HA(SR209)	814107	993430	32:32:00	WTG 64 (MAN-412)	2.1km
				WTG 65 (MAN-417)	1.5km
				WTG 85 (MAN-416)	347m
OY(SR416)	812194	985425	33:54:00	WTG 22 (MAN-127)	2.3km
				WTG 49 (MAN-124)	303m
DM(SR117)	807299	997646	37:48:00	WTG 68 (MAN-162)	2.0km
				WTG 77 (MAN-149)	178m
DC(SR107)	808698	996410	47:47:00	WTG 32 (MAN-159)	2.4km

¹⁶ *The Real Truth about Wind Energy, A Literature Review on Wind Turbines in Ontario, June 10, 2011, SIERRA Club Canada.*

¹⁷ *Dutch standards of 30 hrs/year was used in analysis of significant impact. In, India shadow flickering standards are not available*

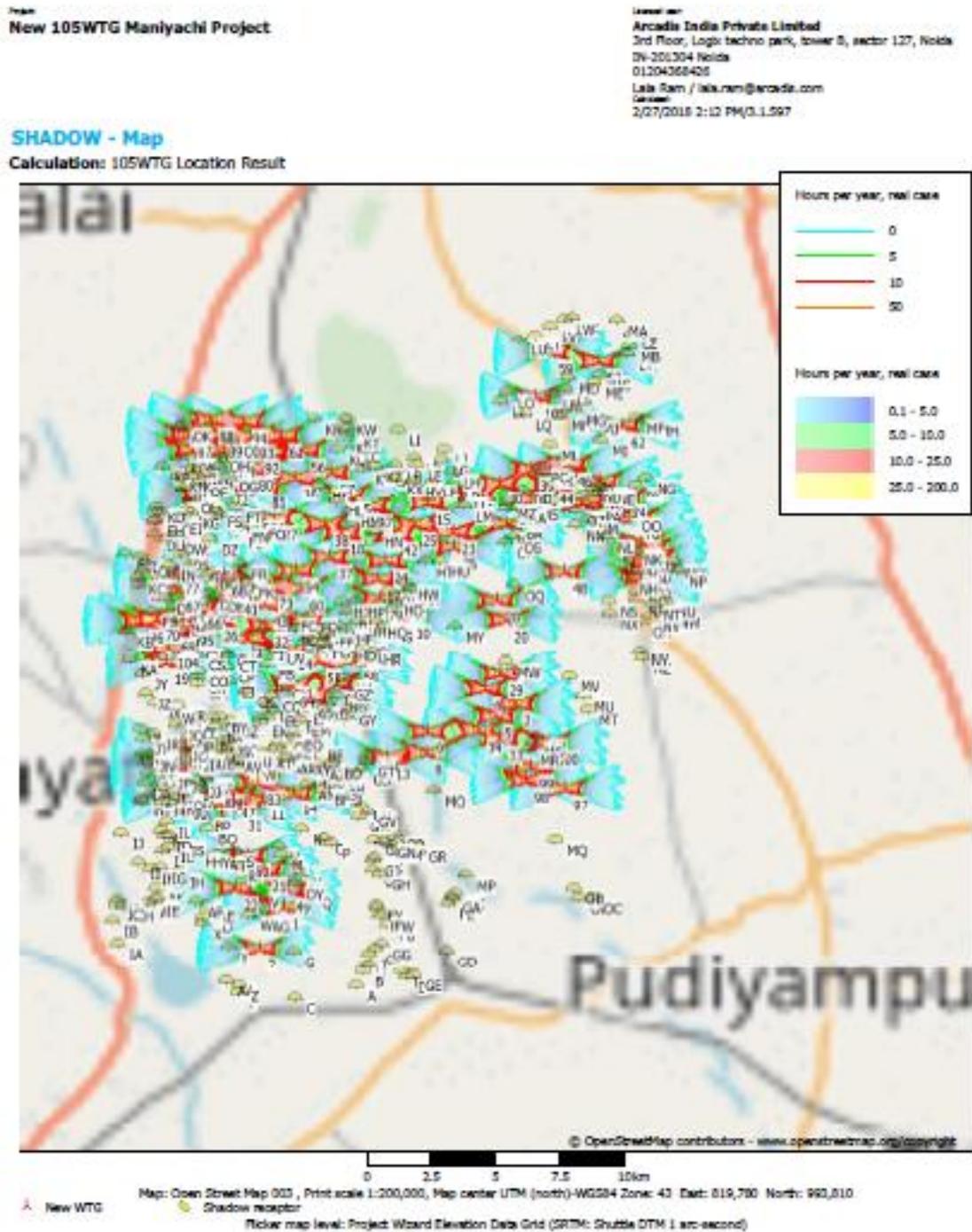
Shadow Receptors	Coordinates Shadow Receptor		Shadow hours per year (h/year)	Impacting WTGs	Distance (m)
	Easting	Northing			
FD(SR160)	812710	995923	146:58:00	WTG 66 (MAN-147)	296m
				WTG 70 (MAN-283)	1.9km
				WTG 32 (MAN-159)	1.7km
				WTG 78 (MAN-183)	98m

The modelling map is shown below in **Figure 6-2**.

Based on the results, it is advised to shift the MAN-183 location to avoid the impact on the receptor. Further, based on the discussions with MEIPL, it is understood that the Wind Resource Department is reworking to identify a suitable location for MAN-183.

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

Figure 6-2: Shadow Flickering Map



Mitigation Measures

It is recommended that MEIPL should formulate a grievance redressal mechanism for the local community so that any issues or concerns associated with shadow flicker are reported to the site staff. MEIPL 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	Moderate

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 overhead cable 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 ~94 meters above the ground and therefore the EMF¹⁸ 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)¹⁹, 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.²⁰ The impact due to EMF can be termed as having **No Impact**.

¹⁸ 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].

¹⁹ *The Real Truth about Wind Energy, An Analysis of the Potential Impacts of Wind Turbine Development in Ontario*. Sierra Club Canada, June 2010

²⁰ *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:

MEIPL should ensure that public access is not blocked due to the project activities.

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**.

Overall Impact Assessment

Project Phase	Risk Assessed
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Construction	Low
Operation	No Impact

6.3.4 Traffic Load

State Highway 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. 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 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.

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, GE and MEIPL, a documented grievance redress mechanism developed at Mytrah 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.

It was observed during site visit that in Kottali village, one old temple known as Krishna Kovil located more than 1 km from the nearest WTG location. As information gathered through community, this temple is about 50-80 years old. No other culturally significant site exists in the project area.

During construction phase, care should be taken that the access way to the Krishna Kovil Temple is not disturbed.

Overall Impact Assessment

Project Phase	Risk Assessed
Construction	LOW
Operation	No IMPACT

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 6-11**. 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 6-11: 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	Not applicable as private land is being procured on willing to sell and buy basis
Construction Phase						
2	Engagement of local and migrant labour	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 physical cultural resources	<ul style="list-style-type: none"> Existence of ASI declared cultural resources Existence of physical resources with historical, religious, aesthetics, paleontological and any other cultural significance 	Community protest	Low	PS-8 Cultural Heritage	Applicable

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 (mostly ephemeral layers) 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. Once the WTG is erected, after a good shower, the ephemeral floral species will come up in the unpaved area. Hence, the loss of ground cover is temporary and reversible. 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, common mongoose, hare, reptiles etc. are reported to be present in the project profile 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 profile 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. The entire project area was found to be a modified habitat with mixed land use pattern. 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.
- Plantation shall be carried out near the sub-station.
- 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 labourers 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. As stated above, for this wind turbine model, birds fly beyond 60 m height above ground have a collision threat from these turbines.

Collision Mortality

All the raptors recorded from the project profile area were found flying above 30-100 meters from above the ground. The rest of the birds found flying about 20-25 meters above the ground although some of the birds recorded and many birds which are reported to occur in the project area can even fly beyond 100 meters above the ground. As far as this project is concerned, in terms of the wind turbine model (considering the hub height and blade length), birds fly above 60m 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.

Route no -18 of established migratory route as stated by Swati Bopinar et al, 2012 (Seasonal Movements and Migration of Birds: Indian Scenario) passes through the project area whereas route no-16 passes through far westwards from the project site. In worst case scenario, we have considered the route no-16 too. The details are presented below.

Koonthankulam bird sanctuary is located at 50-60 km from the project profile area. Koonthankulam is also an Important Bird Area (IBA). Impact from project on the movement of migratory birds coming and going out of Koonthankulam bird sanctuary is not envisaged.

Figure 6-3: Migratory Routes of Birds in India

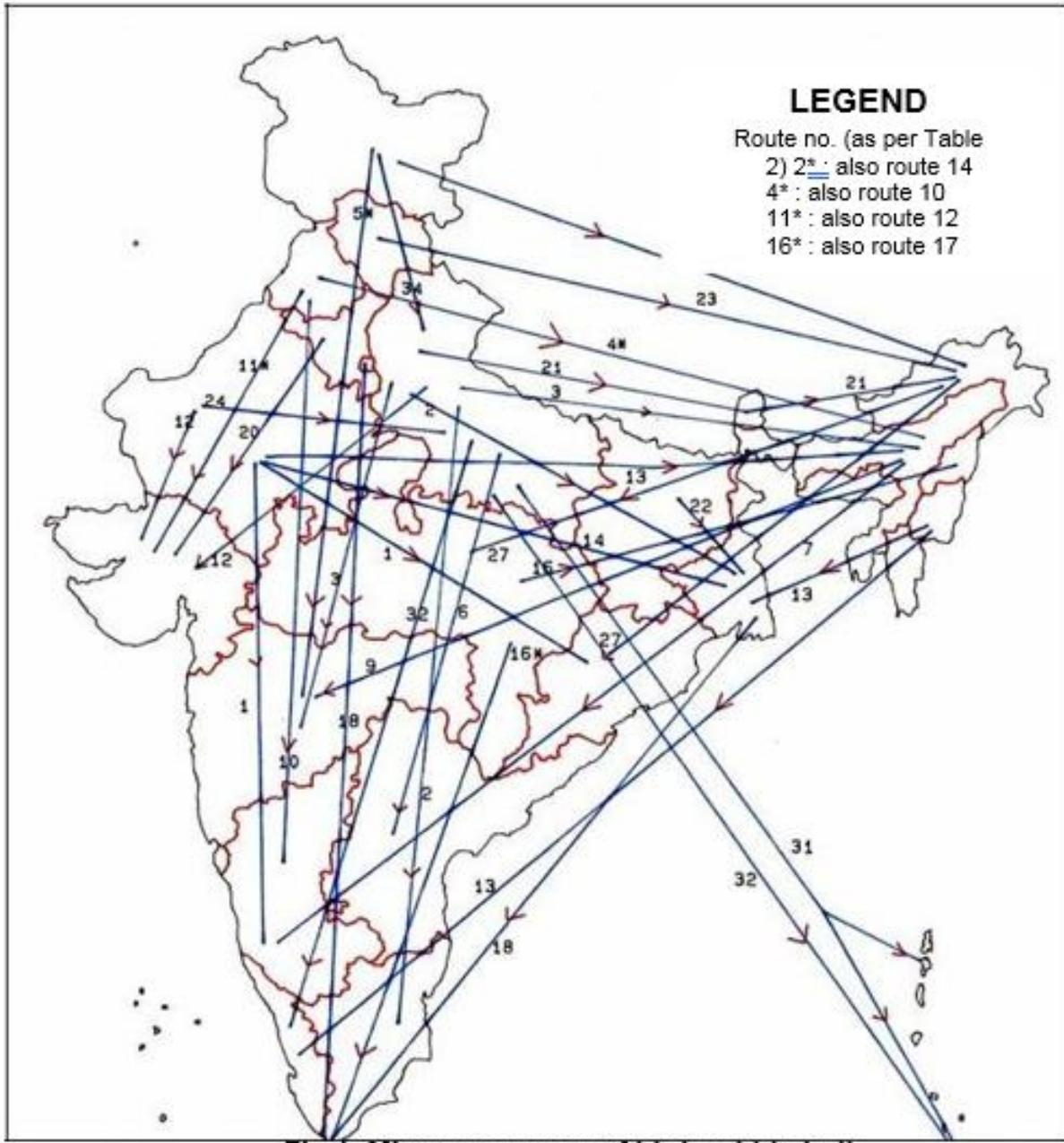


Table 6-12: Presents the Excerpts from an Established Migratory Routes and Bird Species

Route No	Bird Species	Native Place	Migratory Routes within India
16	Blyth's Reed Warbler	Central Eurasia	M.P eastwards to Nagaland and Manipur and Southwards to Kanyakumari
18	Indian booted Tree warbler	Afghanistan, North Iran, Turkestan & Transcaspia	Delhi and Calcutta southwards to Kanyakumari

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

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;

A detailed post-construction bird and bat mortality study for at least during migratory season for 2 consecutive months should be undertaken.

The tip of blades of WTGs should be painted to increase visibility and avoid collision. This is also done for established aircraft navigation path.

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 Disasters

The site is in strong risk zone II and hence prone to earthquake. Apart from earthquake, district also have faced flood, cyclone and Tsunami (in certain area). Thoothukudi is a coastal district and project area is located at 25 km distance from the sea. The area is prone to natural disasters and shall be considered this risk into planning and designing. The impact due to natural disaster will be applicable into both construction and operation phase. MEIPL is recommended to coordinate with district Disaster Management Authority and implement the recommendations to manage the situations in event of any natural disaster.

6.5 Cumulative Impacts

Tamilnadu has a very good wind profile and this is the reason why number of wind farm developers have setup plants in the area. Good wind profile of the area is expected to attract development of some more wind farm in the area. As land acquisition is involved in the wind power project, there are possibilities of impacts on the private land owners and enjoyers of assigned lands. All the settlements are located at a distance from the plant, hence no issues regarding the same is noticed there. Since wind power projects do not require any resource consumption for its operation, no obstruction to common property resources are anticipated. The potential cumulative impacts identified for the project has been highlighted in the following sub sections.

6.5.1 Socio-economic

Impact on Land

On average 4.2 Acre of land is required for each WTG location. It is assumed, around 441 Acres of land is required for 105 WTGs. Additionally around 16 Acres Land is already procured separtely for Pooling Sub station (PSS). Additional Land is also required for transmission line, for which land has already been identified. The Land identified for the proposed project site is primarily mix of dry agricultural and barren land, devoid of any physical / archeological infrastructure and do not involve any economical / residential displacement. The land is being procured under willing seller and willing buyer basis and compensation paid best of the market value in respect to circle rate, defined by government. Thus the impact on land is minor.

Migrant Workers

Operation of the project doesn't involve migrant labour. Only skilled personnel will be hired from outside places, who will be accomdated in rented accomoadted complying the international standards as mentioned in ILO guidelines.

Most of the civil works being small in nature should be handled by the local contractors from the nearby regions. This would ensure that the workers are from local area. Only skilled workers for erection of turbines and operation cranes should be sourced from outside and their numbers should be relatively less.

As a startegical principle, MEIPL and its contractor has decided to engage local people during construction to avoid migration of labour from far off places. This will not have any stress on the local and moreover provide job opportunities to the local population.

Impact on Infrastructure

The road connectivity in the area is good therefore transportation of turbine components will not lead to any disturbances to the habitations. There will be no disturbance to habitations as the turbines are erected on isolated plateaus.

Impact on Aesthetic Value

Multiple projects, including several utility-scale production facilities, are proposed around the proposed project. These have the potential to result in cumulative impacts to aesthetics when considered together with the proposed project. After construction of the project, the existing visual character of the area would be altered as well as its surroundings. The proposed project is not located in a designated scenic vista, nor has an important visual resources. None of the roadways abutting or surrounding the project sites are designated or proposed scenic roadways. In addition, the sites would not be visible from any designated scenic resources or scenic highways. No historic structures or significant scenic resources exist on the proposed project sites. Accordingly, no significant cumulative impact would result from the proposed project's incremental impact on a scenic vista, or damage to scenic resources.

6.5.2 Impact on air quality, water quality and soil characteristics

During operation of the project no fuel of any kind will be burnt. Therefore, the impact on air quality is not considered. There is no wastewater generation from the wind turbine. The domestic wastewater may be generated from office of the O&M team. Septic tanks with soak pits should be provided to treat sewage during operation phase. There is no significant solid waste generation during operation phase. Therefore, the impact on soil is not envisaged.

Noise

The noise from existing surroundings has been captured in the baseline recorded for the project. It was observed that the average day time noise level ranges from 53.2 – 54.5 dB (A) and average night time noise level ranges between 42.5 – 44.4 dB (A). The baseline noise levels in the area are thus within the prescribed CPCB standards of 55 dB (A) and 45 B (A) during the day and night time respectively at all locations.

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

6.5.3 Impact on Biodiversity

The project area also has wind power plant developed by Gamesa. Good wind profile of the area is expected to attract development of some more wind farm in the area. Establishment of number of wind farm in the area is expected to have direct impact on birds and bat in the area.

Vallanadu is a bird sanctuary located at approx. 70 km distance from the project site. Reportedly, this sanctuary is a place of migratory birds also therefore cumulative impact due to proposed and existing wind power project will be more.

Due to increase in number of wind farms in the area, cumulative impacts on birds and bat need to be ascertained with the help of seasonal bird and bat studies

Overall Impact Assessment

Phase of the Project	Risk Assessed
Construction	Low impact
Operation	Moderate

6.6 Conclusion:

The proposed wind power project will have minor as well as short term impact during construction phase. 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. Land for the proposed project is private and will be taken on the basis of willing to share and willing to buy basis. 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 would change the overall character of the region, and would contribute to the conversion of rural dry agricultural lands to landscapes with industrial character. However, no existing highly scenic views or aesthetically unique or distinctive landscape would be forfeited by the introduction of these types of projects. The project represents conversion from a natural environment of dry agricultural fields to built environment with an industrial character. The area is unpopulated and no residents would be subject to alteration of views in association with the proposed projects. Therefore, a weak cumulative impact may be expected due to the project and other projects which may come in future in the area.

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 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. MEIPL 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. MEIPL has a dedicated HSE team to manage the HSE issues in each and every project of Mytrah Energy. Role and responsibilities of HSE team is clearly defines in ESMS and will be applicable on this proposed project also. This chapter bridges the gaps to become site specific ESMS and hence it is recommended to implement the mitigation measures suggested or recommended here along with the corporate level ESMS. 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 7-1**. 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 Training of Personnel & Contractors

MEIPL 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;

Aware of the potential risks from the project activities.

A basic occupational training program 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.

7.2 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. MEIPL 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. The monitoring program and frequency of monitoring should be in line with the ESMS manual of MEIPL.

7.3 Documentation & Record Keeping

Documentation and record keeping system has to be established to ensure updating and recording of requirements specified in ESMP. Responsibilities have to be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained and that document control is ensured. The following records 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 7-1: 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.	GROUND WATER ABSTRACTION	The total water requirement is high but of short term, the region as per CGWB falls in over exploited zone. Since, water tank is planning to use in proposed project therefore the impact on ground water level is not much envisaged.	LOW	<ul style="list-style-type: none"> The water should be sourced from authorised water tankers. 	NO IMPACT	Maximum efforts should be made to reuse and recycle water to reduce water consumption.	Project Developer/ Contractor under the supervision of MEIPL Personnel
2.	SURFACE 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	<ul style="list-style-type: none"> 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 Waste water holding tanks / septic tank should be provided. It should be ensured that the waste water does not find its way into surface waters or water wells. 		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	
3.	AIR QUALITY	Fugitive Dust due to movement of project vehicles Emission from Diesel Generators	MODERATE	<ul style="list-style-type: none"> 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 from 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 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. 	LOW		Project Developer/ Contractor under the supervision of MEIPL's Personnel
4.	SOIL QUALITY	Top Soil Loss	LOW	<ul style="list-style-type: none"> 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 	NO IMPACT	<ul style="list-style-type: none"> 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 MEIPL's Personnel
		Soil Contamination		<ul style="list-style-type: none"> 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. 			

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				<ul style="list-style-type: none"> 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. 			
5.	NOISE LEVEL	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Regular maintenance of construction machinery and equipment should be carried out to ensure noise emissions are maintained at design levels. 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. Sensitive 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. 	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 MEIPL's Personnel
6.	HAZARDOUS WASTE	Contamination of land and soil	LOW	<ul style="list-style-type: none"> 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 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 MEIPL's Personnel
7.	SOLID WASTE	Contamination of land	LOW	<ul style="list-style-type: none"> 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 MEIPL's Personnel
8.	CHANGE IN LOCAL TOPOGRAPHY	Alteration in natural drainage pattern	LOW	<ul style="list-style-type: none"> 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. 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 MEIPL's Personnel
9.	ECOLOGY	The construction activities may lead to loss of vegetation	LOW	<ul style="list-style-type: none"> The site clearance for tower erection, access road and ancillary facilities should be restricted to the necessary footprint area around WTG. 	NO IMPACT	The entire workforce should be sensitized (by the construction contractor) to possible adverse	Project Developer/ Contractor under the

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
		resulting in displacement of wildlife species. Disturbance to local livestock population		<ul style="list-style-type: none"> 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; 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. Speed limits to be maintained in the internal road to avoid road accident. 		ecological impacts during the construction phase by conducting awareness programs	supervision of MEIPL's Personnel
10	BIODIVERSITY	Site development will lead to the loss of mainly herbaceous species	LOW	<ul style="list-style-type: none"> 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; 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 MEIPL's Personnel
B	Social Management Plan						
1	ENGAGEMENT OF LOCAL AND MIGRANT LABOUR	Conflicts between labour and contractor	MODERATE	<ul style="list-style-type: none"> Employment will be provided to local people wherever possible, especially as unskilled construction workers and security guards MEIPL 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 MEIPL 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 MEIPL should conduct internal audits as when required to monitor the performance of contractor. MEIPL through the contractor inform the labour about emergency preparedness plan and communication system to be followed during emergency situation MEIPL through contractor should ensure that labour receive training on health and safety issues involved in the proposed project. 	LOW	Periodic EHS audits should be conducted to monitor the same	Project Developer/ Contractor under the supervision of MEIPL's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
2	LABOUR ACCOMMODATION	Conflicts between labour and local community	MODERATE	<ul style="list-style-type: none"> As decided by MEIPL unskilled labourers would be hired from local community through the contractors during construction phase. Only skilled personnel would be hired from outside, who will be accommodated in rented arrangements in nearby places complying all the requirements of ILO (Appendix E) and other international guidelines. Hence there would be no Labour Camps for the present 252 MW wind power project. Therefore, there is no chance of conflict between the labour and local community. It is suggested that the rented accommodation in nearby places should have separate arrangements to avoid any kind of conflict, if raised. 	LOW	Grievance Redressal mechanism should be followed and monitored	Project Developer/ Contractor under the supervision of MEIPL's Personnel
3	SOCIAL/LIVELIHOODS	ROW for transmission lines Obstruction to places of relevance	MODERATE	<ul style="list-style-type: none"> 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 movement of the locals. Any waste generated during the construction phase will be properly disposed off. 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	<ul style="list-style-type: none"> Construction contractors should adhere to social obligations, labour laws and international commitments MEIPL 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 MEIPL 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 	<ul style="list-style-type: none"> Project Developer/ Contractor under the supervision of MEIPL's Personnel Social Management team for grievance Handling
4	COMMUNITY ENGAGEMENT	Community empowerment	MODERATE	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Continuously throughout the project lifecycle. Grievance Redressal Mechanism should be followed and grievance register should be maintained onsite. 	Project Developer/ Contractor under the supervision of MEIPL's Personnel / PRI representatives
5	OCCUPATIONAL HEALTH AND SAFETY	Material handling and storage Possible injuries associated with working at height (≥ 2m) Other occupational hazards	MODERATE	<ul style="list-style-type: none"> 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 	LOW	<ul style="list-style-type: none"> The labour engaged for working at height should be trained for temporary fall All the workers should be made aware of the possible occupational 	Contractor under the supervision of MEIPL's Personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				<ul style="list-style-type: none"> 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 		<ul style="list-style-type: none"> risks/hazards by the way of an OHS training/awareness programme An accident reporting and monitoring record should be maintained 	
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 MEIPL's Personnel
				Developmental needs and expectations (such as employment in the project or up-gradation of educational health care facilities, cultural property and infrastructure) of local communities will be identified through the Gram Panchayat, villagers and local administration.		Should be conducted continuously through the project cycle.	MEIPL's Personnel
				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.	MEIPL's Personnel

OPERATION PHASE

A. ENVIRONMENT MANGEMENT PLAN

1	AMBIENT NOISE LEVELS	Noise generation due to operation of wind turbines.	LOW	<ul style="list-style-type: none"> Wind turbines should be 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; Curtailling turbine operations above the wind speed at which turbine noise becomes unacceptable in the project-specific circumstances. Also, locations will be 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). 	NO IMPACT		EPC Contractor / MEIPL's Personnel
2	BIODIVERSITY	Bird Collision Modification of habitat	LOW	<ul style="list-style-type: none"> Adequate space between each turbine; Daytime visual markers on transmission lines; The vane tips of the wind turbine should be painted with orange colour to avoid bird hits; Visibility enhancement objects such as marker balls, diverters on transmission lines; Conduct birds and bats survey by an independent ornithologist in operation stage of wind power project for two months; 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; 	LOW	Short term/Long term Bird and bat monitoring study should be conducted.	MEIPL personnel

S. N	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
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	MODERATE	<ul style="list-style-type: none"> To avoid possible shadow flicker impacts as recommended by IFC in its guidelines for Wind Energy Sector followings will be followed: <ul style="list-style-type: none"> 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). 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. 	LOW	Necessary procedure will be followed and records will be maintained for consultations, essential documents, compensation benefits etc.	EPC Contractor / MEIPL's Personnel
4	Aviation Hazard	<ul style="list-style-type: none"> 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 	Moderate	<ul style="list-style-type: none"> 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	EPC Contractor / MEIPL's Personnel
B SOCIAL MANAGEMENT PLAN							
1.	COMMUNITY HEALTH AND SAFETY	<ul style="list-style-type: none"> All WTGs should be located away from habitations Visual Aesthetics and Blade Glint Electromagnetic Field (EMF) interference 	LOW	<ul style="list-style-type: none"> 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	EPC Contractor / MEIPL'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	<ul style="list-style-type: none"> • Electrocution • Firing due to short-circuit • Possible injuries associated with working at height • Diseases due to unhygienic condition 	MODERATE	<ul style="list-style-type: none"> • 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	EPC Contractor / MEIPL's EHS officer
3.	SOCIAL WELFARE	Dissatisfaction among locals due to project operation	MODERATE	<ul style="list-style-type: none"> • Maximum employment will 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. • CSR 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 MEIPL 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 MEIPL. • 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 programme should be able to yield long-term benefits to the community members. • The community development programme would initially be targeted to villages close to project site 	LOW	Periodic CDP/ GR & EHS audits	EPC Contractor/ MEIPL's EHS officer

7.4 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 MEIPL 252 MW Wind Power Plant at Thoothukudi district of Tamilnadu. The management plans will be executed through Environmental Social Management System.

7.4.1 Emergency Preparedness and Response Plan

Purpose

MEIPL has setup an Emergency Response plan at the corporate level and circulated to all sites. The emergency plan covers all the possible emergencies of wind energy sector. It also supports amendments in the existing plan as per the site-specific emergencies. To make the available emergency plan, a site specific document, following measures have been suggested.

Emergencies

Detailed on site and off site emergency plan addressing different emergencies are incorporated in MEIPL's Integrated Management System (IMS). However, 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, flood and cyclone. District Disaster Management Authority has identified earthquake, flood, cyclone and Tsunami as natural disasters which may affect Thoothukudi district. 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 MEIPL & 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:

- 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;
- 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;
- 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:

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.

Onsite and offsite emergency response plan is enclosed as **Appendix T**.

7.4.2 Grievance Redressal Mechanism

IFC PSs, OPIC & ADB guidelines require 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 MEIPL (**Appendix G**). 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 MEIPL 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 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: MEIPL (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 MEIPL 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. MEIPL 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 MEIPL and its contractors.

7.4.3 Waste Management Plan

Waste Management Plan (WMP) will be applicable to the wastes arising during commissioning and operation of the proposed wind power plant of MEIPL. Major waste streams from the project include non-hazardous solid waste and sewage. However, the waste quantity will be very insignificant.

WMP is intended to serve as a guideline for MEIPL 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, spent oil from DG set, etc. The management measures of the solid wastes and the hazardous wastes are presented below:

The recyclable and non-recyclable non-hazardous solid waste generated onsite should be collected and stored in a 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).

Spent oil and transformer oil will be stored at site during operational phase and whatever the quantity is generated will be given to authorized vendor for appropriate disposal.

7.4.4 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: MEIPL would take responsibility for construction of the road before the existing road is diverted / closed for use by villagers. MEIPL (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.

MEIPL 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 MEIPL (including contractors) should have an agreement with the Gram Sabha for the sharing of the resource. In case of damage to community property MEIPL including its contractors should ensure that it is repaired or replaced to the satisfaction of the community at the earliest. MEIPL should maintain documentation of all incidents of damages to the community property. All cost for repair/replacement should be borne by MEIPL /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.

7.4.5 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.

MEIPL has its own Quality, Safety, Health and Environment Policy and has been annexed as **Appendix F**. OHS hazards specifically for the project primarily include the following:

Work at height

Work in confined spaces

Lifting 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.

7.4.6 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 some receptors will be cumulatively impacted by 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

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.

7.4.7 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 WTG site and drainage system improvement.

The MEIPL 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.

7.4.8 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.

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.

7.4.9 Stakeholder Engagement Plan (SEP)

Mytrah should develop 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), ADB SPSs & OPIC guidelines. 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 MEIPL 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 Stakeholders	Gram Panchayats Project investors	Village Institutions (schools, health centres);
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 cognizant of the requirement of the various stakeholders and the level at which communication is presently being undertaken by the project.

Table 7-2: Stakeholder Engagement Strategy

Sl. No.	Particular	Responsibility
1	Regulatory Authorities	The regulatory authorities will be coordinated directly by Mytrah 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 Mytrah at various levels. MEIPL 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	Mytrah ESG head along with the developers/ contractors 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 MEIPL corporate team in the form of stakeholder engagement records. Nobody apart from designated the MEIPL 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 MEIPL 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 7-3: 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	Mobilisation Construction Stage Operation stage	<ul style="list-style-type: none"> Engagement by Project team will be at various stages of the project 	<ul style="list-style-type: none"> Meetings Submission of reports 	<ul style="list-style-type: none"> HSE officer, EPC Contractor for implementation and site head (Mytah) for supervision 	<ul style="list-style-type: none"> Construction head, Mytrah 	<ul style="list-style-type: none"> Reports on various aspects
Regulatory Authorities	Mobilisation Construction Stage Operation stage	<ul style="list-style-type: none"> Various permissions and licenses related to setting up of the project Land procurement on lease; Submission of compliance related returns; 	<ul style="list-style-type: none"> Meeting Submission of compliance documents; Official letters 	<ul style="list-style-type: none"> HSE officer, EPC Contractor for implementation and site head (Mytrah) for supervision 	<ul style="list-style-type: none"> Construction head, Mytrah 	<ul style="list-style-type: none"> Evidence as well as details of communication
District/Tehsil Administration (Sub- registrar Officer, Bhuj)	Mobilisation Construction Stage Operation stage	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Meeting Submission of compliance documents; Official letters 	<ul style="list-style-type: none"> HSE officer, EPC Contractor for implementation and site head (Mytah) for supervision 	<ul style="list-style-type: none"> Construction head, Mytrah 	<ul style="list-style-type: none"> Evidence as well as details of communication Verbal communication and relevant records as applicable
Gram Panchayats (of project area)	Mobilisation	<ul style="list-style-type: none"> NOC from the local Panchayat Information on the project at village level 	<ul style="list-style-type: none"> Meetings 	<ul style="list-style-type: none"> Land Team, Mytrah CSR Officer, Mytrah 	<ul style="list-style-type: none"> Construction head, Mytrah 	<ul style="list-style-type: none"> Records of communication at site level
	Construction Stage					
	Operation stage					
Local Community (Panchayat members, Villagers)	Mobilisation	<ul style="list-style-type: none"> Information sharing on the project; Compensation and other issues; Details on the activities to the project; CSR and other benefits to the local population 	<ul style="list-style-type: none"> Meetings on regular basis 	<ul style="list-style-type: none"> CSR Officer, Mytrah 	<ul style="list-style-type: none"> Construction head, Mytrah 	<ul style="list-style-type: none"> Records of communication at site level
	Construction Stage					
	Operation stage					
Vulnerable Community (Widow, Handicapped and landless people at village level)	Mobilisation	<ul style="list-style-type: none"> Benefits from the project 	<ul style="list-style-type: none"> Meetings on regular basis 	<ul style="list-style-type: none"> CSR Officer, Mytrah 	<ul style="list-style-type: none"> Construction head, Mytrah 	<ul style="list-style-type: none"> Meeting records maintained at the village level as well as submitted to site in-charge.
	Construction Stage					
	Operation stage					
Sub-contractor/ Local Labourers/ Migrant Workforce (Civil contractor)	Mobilisation	<ul style="list-style-type: none"> Working conditions and terms of employment; Any other issue including conflict of the migrant population with the locals 	<ul style="list-style-type: none"> Meetings on regular basis 	<ul style="list-style-type: none"> CSR Officer, Mytrah 	<ul style="list-style-type: none"> Construction head, Mytrah 	<ul style="list-style-type: none"> Meeting and grievance records submitted to the site in-charge
	Construction Stage					
	Operation stage					
Civil Society/Local NGOs/ media	Mobilisation	<ul style="list-style-type: none"> Information sharing on the project; Discussion on specific issues 	<ul style="list-style-type: none"> Meetings 	<ul style="list-style-type: none"> CSR Officer, Mytrah 	<ul style="list-style-type: none"> Construction head, Mytrah 	<ul style="list-style-type: none"> Records of communication at site level
	Construction Stage					
	Operation stage					

7.5 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 – QSHE and systems of MEIPL. Monitoring requirements (including monitoring frequency) have been presented in the following Table 7-4.

Table 7-4: 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	EPC Contractor and MEIPL Site team	PS 3: Resource Efficiency and Pollution Prevention
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.	EPC Contractor and MEIPL Site team	PS 1: 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	EPC Contractor and MEIPL Site team	
A4	Air emissions from vehicles and machineries	Vehicles possessing valid PUC Certificates	Exhausts near project site	Monthly during construction phase	EPC Contractor and MEIPL 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)	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)	DG Compliance certificate	DG Stack	Once during construction phase	EPC Contractor and MEIPL 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	EPC Contractor and MEIPL 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	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 2: Labour & Working Conditions
		Sanitation status of labours working during construction phase	Onsite records		HSE Head at corporate level	
		Usage of proper PPEs Safety performance indicators viz. LTIs. Near misses, fatalities etc	Construction site	Daily during construction phase	HSE Head at corporate level	
A12	Disposal of sewage	Visual observation of leaks, overflows etc and odour problems if any.	Septic tank and soak pits	Daily during construction phase	EPC Contractor and MEIPL Site team	PS 3: Resource Efficiency and Pollution Prevention
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
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

EPI No.	Environmental Performance Indicator (EPI)	Monitoring Parameter	Location	Period & Frequency	Monitoring Entity	Applicable IFC PS
A17	Hunting of Schedule I and other animals					Living Natural Resources
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 1: 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		
B.	OPERATIONAL PHASE					
B1	Noise generated from operation of wind mill	Noise pressure level in dB(A)	Near noise sources (50 m)	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
		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 3: Resource Efficiency and Pollution Prevention
		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 3: Resource Efficiency and Pollution Prevention
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			
		Potable nature of drinking water viz. coliform, pH, TSS, Residual chlorine	Drinking water storage tank			
		Usage of proper PPEs Safety performance indicators viz. LTIs. Near misses, fatalities etc	Operational sites	Daily during operational phase		
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	PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

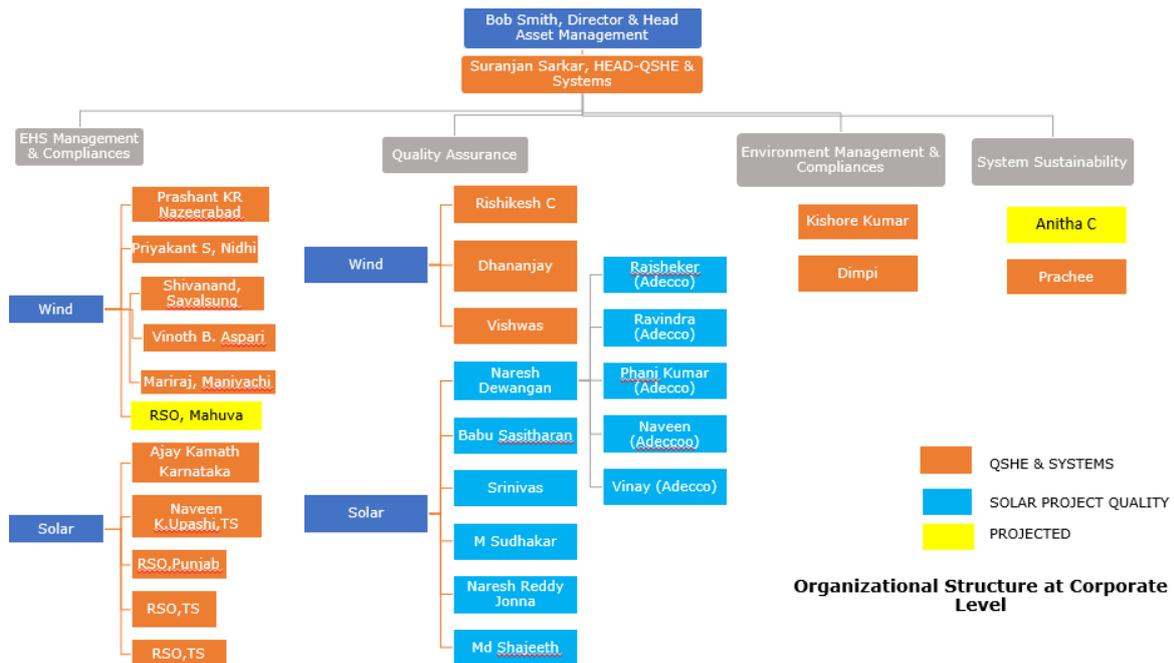
B. Environmental Quality Monitoring

EQI No	Environmental Quality Indicator (EQI)	Monitoring Parameter	Location	Period & Frequency
A. CONSTRUCTION PHASE				
A1	Ambient Air Quality	Measurement of PM2.5, SOx, NOx, CO	Nearest receptor viz. villages, schools, ecological habitat	Once during construction phase
A2	Ambient Noise quality	Measurement of Noise Pressure Level in dB(A)	Nearest receptor viz. villages, schools, ecological habitat	Once 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

7.6 Organisational Structure

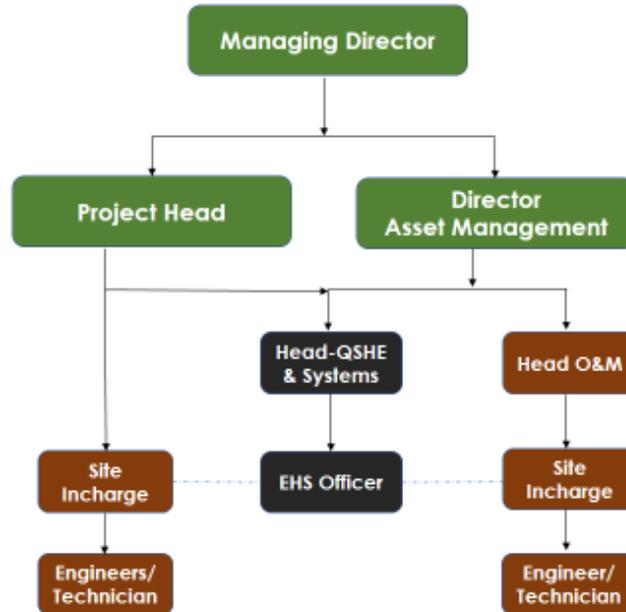
Mytrah Energy India Pvt. Ltd. (MEIPL) has their own Organisational Structure, given in, at their Corporate Level.

Figure 7-1: MEIPL Corporate level organisational structure



MEIPL has a Special Purpose Vehicle (SPV) namely Mytrah Vayu (Sabarmati) Pvt. Ltd. for the development of the present 252 MW wind power project in Thoothukudi district of Tamilnadu. Organisational Structure meant exclusively for the project is given in **Figure 7-2**.

Figure 7-2: MEIPL site specific organisational structure



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 MEIPL for execution of environmental management plan.

It is proposed that approximately INR 700,000 (Lac) per year will be required for EMP implementation.

8 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 adverse environment and social impacts which, can be mitigated by adopting suitable mitigating measures.

As per ADB categorization requirement, project has been categorized in following ways:

Environment: Project has been categorized as “**Category B**” project. Impacts arising out of the project are minimal and limited. Mitigation measures are readily designed and able to control the impacts. 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.

Involuntary Resettlement: No involuntary resettlement is involved. Project has been categorized as “**Category C**” The project involves only private land for all proposed WTGs. The land to be purchased for the project is mostly open scrubland and is without habitation. This was confirmed based on site observations and consultations.

Indigenous People: The study area located in Thoothukudi district does not fall in any notified tribal area of Tamilnadu. The project does not involve any uptake of land from indigenous people. The project is categorized as “**Category C**” project

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.

According to “Guideline for Eco-Sensitive Zones around Protected Areas” issued by MOEF&CC (F. No-1-9/2007 WL-I(pt) on 9th February 2011, development and use of renewable energy sources are permitted in the ESZ area.

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 more than 150 m above ground level²¹ and is located within 20km as per Visual Flight Rules. The hub height of GE model GE2.4-116 is 94 m to which the rotor blade length (58 m) will also be added. Thus, 152 m will be the total height of WTG from ground. Since, height of WTG in proposed project is 152 m but the distance of nearest WTG (WTG No MAN NEW 3) from airport is 26 km therefore NOC is not required. Kayatar Air strip which was used

²¹ <http://nocas2.aai.aero/nocas/#>

during World War II is presently abundant and being used for drying agricultural crops by the farmers. Hence NOC from AAI is not required.

Private land has been procured for 66 WTGs whereas land for rest 39 WTGs will be procured later. Location of rest 39 WTGs are tentative and may be changed later, depending on the land availability.

During primary survey 58 bird species were identified and recorded from the project profile area. Out of these 58 birds, 4 bird species belong to Schedule-I category and three were raptors. Out of these three raptors, Montagu's harrier is a migratory bird, while Oriental honey buzzard is widespread in its distribution. The third raptor Brahminy kite was found frequently in the project profile area. All these raptors were found flying above 30-100 meters from above the ground. The rest of the birds found flying about 20-25 meters above the ground. As far as this project is concerned, in terms of the wind turbine model (considering the hub height and blade length), birds fly above 60m 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. A detailed short term/long term bird and bat study is recommended to gather more concrete information on bird species during winter season.

All 66 WTG locations are proposed on private land and are free from any physical structures, hence no resettlement or rehabilitation is required.

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.

Brief Assessment:

Source of Pollution: The proposed wind power project is based on clean technology and does not cause pollution. Further, proposed project will help to reduce GHG emissions.

Resettlement: No resettlement and rehabilitation involved in the project.

Community Willingness: community is aware about the project and does not show unwillingness for the project due to clean technology. Further, landowners have provided their land on willing to sell and willing to buy basis

Project Benefit: The produced electricity will be evacuated to the state electricity grid and will help to cater the energy requirement of the state

Gender and Social Inclusion: The CSR plan focused on community development and women empowerment will be implemented by the MEIPL

Indigenous People: The project site does not falls under scheduled area. Further, no land has been taken from ST people in this project.

Proper Grievance Redressal Mechanism (GRM) will have to be implemented by MEIPL 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.

APPENDIX A: MOEFCC NOTIFICATION



B.M.L. Garg
Director

भारत सरकार
अपरम्परिक ऊर्जा स्रोत मंत्रालय
Government of India
MINISTRY OF NON-CONVENTIONAL ENERGY SOURCES
ब्लॉक नम्बर 14, केन्द्रीय कार्यालय परिसर, लोदी रोड, नई दिल्ली-110003
BLOCK No. 14, C.G.O. COMPLEX, LODI ROAD, NEW DELHI-110003.

DO No. 36/185/97-WE(PG)

दिनांक 20.11.1997
Dated.....

Dear Shri Vedant,

Please refer to the discussions held on 11th November 1997 at Bangalore regarding environmental clearance for wind power projects. In this connection, the Ministry of Environment and Forest have clarified that the power projects based on non-conventional energy source, as the main feed stock, are not required to take environmental clearance as per EIA Notification, 1994. As such, you are requested to take up this matter with the concerned authorities in your State so that environmental clearances, including pollution clearance, are not insisted by them.

With regards

Yours sincerely,

B.M.L. Garg
(B.M.L. Garg)

Shri C.S. Vedant
Managing Director,
Karnataka Renewable Energy Development Agency Ltd. (KREDL),
No. 1, Coffee Board Building, Dr. B.R. Ambedkar Veedhi,
Bangalore-560 001.

2391
20/12/97
(Signature)

(Signature)
12/12
Su K.P.

APPENDIX B: CPCB NOTIFICATION FOR RE-CLASSIFICATION OF INDUSTRIES (SAMPLE PAGES)



केंद्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
(पर्यावरण एवं वन मंत्रालय, भारत सरकार)
MINISTRY OF ENVIRONMENT & FORESTS, GOVT. OF INDIA

No.B-29012/ESS(CPA)/2015-16/ March 07, 2016

To
The Chairman
All the State Pollution Control Boards / Pollution Control Committees.
(List Attached)

SUB: MODIFIED DIRECTIONS UNDER SECTION 18(1)(b) OF THE WATER (PREVENTION & CONTROL OF POLLUTION) ACT, 1974 and THE AIR (PREVENTION & CONTROL OF POLLUTION) ACT, 1981 REGARDING HARMONIZATION OF CLASSIFICATION OF INDUSTRIAL SECTORS UNDER RED/ORANGE/GREEN/WHITE CATEGORIES.

WHEREAS, under section 16 (2)(b) of the Water (Prevention and Control of Pollution) Act, 1974 and under Section 16 (2)(c) of the Air (Prevention & Control of Pollution) Act, 1981, one of the functions of the Central Pollution Control Board (CPCB), constituted under the Water (Prevention and Control of Pollution) Act, 1974, is to coordinate activities of the State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs), and

WHEREAS, under section 16 (2)(c) of the Water (Prevention and Control of Pollution) Act, 1974 and under Section 16 (2)(d) of the Air (Prevention & Control of Pollution) Act, 1981, one of the functions of the CPCB is to provide technical assistance and guidance to SPCBs and PCCs; and

WHEREAS, it was brought to the notice of CPCB, that different SPCBs /PCCs were following different criteria for classification of industrial sectors under Red/Orange/ Green category and that classification was being used by the SPCBs/PCCs for grant of consents to industries and for Inventorization / surveillance of industries.

WHEREAS, the issue regarding classification of industries was deliberated upon in the 56th Conference of Chairmen & Member Secretaries of CPCB & SPCBs/PCCs held on August 31, 2010 and a working group comprising of representatives from SPCBs & CPCB was constituted to prepare a consolidated list of industrial sectors falling under Red/Orange/Green category to bring uniformity in classification of industrial sectors across the country;

परिवेश रक्षक सुदी अर्जुन नगर, दिल्ली-110032
Parnesh Bhawan, East Arjun Nagar, Delhi - 110032
दूरभाष: Tel: 43102000, 43102001, 43102002, 43102003, 43102004, 43102005, 43102006, 43102007, 43102008, 43102009, 43102010, 43102011, 43102012, 43102013, 43102014, 43102015, 43102016, 43102017, 43102018, 43102019, 43102020, 43102021, 43102022, 43102023, 43102024, 43102025, 43102026, 43102027, 43102028, 43102029, 43102030, 43102031, 43102032, 43102033, 43102034, 43102035, 43102036, 43102037, 43102038, 43102039, 43102040, 43102041, 43102042, 43102043, 43102044, 43102045, 43102046, 43102047, 43102048, 43102049, 43102050, 43102051, 43102052, 43102053, 43102054, 43102055, 43102056, 43102057, 43102058, 43102059, 43102060, 43102061, 43102062, 43102063, 43102064, 43102065, 43102066, 43102067, 43102068, 43102069, 43102070, 43102071, 43102072, 43102073, 43102074, 43102075, 43102076, 43102077, 43102078, 43102079, 43102080, 43102081, 43102082, 43102083, 43102084, 43102085, 43102086, 43102087, 43102088, 43102089, 43102090, 43102091, 43102092, 43102093, 43102094, 43102095, 43102096, 43102097, 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of Pollution) Cess (Amendment) Act, 2003, Standards so far prescribed for various pollutants under Environment (Protection) Act, 1986 and Doon Valley Notification, 1989 issued by MoEFCC. The Pollution Index (PI) of any industrial sector is a number from 0 to 100 and the increasing value of PI denotes the increasing degree of pollution load from the industrial sector;

WHEREAS, based on the series of consultations with SPCBs, different Government / Non-government Institutions including industries and MoEFCC, the following criteria on 'Range of Pollution Index' for the purpose of categorization of industrial sectors has been finalized:

- o Industrial Sectors having Pollution Index score of 60 and above - Red category
- o Industrial Sectors having Pollution Index score of 41 to 59 -Orange category
- o Industrial Sectors having Pollution Index score of 21 to 40 -Green category
- o Industrial Sectors having Pollution Index score incl. & upto 20 -White category

WHEREAS, based on the revised criteria, the 'Final Report on Revised Categorization of Industrial Sectors under Red/Orange/Green/White' has been evolved. The 'Categorization' is based on the relative pollution potential of the industrial sectors and grouping of the industrial sectors based on the use of raw materials, manufacturing process adopted and pollutants likely to be generated;

WHEREAS, based on relative Pollution Index, the number of industries in various categories are as under :

- i. The Red category of industrial sectors: 60
- ii. The Orange category of industrial sectors: 83
- iii. The Green category of industrial sectors: 63 and
- iv. The Newly introduced White category: 36

WHEREAS, there shall be no necessity of obtaining the Consent to Operate" for White category of industries and an intimation to concerned SPCB / PCC shall suffice;

WHEREAS, the purpose of categorization is to ensure that the industry is established in a manner consistent with the environmental objectives and to prompt industrial sectors to adopt cleaner technologies, ultimately resulting in generation of no or minimum pollutants.

WHEREAS the new categorization system shall also facilitate in self-assessment by industries;

Now, therefore, in exercise of the powers delegated to the Chairman, C/PCB under Section 18(1)(b) of the Water (Prevention & Control of Pollution) Act, 1974 and Section 18(1)(b) of the Air (Prevention & Control of Pollution), Act, 1981 the earlier Directions issued in June 2012 in the context of categorisation of industries as Red, Orange & Green are withdrawn with immediate effect and following 'Directions' are hereby issued for compliance by all SPCBs and PCCs :

1. That the SPCBs and PCCs shall adopt the Revised Criteria of categorization of industrial sectors as detailed in table nos. F1, F2, F3 and F4 and Revised Lists of Red, Orange, Green and White categories of industrial sectors, presented at table no. G2, G3, G4 and G5 respectively, in the 'Final Report' as attached herewith immediately.
2. That all pending applications for consideration of 'Consent to Establish' and 'Consent to Operate' and future such applications shall be processed as per revised criteria.
3. That the SPCBs and PCCs will provide the list of industries identified in each category existing in the State which have been considered for grant of consents. SPCBs/PCCs will forward the list of such industries before 31.05.2016 and the same will be uploaded on the websites of respective SPCB/PCC.
4. That the 'Revised Lists of Red, Orange, Green and White category of industrial sectors' shall be used by the SPCBs and PCCs for Consent Management and inventorization of industries under Red, Orange, Green and White categories. Siting of industries shall be only in conforming areas. SPCBs / PCCs shall evolve sector specific plans for control of pollution and industrial surveillance for verifying compliance.
5. That the SPCBs and PCCs shall revise /prepare the inventory of Red, Orange, Green and White categories of industries operating in their jurisdiction based on the revised criteria specified in the Final Report and submit the same to CPCB within 90 days i.e., before 30.05.2016 in hard copy as well as soft copy.
6. That the listed category of industries or those identified later-on under different categories shall not be linked to sanction of loan /finance or bank proceedings.
7. That any further addition of any new or left-over industrial sector and their categorization which is not listed in the revised list of Red, Orange, Green and White industrial sectors, shall be done at the level of concerned SPCB /PCC following revised criteria & guidelines as detailed in the attached document and no concurrence of CPCB shall normally be required. It is further clarified that while categorizing the industries, fractional numbers shall be rounded off to nearest integer.

APPENDIX C: NOTIFICATION OF CPCB FOR EXEMPTION OF WIND POWER PROJECTS FROM OBTAINING CTE AND CTO



ए.बी. अकोलकर
सदस्य सचिव
A.B. AKOLKAR
Member Secretary

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
पर्यावरण एवं वन मंत्रालय
(भारत सरकार)

Central Pollution Control Board
Ministry of Environment & Forests
(Government of India)
Phone: 22307078/22303655

No. B- 29012/ESS/CPA/2016-17/

January 18, 2017

To:

The Member Secretary,
All the State Pollution Control Boards / Pollution Control Committees
(List Attached)

Sub : Clarification in the matter of Revised Categorization of the industrial Sector namely
"Solar power generation through solar photovoltaic cell, wind power and mini hydel
power (less than 25 MW)".

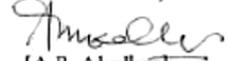
Modified Directions are issued by CPCB on 07.03.2016 u/s 18(1)(b) of the
Water (P&C of Pollution) Act, 1974 and Air (P&C of Pollution) , Act, 1981 on "Revised
Classification of Industrial Sectors under Red, Orange , Green and White Categories ". In
this context, references are received by Central Pollution Control Board for elaboration of
the activities covered under the industrial sector namely "Solar Power generation
through solar photovoltaic cell, Wind Power and Mini Hydel Power (less than 25 MW) "
which is placed at Sl. No 35 in White category of industrial sectors. The matter has been
examined and it is hereby clarified that this category of industrial sector includes the
following units :

1. Solar Power generation through photo-voltaic cells, Plants of all capacities.
2. Wind Power generation Plants of all capacities.
3. Mini Hydel Power Plants having capacity less than 25 MW.

Accordingly, for all future references, the entry at Sl. No. 35 in White category of
industrial sectors namely "Solar Power generation through solar photovoltaic cell, Wind
Power and Mini Hydel Power (less than 25 MW) " shall be read as "Solar Power generation
through solar photovoltaic cell Plants of all capacities, Wind Power Plants of all capacities
and Mini Hydel Power Plants of capacity less than 25 MW.

This is for reference of all concerned, please.

Yours faithfully


[A.B. Akolkar]
Member Secretary

Copy for kind information to :

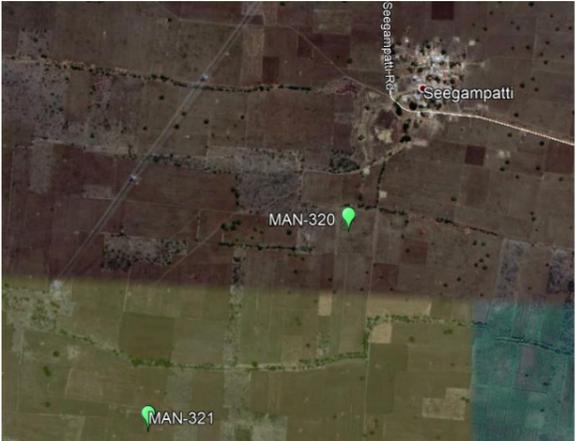
- ✓ The Joint Secretary (AKM), CP Division, MoEFCC, New Delhi
- ✓ Incharge - IT, CPCB, Delhi, for uploading on website of CPCB.

1	The Member Secretary Andhra Pradesh Pollution Control Board A-3, Prayauaraana Bhavan, Industrial Estate Sanath Nagar, Moosapet, Telangana 500018 (Hyderabad)	2	The Member Secretary Assam Pollution Control Board Bamunimaidan, Guwahati – 781 021 Assam
3	The Member Secretary Arunachal Pradesh Pollution Control Board, Department of Environment & Forests Office Complex, P-Sector, Itanagar 791 111 Arunachal Pradesh	4	The Member Secretary Bihar State Pollution Control Board 2 nd Floor, Beltron Bhavan, Jawaharlal Nehru Marg, Shastri Nagar, Patna 800 023 Bihar
5	The Member Secretary Chhatisgarh Environment Conservation Board, H.No. 1, Tilak Nagar, Shiv Mandir Chowk, Main Road, Avanti Vihar, Raipur – 421 001	6	The Member Secretary Goa State Pollution Control Board Dempo Towers, 1 st Floor EDC Plaza, Patto Panaji – 403001, Goa
7	The Member Secretary Gujarat State Pollution Control Board Paryavaran Bhavan, Sector-10-A, Gandhi Nagar-382010 Gujarat	8	The Member Secretary Haryana State Pollution Control Board Plot No. C – 11, Sector 6, Panchkula, Haryana
9	The Member Secretary Himachal Pradesh State Environmental Protection and Pollution Control Board "Paryavaran Bhavan" Phase – III, Below BCS New Shimla – 171009, Himachal Pradesh	10	The Member Secretary Jammu and Kashmir State Pollution Control Board Sheikal-ul-Alam Campus, Raj Bagh, Behind Govt. Silk Factory, Rajbagh, Srinagar 190 008
11	The Member Secretary Jharkhand State Pollution Control Board T.A. Division Building (Ground Floor) HEC Dhurwa, Ranchi – 834004, Jharkhand	12	The Member Secretary Karnataka State Pollution Control Board # 49, Parisara Bhavan 4 th and 5 th Floor, Church Street Bangalore – 560001, Karnataka
13	The Member Secretary Kerala State Pollution Control Board Plamoodu Junction Pattom Palace P.O. Thiruvananthapuram – 695004, Kerala	14	The Member Secretary Maharashtra State Pollution Control Board Kalpataru Point, 3 rd & 4 th Floor Sion Matunga Scheme, Road No. 8 Opp. Cine Planet Cinema Near Sion Circle, Sion (East) Mumbai – 400022, Maharashtra
15	The Member Secretary Manipur State Pollution Control Board, Lamphalpat Imphal – 795004, Manipur	16	The Member Secretary Madhya Pradesh State Pollution Control Board Paryavaran Parisar E – 5, Arera Colony Bhopal – 462 016, Madhya Pradesh
17	The Member Secretary Mizoram State Pollution Control Board M.G. Road, Khatla Aizwal-796 001, Mizoram	18	The Member Secretary Meghalaya State Pollution Control Board "ARDEN" Lumpyngngad Shillong – 793014, Meghalaya

19	The Member Secretary Nagaland State Pollution Control Board Signal Point, Dimapur-797112, Nagaland	20	The Member Secretary Orissa State Pollution Control Board, Paribesh Bhawan A / 118, Nilakantha Nagar Unit – VIII, Bhubaneswar – 751012, Orissa
21	Punjab State Pollution Control Board Vatavaran Bhavan Nabha Road Patiala – 147 001 Punjab	22	The Member Secretary Rajasthan State Pollution Control Board 4, Paryavaran Marg, Institutional Area Jhalana Doongari, Jaipur – 302004, Rajasthan
23	The Member Secretary Sikkim State Pollution Control Board Department of Forest, Environment & Wildlife Management Govt. of Sikkim Deorali, Gangtok, Sikkim	24	The Member Secretary Tamil Nadu State Pollution Control Board No. 100, Anna Salai Guindy, Chennai – 600032, Tamil Nadu
25	The Member Secretary Telangana State Pollution Control Board A-3, Prayauaraana Bhavan, Industrial Estate Sanath Nagar, Moosapet, Telangana 500018 (Hyderabad)	26	The Member Secretary Tripura State Pollution Control Board Vigyan Bhavan Pandit Nehru Complex Gorkhabasti, P.O: Kunjaban, Agartala West Tripura – 799006
27	The Member Secretary Uttarakhand Environment Protection and Pollution Control Board Paryavaran Bhavan E-115, Nehru Colony Dehradun-248 001, Uttaranchal	28	The Member Secretary Uttar Pradesh State Pollution Control Board PICKUP Bhavan 3 rd Floor, B – Block Vibhuti Khand, Gomti Nagar Lucknow – 226 010, Uttar Pradesh
29	The Member Secretary West Bengal State Pollution Control Board Department of Environment, Government of West Bengal Paribesh Bhavan Building No. – 10A Block – LA, Sector – III, Salt Lake City Kolkata – 700 098, West Bengal	30	The Member Secretary Daman, Diu & Dadra & Nagar Haveli Pollution Control Committee Office of the Dy. Conservator of Forests Moti Daman, Daman - 396220
31	The Member Secretary Pondicherry Pollution Control Committee Department of Science Technology and Environment 3 rd Floor, Housing Board Building Anna Nagar, Pondicherry – 605 005	32	The Member Secretary Chandigarh Pollution Control Committee Additional Town Hall Building, 2 nd Floor Sector 17 – C Chandigarh – 160 017
33	The Member Secretary Delhi Pollution Control Committee 4 th Floor, ISBT Building, Kashmere Gate Delhi-110 006	34	The Executive Engineer Public Works Department U.T. of Lakshadweep Kavaratti – 682555 Lakshadweep

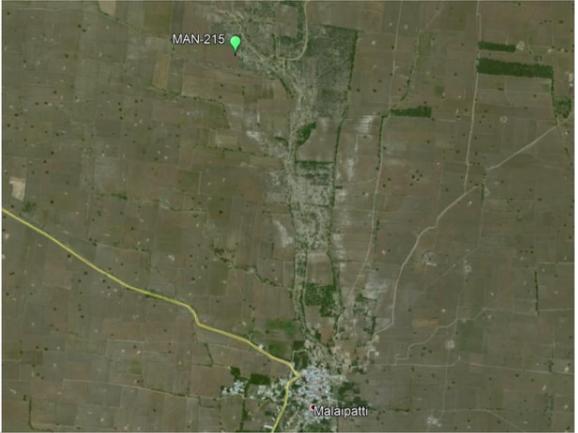
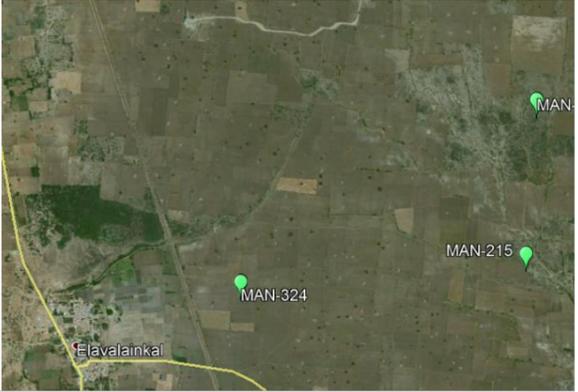
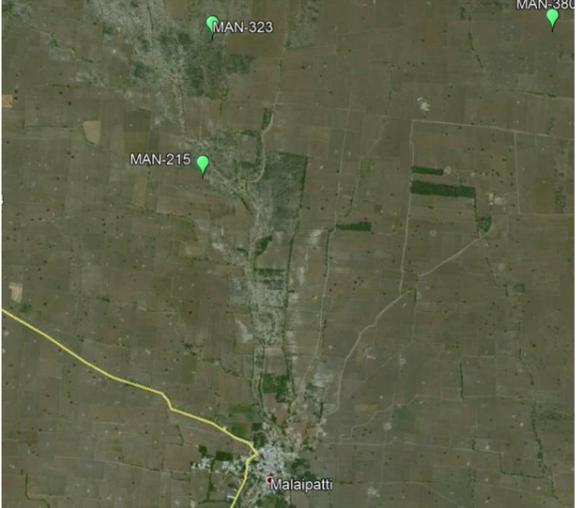
APPENDIX D:SITE SURROUNDING OF 105 WTG LOCATIONS

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
1	MAN-125	811777	984636	812481 E 985833 N	Kothali	Private Land	Dry agricultural Land	Kothali Village	1.25 km NE	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				Ammalpatti village				1.44 km W					
2	MAN-322	820766	992594	821344 E 990911 N	Kudhiraikulam	Private Land	Dry agricultural Land	Om Saravanapuram Village	1.73 km SE	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				820366 E 994130 N				Sangampatti	1.64 km N				
3	MAN-158	810306	995127	811351 E 994353 N	Akilandapuram	Private Land	Dry agricultural Land	Nockikulam	1.19 km SE	Flat Terrain	Surrounded by Barren land		
				809484 E 994452 N				Chatrapatti village	0.98 km SW				
4	MAN-321	819582	993172	820366 E 994130 N	Kudhiraikulam	Private Land	Dry agricultural Land	Sangampatti	1.23 km NE	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		

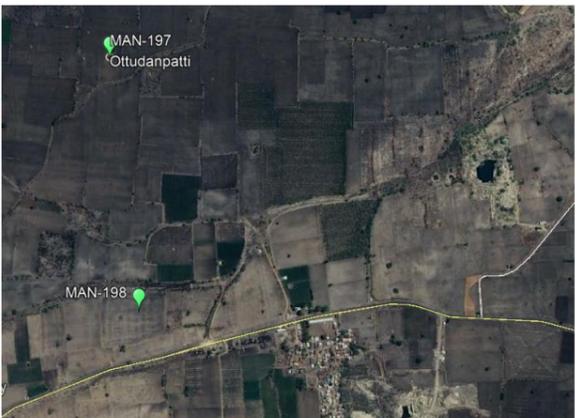
SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
5	MAN -222	820012	992114	821344 E 990911 N	Malaipatti	Private Land	Dry agricultural Land	Om Saravanapuram Village	1.72 km SE	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				820366 E 994130 N				Sangampatti	2.03 km N				
6	MAN-310	819228	1000788	820555 E 1000380 N	Vdakuandanam	Private Land	Dry agricultural Land	North Vandanam	1.38 km E	Flat Terrain	Surrounded by Cultivated & uncultivated agricultural land with few crops, weeds and thorny plants		
			8187666 E 1000189 N	puthupatti village				0.76 km SW					

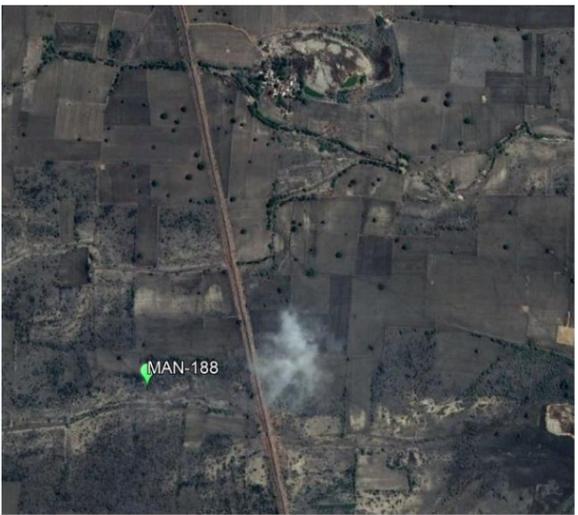
SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
7	MAN-126	810865	983032	809649 E 983016 N	Keelakottai	Private Land	Dry agricultural Land	Kalapattai village	1.15 km W	Flat Terrain	Surrounded by uncultivated land		
				Cluster of Houses				1.25 km E					
8	MAN-215	817306	990692	814951 E 990322 N	Ilavelangal	Private Land	Dry agricultural Land	Elvalainkal village	2.322 km W	Flat Terrain	Surrounded by Barren land		

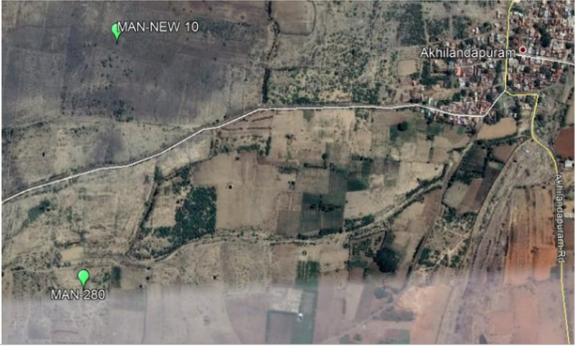
SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land	Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing									
				817732 E 989034 N			Malaipatti Village	1.62 km S				
9	MAN-323	817356	991505	814951 E 990322 N	Malaipatti	Private Land Dry agricultural Land	Elvalainkal village	2.60 km SW	Flat Terrain	Surrounded by Barren land		
				817732 E 989034 N			Malaipatti Village	2.35 km S				

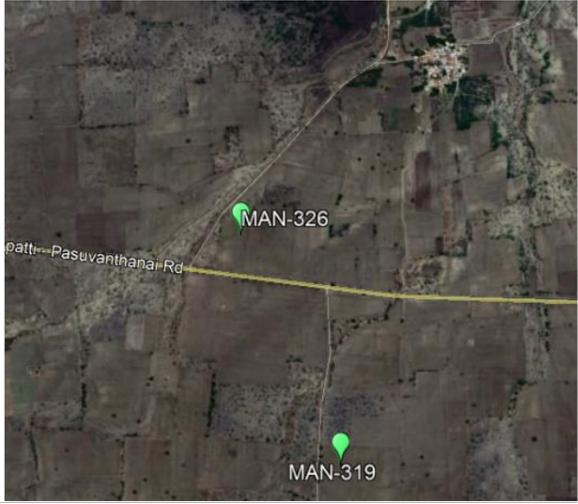
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		Easting	Northing										
				814299 E 992140 N				Onamakulam	3.12 km NW				
10	MAN-199	816538	996011	815994 E 996604 N	Ottudanpatti	Private Land	Dry agricultural Land	cluster of Houses	0.63 km NW	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				818438 E 995449 N				Chokkalingapuram	1.88 km SE				
11	MAN-135	810925	988843	808851 E 988799 N	Pannikulam	Private Land	Dry agricultural Land	Cluster of Houses	3.60 km W	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		

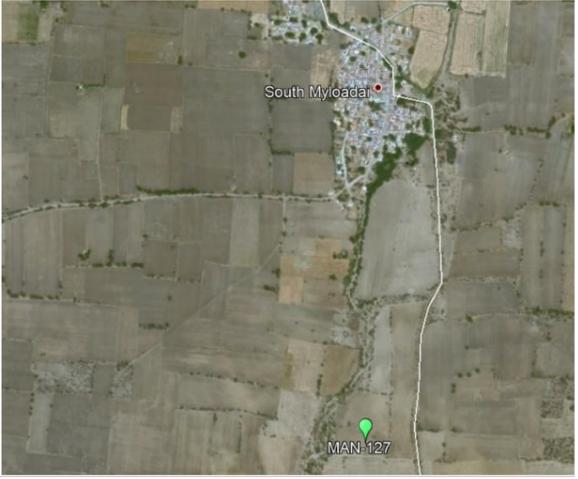
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		Easting	Northing			Private Land	Dry agricultural Land	Cluster of Houses	0.80 km W				
12	MAN-138	809792	988917	808851 E 988799 N	Pannikulam	Private Land	Dry agricultural Land	Cluster of Houses	0.80 km W	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
13	MAN-324	815786	990531	814951 E 990322 N	Ilavelangal	Private Land	Dry agricultural Land	Elvalainkal village	0.82 km W	Flat Terrain	Surrounded by uncultivated land and the railway track is passing near by		
14	MAN-136	812172	989090	813154 E 989176 N	Thennampatti	Private Land	Barren land	Cluster of Houses	0.98 km E	Flat Terrain	Surrounded by Barren land		
15	MAN-307	817306	1000392	8187666 E 1000189 N	Koppampatti	Private Land	Dry agricultural Land	puthupatti village	1.45 km E	Flat Terrain	Surrounded by uncultivated land		

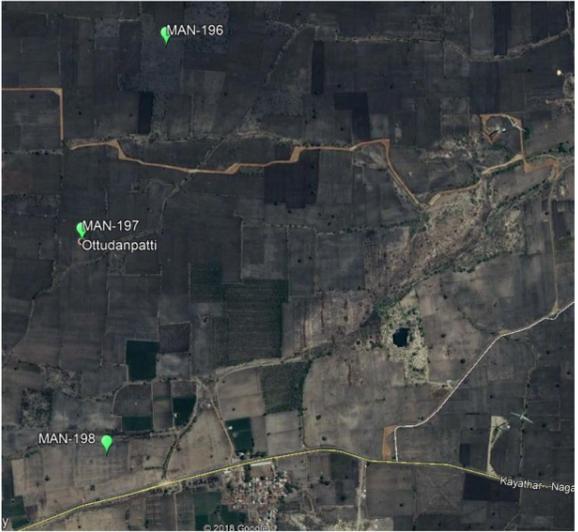
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		Easting	Northing										
				816778 E 1001184 N				cluster of Houses	0.95 km N				
16	MAN-301	812097	1001412	813116 E 1000994 N	Sundaresawar apuram	Private Land	Barren land	Kammapatti Village	1.09 km SE	Flat Terrain	Surrounded by Barren land		
17	MAN-197	815368	997457	815994 E 996604 N	Kadambur	Private Land	Dry agricultural Land	cluster of Houses	0.96 km SE	Flat Terrain	Surrounded by uncultivated land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				814546 E 996480 N				Chidamparapuram Colony	1.22 km SW				
18	MAN-188	813932	999215	815164 E 999117 N	Ottudanpatti	Private Land	Barren land	Mumalaipattai	1.15 km E	Flat Terrain	Surrounded by Barren land		
				814251 E 999910 N				cluster of Houses	0.75 km NE				

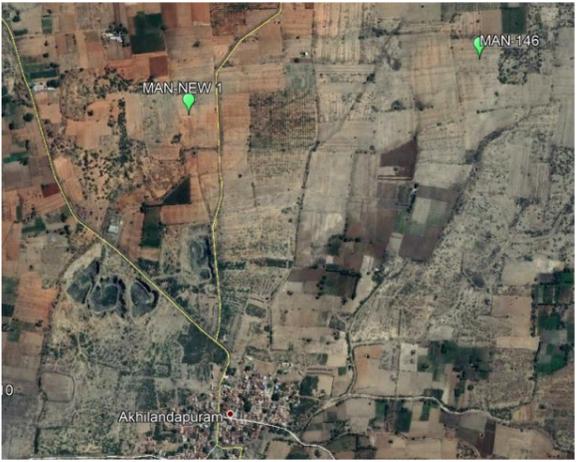
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		Easting	Northing										
19	MAN-280	807143	994093	808227 E 994694 N	Akilandapuram	Private Land	Dry agricultural Land	Akhilandapuram Village	1.03 km NE	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				Cluster of Houses				1.24 km SE					
20	MAN-319	820357	995922	820366 E 994130 N	K.Kumarapuram	Private Land	Dry agricultural Land	Sangampatti	1.69 km S	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				Chokkalingapuram				1.95 km W					

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				820667 E 997211 N				Kalingapatti	1.27 km N				
21	MAN-123	810991	986076	809903 E 986067 N	Kalapaipatti	Private Land	Dry agricultural Land	South Myloadai	1.03 km W	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				812481 E 985833 N				Kothali Village	1.42 km E				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
22	MAN-127	809888	985348	809903 E 986067 N	Kalapaipatti	Private Land	Dry agricultural Land	South Myloadai	0.75 km N	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				810405 E 984236 N				Ammalpatti village	1.19 km S				
23	MAN-328	818302	999265	8187666 E 1000189 N	Koppampatti	Private Land	Barren land	puthupatti village	1.04 km NE	Flat Terrain	Surrounded by Barren land with few weeds and thorny plants		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				820433 E 998891 N				South vandanam	1.98 km E				
24	MAN-196	815660	998146	816778 E 1001184 N	Ottudanpatti	Private Land	Barren land	cluster of Houses	1.08 km N	Flat Terrain	Surrounded by uncultivated barren land		
				817772 E 998127 N				Kuppanapuram	2.00 km E				
				815994 E 996604 N				cluster of Houses	1.52 km S				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				814546 E 996480 N				Chidamparapuram Colony	1.96 km SW				
25	MAN-194	816770	999568	8187666 E 1000189 N	Koppampatti	Private Land	Barren land	puthupatti village	1.97 km E	Flat Terrain	Surrounded by Barren land with few weeds and thorny plants		
				816778 E 1001184 N				cluster of Houses	1.60 km W				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
26	MAN-146	809041	995856	807388 E 996236 N	Kapulingampatti	Private Land	Dry agricultural Land	Karisalkulam	1.63 km W	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				808227 E 994694 N				Akhilandapuram Village	1.22 km SW				
27	MAN-297	811317	999757	810710 E 999640 N	Sivagnanapuram	Private Land	Dry agricultural Land	Senivelalapuram	0.63 km W	Flat Terrain	Surrounded by uncultivated land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
28	MAN-326	820022	996672	818438 E 995449 N	K.Kumarapuram	Private Land	Dry agricultural Land	Chokkalingapuram	0.8 km NE	Flat Terrain	Surrounded by uncultivated land		
				820667 E 997211 N				Kalingapatti	1.96 km SW				

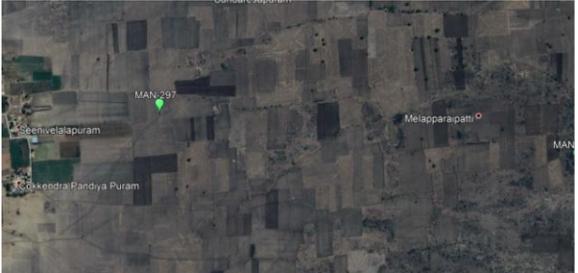
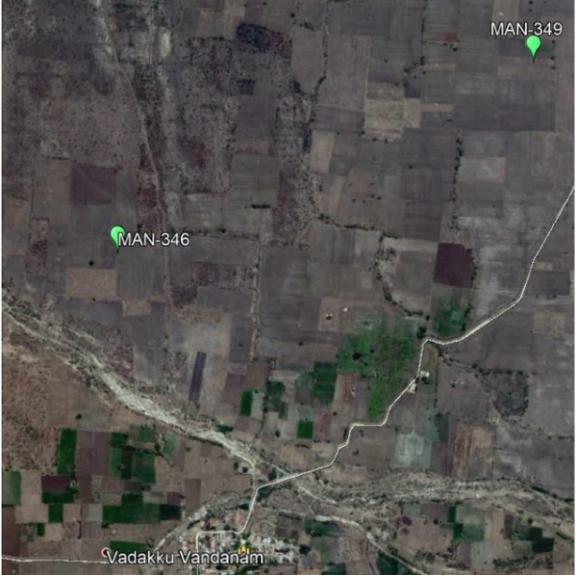
SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
29	MAN-320	820169	993759	820366 E 994130 N	Kudiraikulam	Private Land	Dry agricultural Land	Sangampatti	0.48 km NE	Flat Terrain	Surrounded by uncultivated land		
30	MAN-346	820089	1001245	820555 E 1000380 N	Vadakuva nam	Private Land	Dry agricultural Land	North Vandanam	1.03 km S	Flat Terrain	Surrounded by uncultivated land		
				818744 E 1001931 N				cluster of Houses	1.54 km NW				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
31	MAN-355	810018	988401	808851 E 988799 N	Terku mailodai	Private Land	Dry agricultural Land	Cluster of Houses	1.10 km NW	Flat Terrain	Surrounded by uncultivated land		
32	MAN-159	811005	995642	811896 E 995913 N	Thirumalapuram	Private Land	Barren land	thirumalapuram	0.89 km NE	Flat Terrain	Surrounded by Barren land with few weeds and thorny plants		
				811351 E 994353 N				Nockikulam	1.35 km SE				

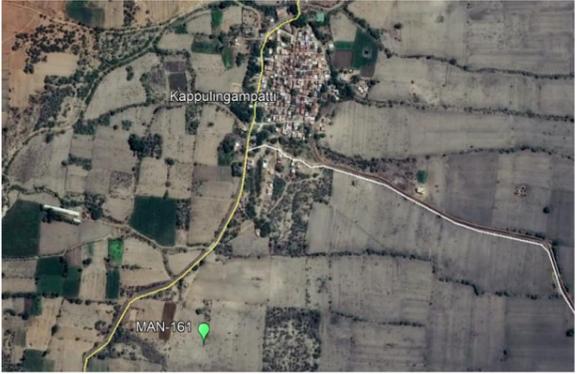
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		Easting	Northing			Private Land	Dry agricultural Land					
33	MAN-353	820167	991285	821344 E 990911 N	Malaipatti	Private Land	Dry agricultural Land	Om Saravanapuram Village	1.15 km E	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants	
34	MAN-380	819352	991563	821344 E 990911 N	Malaipatti	Private Land	Dry agricultural Land	Om Saravanapuram Village	2.04 km E	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants	
35	MAN-311	818339	998690	820433 E 998891 N	Kuppanapuram	Private Land	Barren land	South vandanam	1.93 km E	Flat Terrain	Surrounded by Barren land with few weeds and thorny plants	

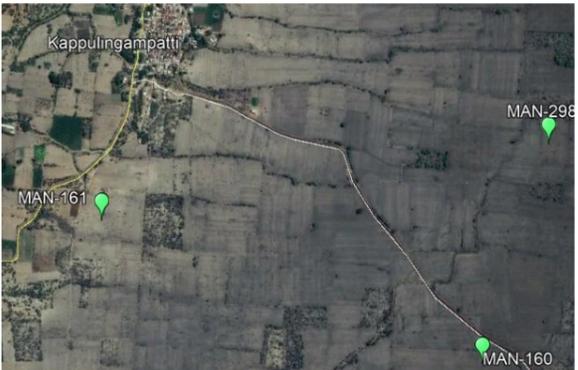
SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				820023 E 997992 N				Therku vandanam Pond	1.88 km SE				
				817772 E 998127 N				Kuppanapuram	0.88 km SE				
36	MAN-312	820370	999605	820555 E 1000380 N	Terku vandanam	Private Land	Dry agricultural Land	North Vandanam	0.66 km N	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				8187666 E 1000189 N				puthupatti village	1.68 km NW				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				820433 E 998891 N				South vandanam	0.76 km S				
37	MAN-189	813472	998267	814027 E 996407 N	K.Chidambara puram	Private Land	Barren land	Parumbu kottai	1.72 km S	Flat Terrain	Surrounded by Barren land with few weeds and thorny plants		
				815164 E 999117 N				Mumalaipattai	1.83 km NE				
38	MAN-299	813308	999538	814251 E 999910 N	K.Chidambara puram	Private Land	Barren land	cluster of Houses	1.05 km E	Flat Terrain	Surrounded by Barren land with few weeds and thorny plants		

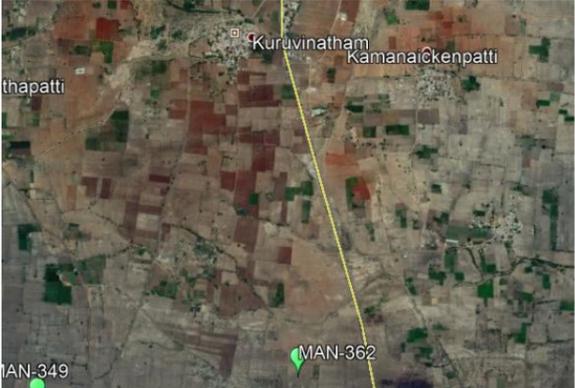
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		Easting	Northing										
				810710 E 999640 N				Senivelalapuram	2.59 km W				
39	MAN-349	821322	1001818	821895 E 1001669 N	Vadaku vandanam	Private Land	Dry agricultural Land	PGCIL	0.5 km SE	Flat Terrain	Surrounded by uncultivated land		
				820555 E 1000380 N				North Vandanam	1.72 km SW				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				820882 E 1003591 N				Elanthapatti village	1.71 km N				
40	MAN-361	824016	1001364	823986 E 1001124 N	Achankulam	Private Land	Dry agricultural Land	Temple	0.25 km S	Flat Terrain	Surrounded by uncultivated land		
				825381 E 1001186 N				Tottampattai village	1.29 km SE				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
41	MAN-161	809818	996870	810011 E 997328 N	Kappulingampatti	Private Land	Dry agricultural Land	Kappulingampatti Village	0.51 km N	Flat Terrain	Surrounded by Uncultivated agricultural & Barren land with few weeds and thorny plants		
				cluster of Houses				1.12 km W					
42	MAN-379	816023	999177	816778 E 1001184 N	Ottudanpatti	Private Land	Barren land	cluster of Houses	0.79 km W	Flat Terrain	Surrounded by barren land with few weeds and thorny plants		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				817772 E 998127 N				Kuppanapuram	1.96 km SE				
43	MAN-160	810978	996446	811896 E 995913 N	Tirumalapuram	Private Land	Dry agricultural Land	thirumalapuram	1.04 km SE	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				810011 E 997328 N				Kappulingampatti Village	1.28 km N				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
44	MAN-350	822093	1001229	821895 E 1001669 N	Achankulam	Private Land	Dry agricultural Land	PGCIL	0.45 km N	Flat Terrain	Surrounded by uncultivated agricultural land with few weeds and thorny plants		
				823793 E 1000865 N				Achankulam village	1.80 km E				
				820555 E 1000380 N				North Vandanam	1.85 km SW				
45	MAN-345	821494	1000590	821895 E 1001669 N	Vadaku vandanam	Private Land	Barren land	PGCIL	1.03 km N	Flat Terrain	Surrounded by uncultivated agricultural & barren land with few weeds and thorny plants		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph	
		Easting	Northing											
				820555 E 1000380 N				North Vandanam	1.02 km W					
				823023 E 999517 N				Govindampatti	1.86 km SE					
46	MAN-362	822783	1001996	822418 E 1003719 N	Achankulam	Private Land	Dry agricultural Land	Kuruvinatham Village	1.83 km N	Flat Terrain	Surrounded by uncultivated barren land with few weeds and thorny plants			
				822844 E 1003435 N				cluster of houses	1.41km N					
				823526 E 1002733 N				cluster of Houses	1.30 km NE					

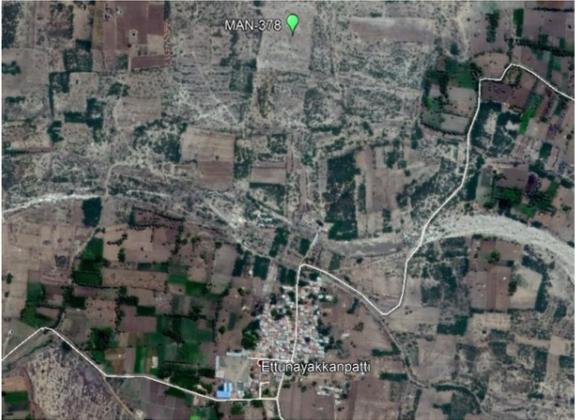
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		Easting	Northing										
				821895 E 1001669 N				PGCIL	0.96 km NW				
47	MAN-305	815032	1000238	815164 E 999117 N	Melparaipatti	Private Land	Barren land	Mumalaipattai	1,01 km S	Flat Terrain	Surrounded by uncultivated agricultural & barren land with few weeds and thorny plants		
				814251 E 999910 N				cluster of Houses	0.67 km SW				
48	MAN-340	822636	997787	820667 E 997211 N	Theethampatti	Private Land	Barren land	Kalingapatti	1.96 km W	Flat Terrain	Surrounded by uncultivated agricultural & barren land with few weeds and thorny plants		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				820451 E 998836 N				South Vandanam	2.32 km NW				
				823090 E 99471 N				Govindampatti	1.60 km NE				
				824405 E 996267 N				Nagampatti	2.27 km SE				

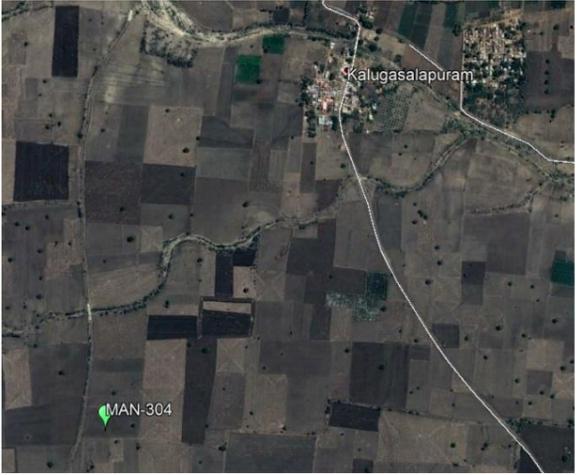
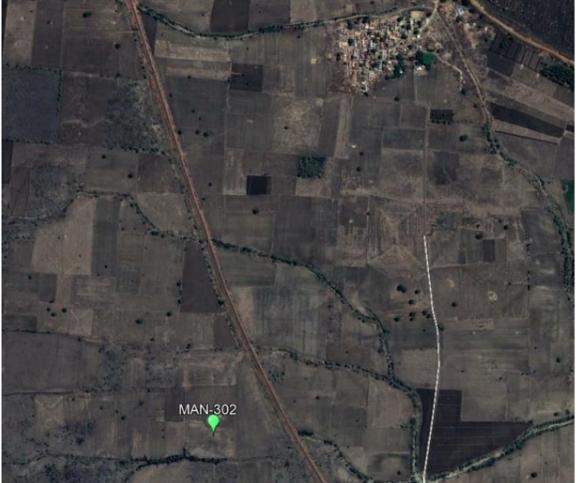
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		Easting	Northing										
49	MAN-124	811942	985275	812481 E 985833 N	Kothali	Private Land	Dry agricultural Land	Kothali Village	0.75 km NE	Flat Terrain	Surrounded by uncultivated agricultural & barren land with few weeds and thorny plants		
									Ammalpatti village				1.85 km SW
50	MAN-356	825881	998206	825303 E 997762 N	pasuvandhan ai	Private Land	Dry agricultural Land	Granite cutting workshop	0.72 km SW	Flat Terrain	Surrounded by uncultivated land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				826957 E 998068 N				Bommyapuram	1.11 km E				
				825250 E 998459 N				Savelapatti Village	0.68 km NW				
51	MAN-415	813078	994190	814106 E 993388 N	K.Chidambara puram	Private Land	Dry agricultural Land	Shivalingapuram	1.20 km SE	Flat Terrain	Surrounded by uncultivated land		
				811351 E 994353 N				Nockikulam	1.63 km W				

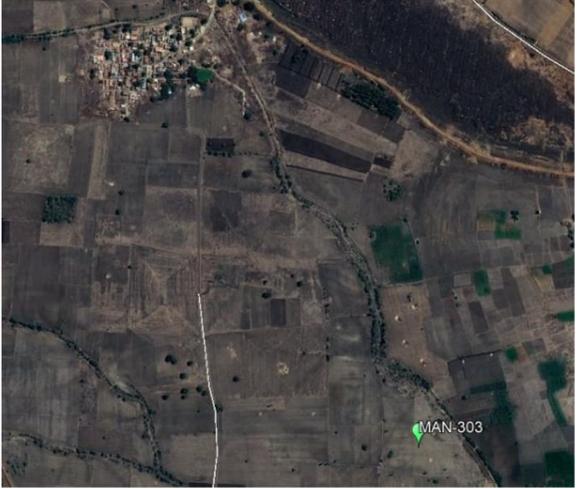
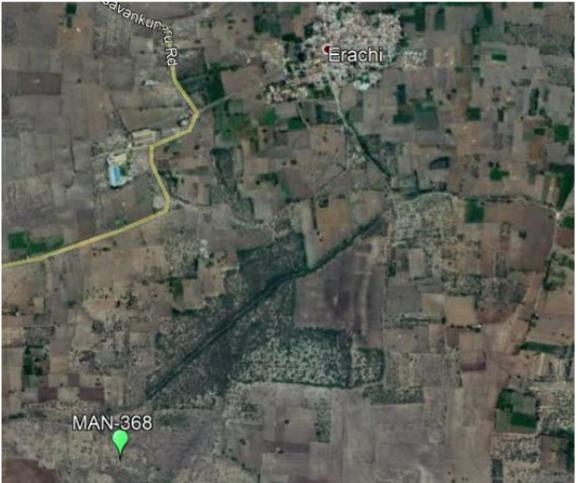
SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing			Private Land	Dry agricultural Land						
52	MAN-352	810353	986610	809903 E 986067 N	Kalappaipatti	Private Land	Dry agricultural Land	South Myloadai	0.65 km S	Flat Terrain	Surrounded by uncultivated land		
53	MAN-366	821463	1004591	822720 E 1004863 N	Thuraiyur	Private Land	Dry agricultural Land	Kamanayakam pattai Village	1.10 km E	Flat Terrain	Surrounded by cultivated land		
				820038 E 1004483 N				koppampattai village	1.35 km W				
				820867 E 1003611 N				Elanthapatti village	0.88 km SW				
				822406 E 1003846 N				Kuruvinatham Village	1.06 km SE				

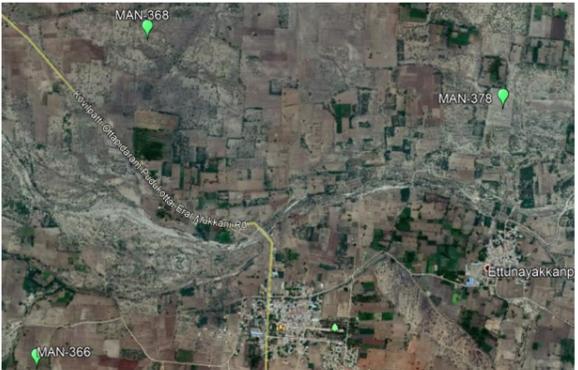
SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
54	MAN-378	823908	1005970	825121 E 1006274 N	Kamanaikanpatti	Private Land	Barren land	Semaputhur Village	1.13 km E	Flat Terrain	Surrounded by Barren land		
				823917 E 1005208 N				Ettunayakanpatti Village	0.63 km S				
55	MAN-185	812187	997753	810011 E 997328 N	K.Chidambaram	Private Land	Barren land	Kappulingampatti Village	2.12 km W	Flat Terrain	Surrounded by Barren land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				814027 E 996407 N				Parumbu kottai	2.00 km SE				
56	MAN-304	814167	1000770	813736 E 1000349 N	Melparaipatti	Private Land	Dry agricultural Land	Cluster of houses	0.56 km SW	Flat Terrain	Surrounded by uncultivated land		
				813116 E 1000994 N				Kammapatti Village	1.04 km W				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				814820 E 1001744 N				Kalugasalapuram	1.04 km NE				
57	MAN-302	812409	1002465	813752 E 1002446 N	Kurumalai	Private Land	Dry agricultural Land	cluster of houses	1.29 km E	Flat Terrain	Surrounded by uncultivated agricultural & barren land with few weeds and thorny plants and near by railway track passing		
				812882 E 1003561 N				cluster of houses	1.09 km NE				
58	MAN-201	814499	994230	814614 E 994624 N	Sankaraperi	Private Land	Barren land	cluster of houses	0.35 km N	Flat Terrain	Surrounded by Barren land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				815153 E 994497 N				Kodangal village	0.61 km NE				
				814106 E 993388 N				Shivalingapuram	0.86 km SW				
59	MAN-303	1001626	813536	813752 E 1002446 N	Kurumalai	Private Land	Dry agricultural Land	cluster of houses	0.29 km S	Flat Terrain	Surrounded by uncultivated land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				814184 E 1003196 N				Kurumalai Village	0.77 km NE				
				812882 E 1003561 N				cluster of houses	1.06 km NW				
60	MAN-368	822032	1006315	822801 E 1007751 N	thuraiyur	Private Land	Barren land	Erachi Village	1.52 km NE	Flat Terrain	Surrounded by barren land with few weeds and thorny plants		

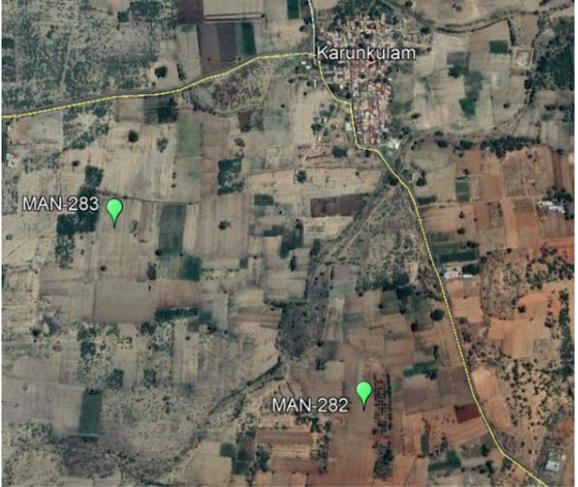
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		Easting	Northing										
				820827 E 1006809 N				Duraiyur Village	1.26 km NW				
				822720 E 1004863 N				Kamanayakam pattai Village	1.47 km SE				
61	MAN-184	812387	997062	811896 E 995913 N	K.chidambarapuram & Thirumalapuram	Private Land	Barren land	thirumalapuram	1.14 km SW	Flat Terrain	Surrounded by barren land with few weeds and thorny plants		
				814027 E 996407 N				Parumbu kottai	1.57 km SE				

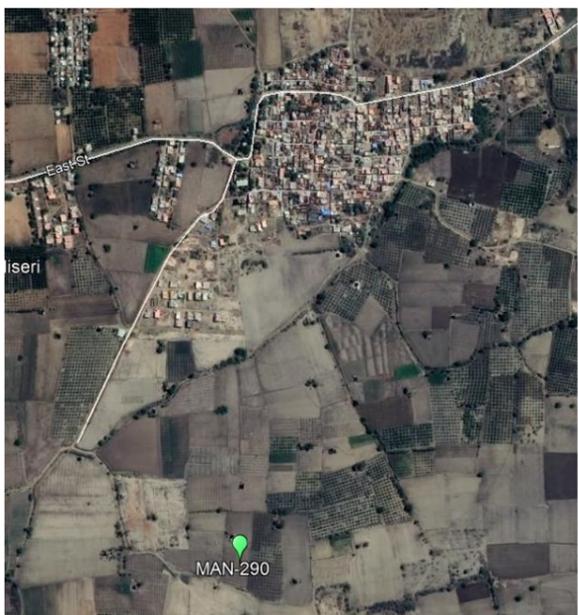
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		Easting	Northing			Private Land	Barren land						
62	MAN-384	811558	1003023	812882 E 1003561 N	kurumalai	Private Land	Barren land	cluster of houses	1.34 km NE	Flat Terrain	Surrounded by barren land with few weeds and thorny plants		
63	MAN-377	824883	1003520	825340 E 1003746 N	Kamanaikanpatti	Private Land	Barren land	Athikinar Village	0.50 km E	Flat Terrain	Surrounded by barren land with few weeds and thorny plants		
				823943 E 1002858 N				Cluster of Houses	1.10 km SW				
				823532 E 1003611 N				Sevelpatti Village	1.28 km W				

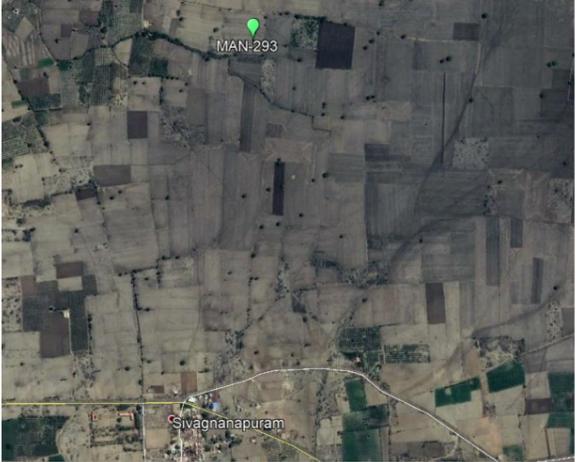
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		Easting	Northing										
64	MAN-388	807678	990926	807982 E 990381 N	Pannikulam	Private Land	Dry agricultural Land	Cluster of Houses	0.65 km S	Flat Terrain	Surrounded by uncultivated land		
65	MAN-412	812034	993253	811351 E 994353 N	Sankareperi	Private Land	Barren land	Nockikulam	1.29 km NW	Flat Terrain	Surrounded by Barren land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				813054 E 992372 N				Cluster of Houses	1.32 km SE				
66	MAN-417	812775	992818	813054 E 992372 N	Sankareperi	Private Land	Barren land	Cluster of Houses	0.49 km SE	Flat Terrain	Surrounded by Barren land		
67	MAN-147	808404	996300	808700 E 996389 N	Akilandapuram	Private Land	Dry agricultural Land	cluster of Houses	0.29 km E	Flat Terrain	Surrounded by cultivated land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				807388 E 996236 N				Karisalkulam	0.97 km W				
68	MAN-148	807551	996955	807388 E 996236 N	Akilandapuram	Private Land	Barren land	Karisalkulam	0.68 km S	Flat Terrain	Surrounded by barren land with few weeds and thorny plants		
				808084 E 997783 N				Cluster of Houses	0.92 km NE				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
69	MAN-162	809358	997578	810011 E 997328 N	Sivagnanapuram	Private Land	Barren land	Kappulingampatti Village	0.61 km SE	Flat Terrain	Surrounded by Barren land		
				808084 E 997783 N				Cluster of Houses	1.20 km W				
70	MAN-282	807382	995425	807388 E 996236 N	Akilandapuram	Private Land	Dry agricultural Land	Karisalkulam	0.658 km N	Flat Terrain	Surrounded by uncultivated agricultural land		

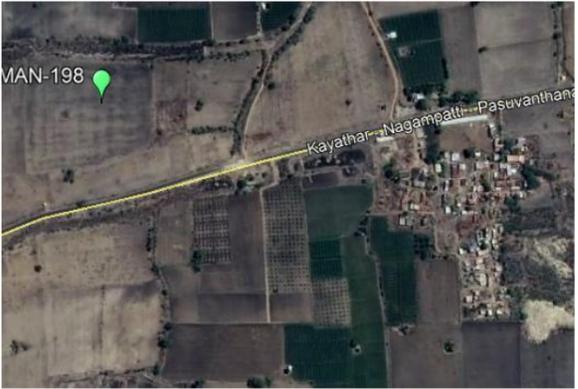
SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				808227 E 994694 N				Akhilandapuram Village	1.04 km SE				
71	MAN-283	806772	995861	807388 E 996236 N	Akhilandapuram	Private Land	Dry agricultural Land	Karisalkulam	0.62 km NE	Flat Terrain	Surrounded by uncultivated agricultural land		
72	MAN-290	808443	1000640	808652 E 1001403 N	Asoor	Private Land	Dry agricultural Land	Villiseri Village	0.65 km N	Flat Terrain	Surrounded by uncultivated agricultural land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				809237 E 999818 N				Shivagananpur am Village	0.92 km SE				
73	MAN-293	809427	1001079	808652 E 1001403 N	Villiseri	Private Land	Dry agricultural Land	Villiseri Village	0.76 km NW	Flat Terrain	Surrounded by uncultivated agricultural land		
				809237 E 999818 N				Shivagananpur am Village	1.20 km S				
74	MAN-298	811173	997111	810011 E 997328 N	Kappulingamp atti	Private Land	Barren land	Kappulingampa tti Village	1.16 km W	Flat Terrain	Surrounded by Barren land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
75	MAN 313	824931	1000700	825381 E 1001186 N	Achankulam	Private Land	Dry agricultural Land	Tottampattai village	0.58 km NE	Flat Terrain	Surrounded by cultivated land		
				824247 E 1000870 N				Cluster of houses	0.68 km NW				
76	MAN 314	825657	998904	826957 E 998068 N	Thottampatti	Private Land	Barren land	Bommyapuram village	1.55 km SE	Flat Terrain	Surrounded by Barren land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				825250 E 998459 N				Savelapatti Village	0.46 km SW				
				824586 E 999004 N				Theethampatti village	0.97 km W				
77	MAN 351	825435	999891	824586 E 999004 N	Thottampatti	Private Land	Barren land	Theethampatti village	1.59 km SW	Flat Terrain	Surrounded by Barren land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				823861 E 1000825 N				Achankulam village	1.07 km NW				
				825381 E 1001186 N				Tottampattai village	0.61 km N				
78	MAN-149	807477	997640	808084 E 997783 N	Akilandapuram	Private Land	Dry agricultural Land	Cluster of Houses	0.53 km E	Flat Terrain	Surrounded by cultivated land		
				806327 E 997949 N				Cluster of Houses	1.24 km W				

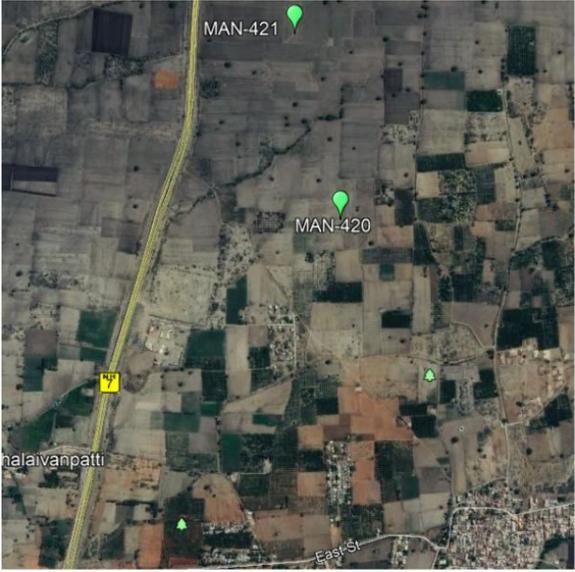
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		Easting	Northing										
79	MAN-183	812615	995895	811896 E 995913 N	Thirumalapuram	Private Land	Dry agricultural Land	thirumalapuram	0.69 W	Flat Terrain	Surrounded by uncultivated agricultural land		
				814027 E 996407 N				Parumbu kottai	1.37 NE				
80	MAN-198	815461	996710	815994 E 996604 N	Kadambur	Private Land	Barren land	cluster of Houses	0.47 km SE	Flat Terrain	Surrounded by Barren land		

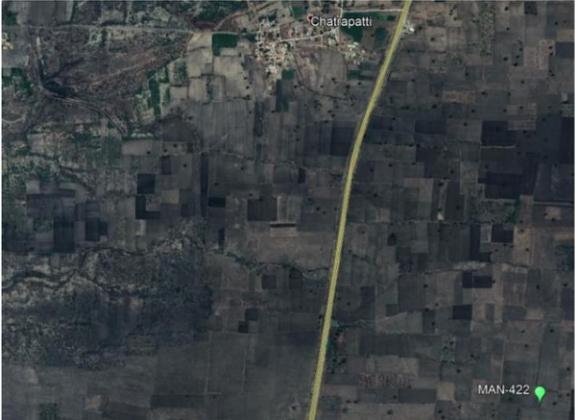
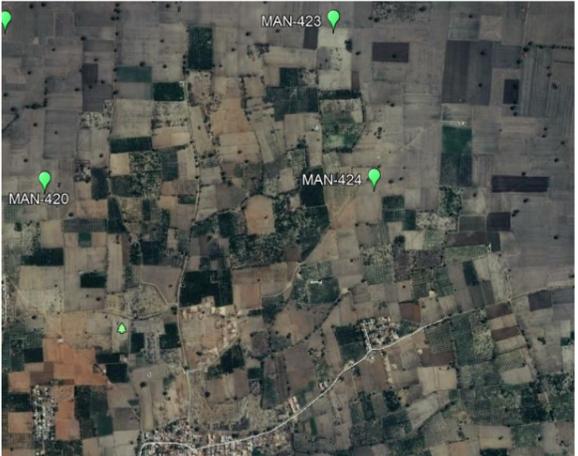
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		Easting	Northing										
				814546 E 996480 N				Chidamparapuram Colony	0.89 km W				
81	MAN-295	810363	1001754	809315 E 1001912 N	Villiseri	Private Land	Dry agricultural Land	Cluster of Houses	0.99 km W	Flat Terrain	Surrounded by uncultivated agricultural land		
82	MAN-296	810875	1000934	810710 E 999640 N	Villiseri	Private Land	Barren land	Senivelalapuram	1.23 km S	Flat Terrain	Surrounded by barren land with few weeds and thorny plants		
				808652 E 1001403 N				Villiseri Village	2.15 km NW				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
83	MAN-387	807431	990053	807124 E 989885 N	Pannikulam	Private Land	Barren land	Cluster of Houses	0.35 km SW	Flat Terrain	Surrounded by Barren land		
				807982 E 990381 N				Cluster of Houses	0.60 km NE				
84	MAN-398	810761	989495	808851 E 988799 N	Pannikulam	Private Land	Dry agricultural Land	Cluster of Houses	1.80 km SW	Flat Terrain	Surrounded by uncultivated agricultural land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				809852 E 990628 N				Paneerkulam village	1.34 km NW				
85	MAN-414	811958	994677	811351 E 994353 N	Thirumalapuram	Private Land	Dry agricultural Land	Nockikulam	0.60 km W	Flat Terrain	Surrounded by cultivated land		
				811896 E 995913 N				thirumalapuram	1.22 km N				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
86	MAN-416	813777	993328	814106 E 993388 N	Sankaraperi	Private Land	Barren land	Shivalingapuram	0.32 km E	Flat Terrain	Surrounded by Barren land		
				813831 E 992717 N				Cluster of houses	0.54 km S				
87	MAN-420	808108	1002445	808652 E 1001403 N	Villiseri	Private Land	Barren land	Villiseri Village	0.98 km S	Flat Terrain	Surrounded by Barren land		

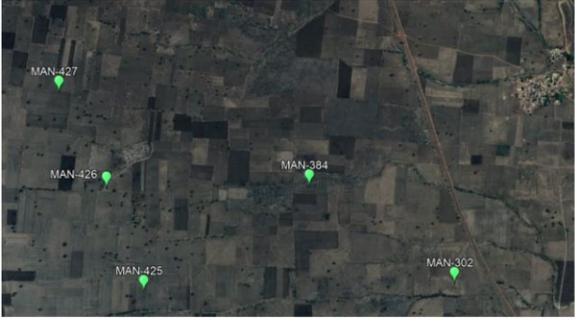
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		Easting	Northing										
88	MAN-421	807958	1003031	808652 E 1001403 N	Villiseri	Private Land	Dry Agricultural Land	Villiseri Village	1.29 km S	Flat Terrain	Surrounded by uncultivated agricultural land		
				807590 E 1003168 N				Cluster of Houses near NH	0.40 km W				
89	MAN-422	808811	1003607	807590 E 1003168 N	Villiseri	Private Land	Dry agricultural Land	Cluster of Houses near NH	1.27 km SW	Flat Terrain	Surrounded by uncultivated agricultural land		

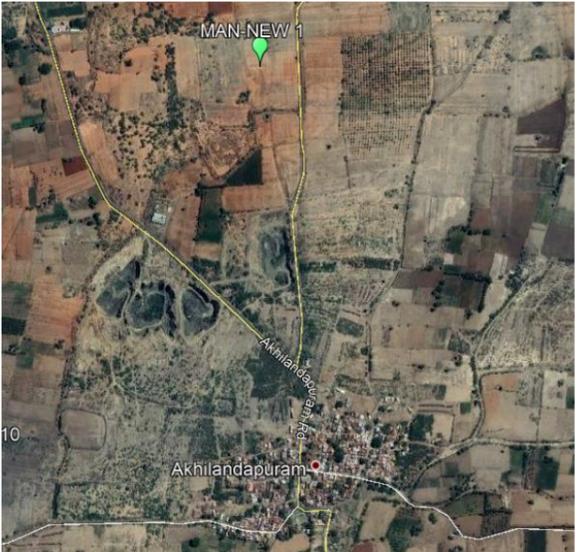
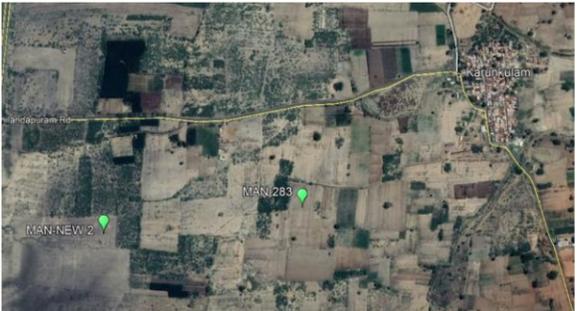
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		Easting	Northing										
				807750 E 1005362 N				Chatrapatti village	2.04 km NW				
90	MAN-423	809170	1003043	807590 E 1003168 N	Villiseri	Private Land	Dry agricultural Land	Cluster of Houses near NH	1.55 km W	Flat Terrain	Surrounded by uncultivated agricultural land		
				809315 E 1001912 N				Cluster of Houses	1.05 km S				

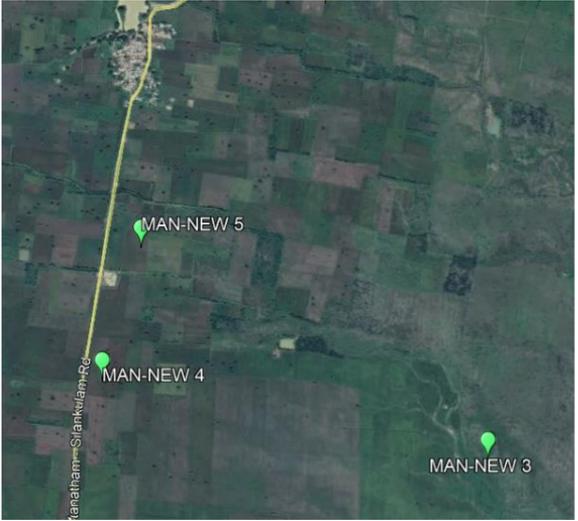
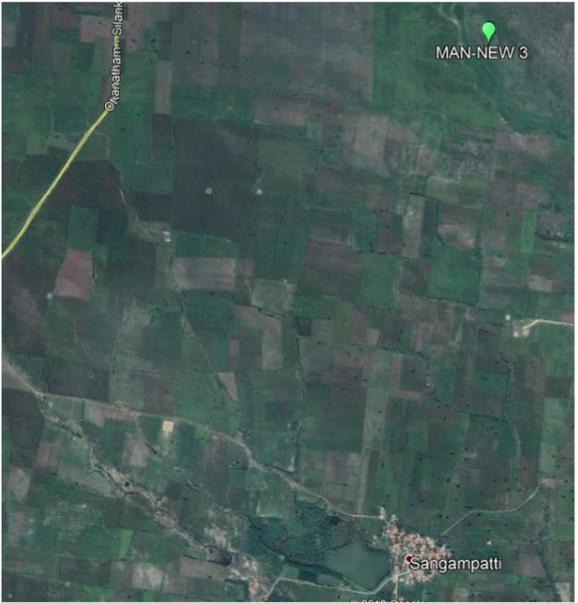
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		Easting	Northing										
91	MAN-385	807879	988834	807291 E 988624 N	Pudukottai	Private Land	Dry agricultural Land	Pudukottai Village	0.58 km W	Flat Terrain	Surrounded by uncultivated agricultural land		
				808335 E 989283 N				Cluster of Houses	0.65 km NE				
				808851 E 988799 N				Cluster of Houses	0.98 km E				

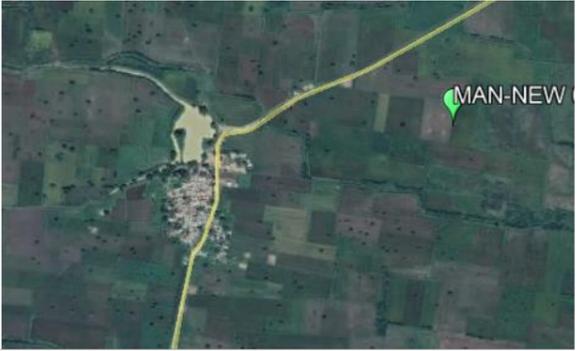
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		Easting	Northing										
				808063 E 988220 N				Pond	0.61 km S				
92	MAN-424	809325	1002465	809315 E 1001912 N	Villiseri	Private Land	Dry agricultural Land	Cluster of Houses	0.46 km S	Flat Terrain	Surrounded by uncultivated agricultural land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
93	MAN-425	810599	1002405	809315 E 1001912 N	Villiseri	Private Land	Dry agricultural Land	Cluster of Houses	1.28 km SW	Flat Terrain	Surrounded by uncultivated agricultural land		
				812882 E 1003561 N				cluster of houses	2.46 km NE				
94	MAN-426	810378	1003001	809315 E 1001912 N	Villiseri	Private Land	Dry agricultural Land	Cluster of Houses	1.40 km SW	Flat Terrain	Surrounded by uncultivated agricultural land		

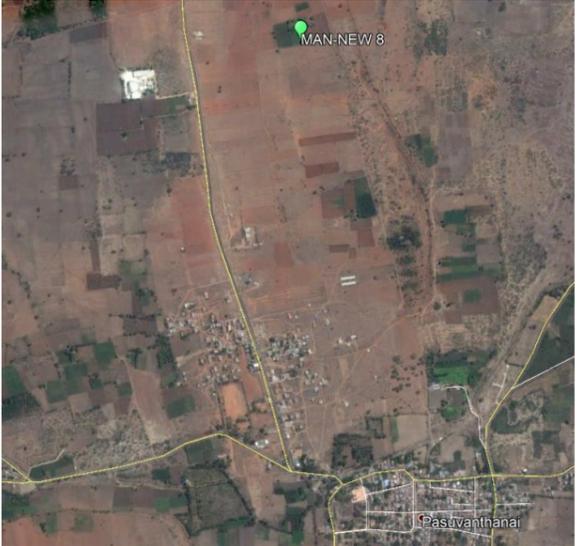
SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				812882 E 1003561 N				cluster of houses	2.44 km E				
95	MAN-427	810097	1003553	809315 E 1001912 N	Villiseri	Private Land	Dry agricultural Land	Cluster of Houses	1.75 km SW	Flat Terrain	Surrounded by uncultivated agricultural land		
				812882 E 1003561 N				cluster of houses	2.66 km E				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
96	MAN-NEW 1	808087	995667	807388 E 996236 N	Akilandapuram	Private Land	Barren land	Karisalkulam	0.78 km NW	Flat Terrain	Surrounded by Barren land		
				Akhilandapuram Village				0.86 km S					
97	MAN-NEW 2	806148	995774	807388 E 996236 N	Akilandapuram	Private Land	Barren land	Karisalkulam	1.24 km NE	Flat Terrain	Surrounded by barren land with few weeds and thorny plants		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
98	MAN-NEW 3	822736	989366	821344 E 990911 N	Sillankulam	Private Land	Dry agricultural Land	Om Saravanapuram Village	2.01 km NW	Flat Terrain	Surrounded by barren land with few weeds and thorny plants		
				822448 E 987157 N				Sangampatti Village	2.19 km S				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing			Private Land	Dry agricultural Land						
99	MAN-NEW 4	821212	989667	821344 E 990911 N	Sillankulam	Private Land	Dry agricultural Land	Om Saravanapuram Village	1.14 km N	Flat Terrain	Surrounded by uncultivated agricultural land		
100	MAN-NEW 5	821362	990187	821344 E 990911 N	Sillankulam	Private Land	Dry agricultural Land	Om Saravanapuram Village	0.62 km N	Flat Terrain	Surrounded by uncultivated agricultural land		
101	MAN-NEW 6	822081	991150	821344 E 990911 N	Sillankulam	Private Land	Dry agricultural Land	Om Saravanapuram Village	0.74 km SW	Flat Terrain	Surrounded by uncultivated agricultural land		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				823888 E 992015 N				Sillankulam Village	1.93 km NE				
10 2	MAN-NEW 7	823327	1000440	823861 E 1000825 N	Govindampatti	Private Land	Dry agricultural Land	Achankulam village	0.57 km NE	Flat Terrain	Surrounded by uncultivated agricultural land and pond near by		
				822425 E 1000575 N				Pond	0.913 km W				
10 3	MAN-NEW 8	825630	997574	825303 E 997762 N	Theethampatti	Private Land		Granite cutting workshop	0.39 km NW	Flat Terrain			

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				825128 E 997431 N				Limestone powder manufacturing yard	0.52 km W				
				826957 E 998068 N		Dry agricultural Land	Bommyapuram		0.45 km E		Surrounded by uncultivated agricultural land		
				825624 E 996620 N			Cluster of Houses/ Pauvandanai Village		0.96 km S				

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
104	MAN-NEW 9	825795	998656	826957 E 998068 N	Thottampatti	Private Land	Dry agricultural Land	Bommyapuram	1.32 km SE	Flat Terrain	Surrounded by uncultivated agricultural land		
				825250 E 998459 N				Savelapatti Village	0.49 km W				
105	MAN-NEW 10	807222	994703	808227 E 994694 N	Akilandapuram	Private Land	Barren land	Akhilandapuram Village	0.83 km E	Flat Terrain	Surrounded by barren land with few weeds and thorny plants		

SL No	Loc No	WTG co-ordinates		Geographical Coordinates of receptor	Location of WTG	Land		Type of nearest receptors		Topography	Site Surroundings	Remarks / Observations	Photograph
		Easting	Northing										
				808393 E 993673 N				Cluster of Houses	1.46 km SE				

APPENDIX E: ILO GUIDELINES

No.6

ILO HELPDESK

ASSISTANCE@ILO.ORG



International
Labour
Organization

Workers' housing

Housing provided to workers as part of the employment contract should meet certain minimum specifications in respect of the nature and standard of the accommodation and facilities to be made available.

The following guidance is based on international labour standards. National or state regulation will often set baseline specifications as part of housing, labour, health or even fire safety regulations; they should be checked and followed. National employers and workers organizations may also be a good source of information on national law, collective bargaining agreements and customs pertaining to housing for workers; or may be able to refer you to the appropriate statutory authority.

Guiding principles

➔ In providing worker¹ housing, the objective should be to ensure "adequate and decent housing accommodation and a suitable living environment"² for workers. This includes upkeep, improvement and modernisation of housing and related community facilities.³

It is "generally not desirable that employers should provide housing for their workers directly".⁴ Employers are encouraged to help their workers to obtain housing through autonomous private agencies, public housing

Housing Standards

➔ Housing should ensure "structural safety and reasonable levels of decency, hygiene and comfort".¹¹ The undertaking should ensure the following:

- a) a separate bed for each worker;
- b) adequate headroom, providing full and free movement, of not less than 203 centimetres;
- c) the minimum inside dimensions of a sleeping space should be at least 198 centimetres by 80 centimetres;
- d) beds should not be arranged in tiers of more than two;
- e) bedding materials should be reasonably comfortable;
- f) bedding and bedframe materials should be designed to deter vermin;
- g) separate accommodation of the sexes;
- h) adequate natural light during the daytime and adequate artificial light;
- i) a reading lamp for each bed;
- j) adequate ventilation to ensure sufficient movement of air in all conditions of weather and climate;
- k) heating where appropriate;
- l) adequate supply of safe potable water;
- m) adequate sanitary facilities (see below);
- n) adequate drainage;
- o) adequate furniture for each worker to secure his or her belongings, such as a ventilated clothes locker which can be locked by the occupant to ensure privacy;
- p) common dining rooms, canteens or mess rooms, located away from the sleeping areas;
- q) appropriately situated and furnished laundry facilities;
- r) reasonable access to telephone or other modes of communications, with any charges for the use of these services being reasonable in amount; and

schemes, or cooperatives.⁵ This is because workers living at the work site on property owned or controlled by the employer tend to be less integrated into the local community, and more dependent on the employer. However, certain circumstances, such as when an undertaking is located far from normal centres of population, or where the nature of the employment requires that the worker should be available at short notice may require the employer to provide housing for his or her workers.⁶

If housing is provided by the employer "the fundamental human rights of the workers, in particular freedom of association, should be recognised."⁷ Arrangements where accommodation and communal services are provided as payment for work should take care to ensure that the interests of the workers are protected. If rent is charged, it should not cost the worker more than a reasonable proportion of his or her income.⁸

Siting and construction

➔ The housing and related community facilities should be of durable construction, taking into account local conditions, such as liability to earthquakes.⁹

The location of workers' housing should ensure that workers are not affected by air pollution, surface run-off or sewage or other wastes.¹⁰

¹ Workers' Housing Recommendation, 1961 (No. 175). The section entitled "Suggestions concerning methods of application," Part I, paragraph 5, encourages "equality of treatment between migrant workers and national workers". Therefore, this guidance applies equally to migrant workers and national workers.

² R. 115, General Principles, Part II, paragraph 2.

³ R. 115, paragraph 3.

⁴ R. 115, Part IV, paragraph 12(2).

⁵ R. 115, Part IV, paragraph 12(1).

⁶ R. 115, Part IV, paragraph 12(2).

⁷ R. 115, Part IV, paragraph 12(3a).

⁸ R. 115, Part II, paragraph 4, Part IV, paragraph 12(3c) and (4).

⁹ R. 115, Suggestions Concerning Methods of Application, Part I, paragraphs 10-11.

¹⁰ R. 115, Suggestions Concerning Methods of Application, Part IX, paragraph 43.

¹¹ R. 115, paragraph 19.

- s) rest and recreation rooms and health facilities, where not otherwise available in the community.

In workers' sleeping rooms the floor area should not be less than 7.5 square metres in rooms accommodating two persons; 11.5 square metres in rooms accommodating three persons; or 14.5 square metres in rooms accommodating four persons. If a room accommodates more than four persons, the floor area should be at least 3.6 square metres per person. Rooms should indicate the permitted number of occupants.

As far as practicable, sleeping rooms should be arranged so that shifts are separated and that no workers working during the day share a room with workers on night shifts.

Provisions should be made for workers' physical safety and well-being, and protection of their belongings. Measures should be reasonable and not unduly restrict workers' freedom of movement. Workers should be allowed visits for social relations or business, including trade union business.¹²

Inspection of premises

- Premises should be inspected frequently to ensure that the accommodation is clean, decently habitable and maintained in a good state of repair. The results of each such inspection should be recorded and be available for review.

Sanitation facilities

- Adequate sanitary facilities should include a minimum of one toilet, one wash basin and one tub or shower for every six persons. They should be provided at a convenient location which prevents nuisances. Sanitary facilities provided should meet minimum standards of health and hygiene. They should also provide reasonable standards of comfort, including hot and cold fresh running water. There should be separate sanitary facilities provided for men and for women. Sanitary facilities should have ventilation to the open air, independently of any other part of the accommodation. Soap and hygienic paper should be adequately stocked.

Health and safety

- As far as possible, floors walls, ceilings and equipment should be constructed to minimize health risks.

The accommodations should be kept free of rats, mice, insects and vermin. In areas where mosquitoes are prevalent, workers should be provided netting.

Measures should be taken to prevent the spread of diseases. Separate facilities should be provided for sick workers to prevent the spread of transmissible diseases among the occupants. Fire safety measures should be taken, including installing and maintaining fire equipment (alarms, extinguishers, etc.). Workers should be trained in fire procedures. Bedding should not contain flammable materials. Radiators and other heating apparatus should be placed so as to avoid risk of fire, and shielded where necessary to prevent discomfort to occupants.

Safety exits should be clearly marked. Adequate means of escape should be provided and properly maintained.

Vacating the premises upon termination of employment

- When a worker's contract of employment is terminated, the worker should be entitled to a reasonable period of time to vacate the premises, in accordance with national law and custom.¹³

Consultation

- In the design of housing for workers, "every effort should be made to consult those bodies representative of future occupants best able to advise on the most suitable means of meeting their housing and environmental needs."¹⁴

References

- Workers' Housing Recommendation, 1961 (No. 115); full text available at: <http://www.ilo.org/ilolex/english/recdisp1.htm>.

- For comparison, you may also wish to consult the Maritime Labour Convention (MLC), 2006, Title 3, which gives detailed guidance for workers' accommodation for seafarers; full text available at: <http://www.ilo.org/ilolex/cgi-lex/convde.pl?C186>.

¹² R. 115, Suggestions Concerning Methods of Application, Part IV, paragraph 17.

¹³ R. 115, General Principles, Part IV, paragraphs 12(3b) and Suggestions Concerning Methods of Application, Part IV, paragraph 15.

¹⁴ R. 115, Suggestions Concerning Methods of Application, Part IX, paragraph 42.

ILO Helpdesk
Multinational Enterprises Programme
International Labour Office
4, route des Morillons
1211 Geneva 22, Switzerland
Tel: +41.22.799.6264
Fax: +41.22.799.6354
assistance@ilo.org

APPENDIX F: MYTRAH ENERGY QSHE POLICY



Mytrah Energy (India) Private Limited
(CIN : U40108TG2009PTC065804)
8001, S.No.109, Q-city, Nanakramguda,
Gachibowli, Hyderabad - 500032, India.
Tel: +91 40 33760100.
www.mytrah.com

Quality, Safety, Health & Environmental Policy

Policy Statement: Mytrah Energy (India) Private Limited (MEIPL), wholly owned subsidiary of Mytrah Energy Limited (MEL) with its all Special Purpose Vehicles (SPVs) are committed to provide Safe, Clean and Healthy Working Environment to its employees and stake holders as an integral part of its business ethics and philosophy.

Company reaffirms continual improvement for its Quality, Safety, Health & Environment (QSHE) performance with full satisfaction of customer in Power generation through renewable sources and transmission services by implementing a structured QSHE management framework in a sustainable and balanced manner.

Scope: Policy applies to employees, contractors across all its operative and applicable stake holders at large in the periphery of Asset management and will be displayed suitably in office/public domain

Objectives:

- 1) Ensure customer satisfaction with product and services offered by us with proper feedback mechanism.
- 2) Promote a Safe, Clean and Healthy Environment to eliminate /minimise and/or control adverse environmental impact and occupational health and safety risks arising out of our operations.
- 3) Establish and achieve QSHE objectives and Targets with adequate management plan and programs.
- 4) Adhere and comply with applicable QSHE legislations, regulations and other requirements pertaining to EHS and community at large.
- 5) Conserve natural resources and energy and promote waste avoidance and recycling measures in a sustainable way not impacting the nature.
- 6) Ensure involvement of employees, contractors, stake holders by providing appropriate training and awareness with effective communication for sound QSHE performances.
- 7) Focus on continual improvement of applicable process and performances through reporting, monitoring and reviewing at regular intervals.

Date : 21.05.2016


(Vikram Kailas)
Managing Director

APPENDIX G: GRIEVANCE REDRESSAL MECHANISM



Company/ SPV Name:			Location:			Grievance Officer /s with Mobile/s			
Month :			Year :			Note: Employee Grievance as per Company policy			
Sl No.	Grievance Date & time	Name & Address or person with Mobile no.	Gender (M/F)	Details of Issue /Problem	Mode of Sharing of Problems/ Issues	Person who attended	Action taken	Remark (Open/Close /Pending)	Remark/s of Grievance officer/s with Signature

APPENDIX H: AMBIENT AIR QUALITY MONITORING RESULTS

S. N	Village	Date of Sampling	1 PM ₁₀ µg/m ³	2 PM _{2.5} µg/m ³	3 SO ₂ µg/m ³	4 NO ₂ µg/m ³	5 CO mg/m ³
1	Pannirkulam Village	18/08/2017	36.25	20.71	7.28	13.30	<0.2
		21/08/2017	33.51	21.08	6.20	10.51	<0.2
2	Ottutanpatti Village	19/08/2017	34.55	20.14	5.50	9.63	<0.2
		22/08/2017	39.56	22.20	7.22	11.50	<0.2
3	Lakshmipuram Village	20/08/2017	38.92	22.70	5.51	10.60	<0.2
		23/08/2017	42.35	24.16	7.60	12.25	<0.2
	CPCB limit		100	60	80	80	2

APPENDIX I: SURFACE WATER QUALITY MONITORING RESULTS

S. N.	Parameter	Unit	Surface Water	
			Pannirkulam Village Pond	Drain Vadakarai Village
1	pH	---	7.84	7.11
2	Colour		160	30
3	Odour		Disagreeable	Disagreeable
4	Electrical Conductivity	mS/cm	211	2512
5	Dissolved Oxygen	mg/l	5.2	4.2
6	Biochemical Oxygen Demand	mg/l	5.5	57
7	Chemical Oxygen Demand	Mg/l	24.0	230
8	Total Dissolved Solids	mg/l	114	1465
9	Oil & Grease	mg/l	<0.1	<0.1
10	Total Hardness	mg/l	62	804
11	Chloride	mg/l	19.0	575.0
12	Sulphide as (H ₂ S)	mg/l	<0.1	<0.1
13	Nitrate	mg/l	11.6	28.7
14	Iron	mg/l	0.17	0.28
15	Mercury	mg/l	<0.001	<0.001
16	Zinc	mg/l	0.12	0.16
17	Total Coliform	MPN/100ml	68	3120
18	Faecal Coliform	---	24	1140

APPENDIX J: GROUNDWATER QUALITY MONITORING RESULTS

S.N	Parameters	Units	Test Methods	Pannirkulam village GW-01	Lakshmpuram village GW-02	IS 10500: 2012	
						Acceptable limit	Permissible limit
1	Temperature	°C		28	27		
2	pH Value	-	APHA 4500- H+B	7.26	7.74	6.5 – 8.5	--
3	Turbidity	NTU	APHA - 2130 - B	<1.0	<1.0	1	5
4	Total Hardness (as CaCO ₃)	mg/l	APHA 2340 - C	412.0	980.0	200	600
5	Iron (as Fe)	mg/l	APHA -3111-B	0.13	0.14	0.3	No relaxation
6	Chlorides (as Cl)	mg/l	APHA 4500-CL-B	177.0	426.0	250	1000
7	Fluorides (F)	mg/l	APHA - 4500 - F- B	0.16	0.29	1	1.5
8	TDS	mg/l	APHA -2540-C	887.0	1568.0	500	2000
9	Calcium	mg/l	APHA -3111-B	98.0	262	75	200
10	Magnesium	mg/l	APHA -3111-B	40.4	87.0	30	100
11	Copper	mg/l	APHA -3111-B	<0.05	<0.05	0.05	1.5
12	Nitrate (as NO ₃)	mg/l	IS 3025 P-34	2.93	6.7	45	No relaxation
13	Mercury	mg/l	IS : 3025 (P-48)	<0.001	<0.001	0.001	No relaxation
14	Arsenic	mg/l	IS : 3025 (P-37)	<0.01	<0.01	0.01	0.05
15	Zinc	mg/l	APHA -3111-B	<0.08	0.11	5	15
16	Alkalinity	mg/l	APHA -2320-B	127.0	229.0	200	600

APPENDIX K: SOCIO ECONOMIC QUESTIONNAIRE

Name of the village					Panchayat					
Tehsil/Block					District					
Respondent					Date:					
Total Population			Total Male			Total Female	HH No.			
Religion	Name	%	Name	%						
Caste/Group	Name	%	Name	%						
Education Level	Illiterate %	Primary %	Secondary %	H.S. %	Graduate %					
Occupation	Agriculture %	Business %	Service %	Labour %	Other %					
Source Drinking water facility	Tube well	Dug well	Stream	Piped water	Hand pumps					
Sanitation facility	Pit latrine %	Sanitary latrine %	Open defecation %	Other %						
Electricity (Available %)			Electricity availability in HH							
Village road type/transport facility										
Schools (distance)	Primary	Middle	H. S.	College	Anganwadi					
Health Facility (distance)	Health sub Centre	Primary	Hospital	Others						
Major diseases										
Major crops cultivated	Name	Period	Yield (q/acr)	Rate/q	Name	Period	Yield (q/acr)	Rate/q		
Irrigation Facility	Ponds		River	Groundwater	Others					
Average land holding size										
Land rights										
Livestock	Cow	Buffalo	Goat	Pig	Fowl					
	Duck	Others								
Grazing areas										

Cooking medium and source	Fuel Wood	Kerosene	Cow Dung cake	Crop Residue	LPG
	Others				
Common property Resources(CPR)	Religious and cultural places	Sacred places	Community hall	community Ponds	Cremation ground
	Streams	canal	river	Others	
Major rituals and festivals	Name	Period	Name	Period	
Fishing area		Name of the			
Forest	Wood	Timber	NTFP	Others	
Any Vulnerable Groups like- landless/homeless- people, Women headed HH, Orphans etc.					
Any program related to child / women health care program					
Any employment generation program					
HH & Cottage industries in the village / area					
Any proposed Scheme / Program related infrastructure / any amenities					
Occurrence any Natural Calamities / industrial / anthropogenic Hazard					

APPENDIX L: WORLD BANK CHANGE FIND PROCEDURE

These procedures were developed in accordance with the Lebanese regulations and the World Bank Guidelines - OP 4.11 of August 1999.

These procedures are included as standard provisions in construction contracts to ensure the protection of cultural heritage.

A clause for “**Protection of Archaeological and Historical Sites**” was added to all bidding documents for the works contract which explains the steps to follow whenever new archaeological remains, antiquity or any other object of cultural or archaeological importance are encountered during construction.

Protection of Archaeological and Historical Sites

- 1- Excavation in sites of known archaeological interest should be avoided. Where this is unavoidable, prior discussions must be held with the Directorate of Antiquities in order to undertake pre-construction excavation or assign an archaeologist to log discoveries as construction proceeds. Where historical remains, antiquity or any other object of cultural or archaeological importance are unexpectedly discovered during construction in an area not previously known for its archaeological interest, the following procedures should be applied:
 - a) Stop construction activities.
 - b) Delineate the discovered site area.
 - c) Secure the site to prevent any damage or loss of removable objects. In case of removable antiquities or sensitive remains, a night guard should be present until the responsible authority takes over.
 - d) Notify the responsible foreman/archaeologist. Who in turn should notify the responsible authorities, the General Directorate of Antiquities and local authorities (within less than 24 hours).
 - e) Responsible authorities would be in charge of protecting and preserving the site before deciding on the proper procedures to be carried out.
 - f) An evaluation of the finding will be performed by the General Directorate of Antiquities. The significance and importance of the findings will be assessed according to various criteria relevant to cultural heritage including aesthetic, historic, scientific or research, social and economic values.
 - g) Decision on how to handle the finding will be reached based on the above assessment and could include changes in the project layout (in case of finding an irrevocable remain of cultural or archaeological importance), conservation, preservation, restoration or salvage.
 - h) Implementation of the authority decision concerning the management of the finding.
 - i) Construction work could resume only when permission is given from the General Directorate of Antiquities after the decision concerning the safeguard of the heritage is fully executed.

APPENDIX M: MOM OF STAKEHOLDER CONSULTATIONS

Type of Stakeholder	Panchayat Members	
Agenda	Stakeholder meeting for proposed Wind Power Project in Thoothukudi district, Tamilnadu	
Date of Meeting	18/08/2017 & 19/08/2017	
Venue	Panchayat office	
List of participants	Arcadis Personnel	
Bhakya Selvi, Maniya Sewan Mandhira Mourty, Bhakya Selvi Maniya Sewan, Mandhira Mourty Kani Thai, Subbuthai Alban Semani Vishwasalkovi Chenadurai, Sakkiama, Karthik Muthu, V. Muthu Pandiya M Durai, Rama Laxmi, Ettu Raj, SVSP Nagarajan, SVSP Kulandhai Raja, Nagarasjan Shanmugeiya, Mari Muthu Jayarama, Thamilmami, Aarumuga Pandiyan, Guru Nathan, Chinnana Durai, Murugan	Mr. Jaydeep Banerjee Mr. Alok Chandra Adhikari	
Issues Discussed	Findings	
<ul style="list-style-type: none"> • Socio-Economic condition in the study area Villages, available infrastructural facilities and their utilization by the local community • Agricultural scenario and major Crops cultivated in study area villages (also the Irrigation Facility in study area villages) • Health facilities in study area villages • Sanitation facilities in study area villages • The circle rate of district and study area villages • Market rates (Land) in study area villages • Average land holding Size in the study area villages • NOC from Panchayat • Ongoing Govt. schemes and programmes 	<ul style="list-style-type: none"> • Area is majorly dependent on agriculture, cattle rearing and allied activities for livelihood. Few agricultural activity which involves cultivation of paddy, bengal gram (locally called cholam), ragi, curry leaves etc. And commercial crops like cotton, chilly, sugarcane and groundnut. etc. • The agriculture is mostly rain-fed and irrigation facilities are not available to maximum numbers of farmers. • Access to health services is limited only to some of the study area villages. Out of 20 villages and 1 town area only Kadambur town have a primary health centre (PHC). • It was informed by both Panchayat Samiti and community that piped water supply system through reservoirs (overhead tanks) exists in all the study area villages. Water is supplied through taps at central locations of different localities. • 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. • Auto-rickshaw, Private and Govt. Buses are the major mode of transportation in the study area. Self-owned motor cycles and bicycles are frequently used private transport for the villagers. • The process of NOC not yet Initiated 	

Type of Stakeholder	Health Staff	
Agenda	Stakeholder meeting for proposed Wind Power Project in Maniyachi district, Tamilnadu	
Date of Meeting	18/08/2017	
Venue	Primary Health Centre, Kadambur	
List of participants	Arcadis Personnel	
Dr. Raj Kumar (BM) Dr. Priyadarshini (MO)	Mr. Jaydeep Banerjee Mr. Alok Chandra Adhikari	
Issues Discussed	Findings	
<ul style="list-style-type: none"> • Health facilities at Kadambur PHC • Common diseases • Emergency plan (Ambulance facility) 	<ul style="list-style-type: none"> • Consultation with the Medical Officer and Block Medical officer was held to develop understanding of the disease profile which exists in the project villages. The discussion also tried to identify the special health concerns in these villages. The key findings of the discussion are as follows: • The Kadambur village has only one Primary Health Centre. Basic facilities like generic medicines, ORS, weighing machine, BP machine, thermometer etc. are available in Health Centre. • The Health Assistant maintains sufficient stock of medicines and provides it to the villagers. The common diseases reported from the study area are urinary tract infection, cough, cold and malaria resulting from mosquito bites. • ANM visits at least once per week in most of the study area villages. In emergency cases, people travel about 10 to 15 km away to avail Kayathar and Kovilpatti government hospitals. Both Kayathar and Kovilpatti also have a few private hospitals. • Child birth facilities are also available in PHC. • RO water facilities are available in PHC. • The PHC covers more than 50 villages in the study area. 	

Type of Stakeholder	ICDS Worker	
Agenda	Stakeholder meeting for proposed Wind Power Project in Maniyachi district, Tamilnadu	
Date of Meeting	18/08/2017	
Venue	Anganwadi, Panneerkkulam village	
Participants		Arcadis Personnel
Mrs. N Vennila		Mr. Jaydeep Banerjee Mr. Alok Chandra Adhikari
Issues Discussed		Findings
<ul style="list-style-type: none"> • Infrastructure of ICDS centre • Facility available of ICDS centre 		<ul style="list-style-type: none"> • The enrolment rate in the AWC is up to 35 children. • Children, in the Anganwadi centres normally sit on chair. • It was told by the ICDS worker that electricity is available almost 24 hours. • It was informed by ICDS worker that piped water supply system through reservoirs (overhead tanks). • RO water is not available within the ICDS Centre. They consume untreated water from panchayat overhead tank located closely.

Type of Stakeholder	School Teacher	
Agenda	Stakeholder meeting for proposed Wind Power Project in Maniyachi district, Tamilnadu	
Date of Meeting	18/08/2017 & 21/08/2017	
Venue	Govt. Primary School, Ottudanpatti Village & R C Middle School, Panneerkkulam	
List of participants		Arcadis Personnel
Ms. A Jeyarani (HM) Ms. S Padma (Asst. Teacher) Mr. Xavier (HM) Ms. S. Vijaya Ms. Sagaya Durachi Mr. Thomas Santhi		Mr. Jaydeep Banerjee Mr. Alok Chandra Adhikari
Issues Discussed		Findings
<ul style="list-style-type: none"> • The basic infrastructure facilities of School • Present education status of School • Present facility available of School 		<ul style="list-style-type: none"> • It was observed that the basic infrastructure facilities such as sitting arrangements, Fan, are insufficient in both the visited schools. • RO drinking water facilities is not available. • Insufficient sitting arrangements in the R C Middle school. • Separate sanitation facilities (separate for male and female) was observed in both the schools. But running water arrangements are not available within the toilet blocks. • R C Middle School (Panneerkkulam):Total No. of Students: 212 (Male: 102 and Female: 110) • Govt. Pry School total 15 (Male: 5 and Female: 10) student come from the nearby villages.

Type of Stakeholder	Land Owners	
Agenda		
Date of Meeting	20/08/2017	
Venue	Land Owners, Study area Villages	
List of participants	Arcadis official	
Mr. P Paramasivan Mr. Davidson Mr. Kannan Mr. Golden CV Annand Mr. Arumugam Mr. Durai Pandiyan Mr. Aravinthan E Mr. Marimuttu Mr. T kumar Mr. Rajan	Mr. Jaydeep Banerjee Mr. Alok Chandra Adhikari	
Issues Discussed	Findings	
<ul style="list-style-type: none"> • Land History • Compensation amount • Source of Livelihood • Compensation amount compatible with Market rates in study area villages • Aware about the project? 	<ul style="list-style-type: none"> • All the land procured are dry lands & cultivated around 4-5 years back. • Agriculture was affected due to lack of irrigation facility and low ground water level • Land has been transferred to two land aggregator companies, viz. 'Mahamudra Realtors' and 'Kailash Associates' • Land owners confirmed that the Compensation amount received are as per market rate • Most of the land owners are either businessman or in service of different professions. • All the land owners are aware about the up-coming Mytrah wind power project 	

APPENDIX N: CSR POLICY, SAMPLE PAGES

MYTRAH ENERGY (INDIA) LIMITED
Corporate Social Responsibility (CSR) Policy
2016

- c) In addition, Mytrah is committed to build a sustainable society and preserving environment through core business and community based initiatives. We endeavor to significantly improve our performance in the areas of energy, fuel and water conservation, green plantation and waste management & recycling. We are committed to promotion of bio-diversity and environment protection in our neighborhood and beyond.

5.2 CSR Policy Statement

Mytrah considers Community as priority area of intervention and is committed to take up result oriented projects/programmes essentially guided by Needs analysis and Consultations.

Mytrah may also consider undertaking or supporting CSR initiatives beyond its geography and Affirmative Action on matters of national importance based on community need and exigencies including natural disasters etc. involving stakeholders opinion and evaluative process.

Vision

To be the catalysts of positive change in the society

Mission:

To contribute towards improving the quality of life of our neighborhood communities and society at large following a participatory development-oriented approach

Based on this thought process, the Mytrah CSR policy has been framed to drive planning, implementation and evaluation of initiatives and resources.

APPENDIX O: ADB CHECKLIST FOR PHYSICAL ENVIRONMENT

Physical Environment Risk Zones	Natural Hazards and Climate Change Impacts	Score
Arid/Semi-Arid & desert environments	Low erratic rainfall of up to 500 mm rainfall per annum with periodic droughts and high rainfall variability. Low vegetative cover. Resilient ecosystems & complex pastoral and systems, but medium certainty that 10–20% of drylands degraded; 10-30% projected decrease in water availability in next 40 years; projected increase in drought duration and severity under climate change. Increased mobilization of sand dunes and other soils as vegetation cover declines; likely overall decrease in agricultural productivity, with rain-fed agriculture yield reduced by 30% or more by 2020. Earthquakes and other geophysical hazards may also occur in these environments.	1 or 2
Humid and sub-humid plains, foothills and hill country	More than 500 mm precipitation/yr. Resilient ecosystems & complex human pastoral and cropping systems. 10-30% projected decrease in water availability in next 40 years; projected increase in droughts, heatwaves and floods; increased erosion of loess-mantled landscapes by wind and water; increased gully erosion; landslides likely on steeper slopes. Likely overall decrease in agricultural productivity & compromised food production from variability, with rain-fed agriculture yield reduced by 30% or more by 2020. Increased incidence of forest and agriculture-based insect infestations. Earthquakes and other geophysical hazards may also occur in these environments.	1
River valleys/deltas and estuaries and other low-lying coastal areas	River basins, deltas and estuaries in low-lying areas are vulnerable to riverine floods, storm surges associated with tropical cyclones/typhoons and sea level rise; natural (and human-induced) subsidence resulting from sediment compaction and ground water extraction; liquefaction of soft sediments as result of earthquake ground shaking. Tsunami possible/likely on some coasts. Lowland agri-business and subsistence farming in these regions at significant risk.	2
Small islands	Small islands generally have land areas of less than 10,000km ² in area, though Papua New Guinea and Timor with much larger land areas are commonly included in lists of small island developing states. Low-lying islands are especially vulnerable to storm surge, tsunami and sea-level rise and, frequently, coastal erosion, with coral reefs threatened by ocean warming in some areas. Sea level rise is likely to threaten the limited ground water resources. High islands often experience high rainfall intensities, frequent landslides and tectonic environments in which landslides and earthquakes are not uncommon with (occasional) volcanic eruptions. Small islands may have low adaptive capacity and high adaptation costs relative to GDP.	3

Physical Environment Risk Zones	Natural Hazards and Climate Change Impacts	Score
Mountain ecosystems	Accelerated glacial melting, rockfalls/landslides and glacial lake outburst floods, leading to increased debris flows, river bank erosion and floods and more extensive outwash plains and, possibly, more frequent wind erosion in intermontane valleys. Enhanced snow melt and fluctuating stream flows may produce seasonal floods and droughts. Melting of permafrost in some environments. Faunal and floral species migration. Earthquakes, landslides and other geophysical hazards may also occur in these environments.	3
Volcanic environments	Recently active volcanoes (erupted in last 10,000 years – see www.volcano.si.edu). Often fertile soils with intensive agriculture and landslides on steep slopes. Subject to earthquakes and volcanic eruptions including pyroclastic flows and mudflows/lahars and/or gas emissions and occasionally widespread ashfall.	2

APPENDIX P: RISK BY SECTOR

PROJECT SECTORS	RISKS (Selected examples only. If the project is likely to be affected by any of the risks listed below, use the score suggested. If it will not be affected, a lower score may be used at your discretion.)	Estimated RISK LEVEL
1. Agriculture & Natural Resources	Impacts on crop production or yield resulting from drought, hail, floods, tropical cyclone/depression winds and rains, storms, heatwaves, wildfires, insect infestations, widespread volcanic ash fall.	Very High (3)
	Possible changes in diversity resulting from changing precipitation and/or temperature regimes Impacts on water availability for agricultural sector from El Niño, Indian Ocean Dipole and similar hemispheric weather influences Impacts from glacial melt flooding, or estuarine or delta-based flooding from storm surges or tsunami	
	Impacts from salinization of soils by drought, storm surge or tsunami Impacts of changes to ocean currents, and on physical & chemical regime of oceans	
	Impacts on land-sea interactions affecting sensitive habitats of marine species through changing water temperatures, increased incidents of marine pollution, greater incidents of coastal erosion, or incidents of algae blooms from warming of ocean areas Impacts on fisheries as a result of changes in migration patterns, fish size and availability	
2. Water Supply, and other municipal infrastructure and services	Decrease in freshwater availability or adverse effects on quality due to drought or heatwaves, algal blooms, salinization by storm surge or tsunami, ground water rise or sea level rise. Contamination of or interruption to water supply (or electricity) resulting from flood, storm surge, landslide, tsunami or earthquake, Adverse effects on treatment plants from volcanic ash fall.	
	Accelerated glacier melt likely to cause increase in the number and severity of glacial melt-related floods, slope and river bank destabilisation and a decrease in river flows as glaciers recede	

PROJECT SECTORS	RISKS (Selected examples only. If the project is likely to be affected by any of the risks listed below, use the score suggested. If it will not be affected, a lower score may be used at your discretion.)	Estimated. RISK LEVEL
3. Education	School infrastructure is used for emergency shelter in most countries and should conform to the highest building codes and be sited as safely as possible with respect to all risks.	
4. Health and Social Protection	Health infrastructure should conform to the highest possible building codes and be sited as safely as possible with respect to all risks. Morbidity/mortality (e.g., fractures or severe trauma, burns, malnutrition, diarrhoeal, cardio-respiratory, or infectious diseases) from earthquakes, tsunamis, heatwaves, floods, storms, cyclones, fires and droughts. Changes in the distribution, frequency & burden of some vector-borne and water-borne diseases	
5. Transport & Communications	Damage to transport infrastructure due to earthquakes, volcanic eruption, landslides, sea-level rise, storm surge, or tsunami Port operations affected by sea-level rise, storms, storm surge, tsunami, wave action, strong winds, or floods, Overhead lines exposed to wind, ground shaking and liquefaction particularly in coastal areas, high country and on soft soils.	High (2)
6. Energy	Rainfall variability, floods, droughts, landslides, earthquakes, or glacial meltwater floods impacting surface water flow and/or downstream water recharge Risk to oil and gas sector infrastructure in coastal locations from tropical cyclone winds and storm surge, floods, tsunami, earthquakes, or sea level rise Overhead transmission and distribution lines exposed to wind, ground shaking and liquefaction particularly in coastal areas, high country and on soft soils. Pipelines subject to ground shaking, liquefaction, subsidence, erosion.	High (2)
7. Multi-sector	Subject to multiple risks similar to examples given throughout this table	
8. Housing Finance & Micro-finance	Housing infrastructure and small businesses are vulnerable to all risks listed in Table 1 or elsewhere in this Appendix (may require higher Risk Level for specific projects). All property can be affected by a range of the risks listed in this table	Medium (1)
9. Industry & Trade	Diverse sector investment subject to risks and market interruptions (e.g. procurement delays, merchandise transfer disruption)	
10. Technical, vocational training & skills development	Limited direct exposure to the types of risks discussed here	Negligible Risk (0)

PROJECT SECTORS	RISKS (Selected examples only. If the project is likely to be affected by any of the risks listed below, use the score suggested. If it will not be affected, a lower score may be used at your discretion.)	Estimated. RISK LEVEL
1. Finance		
2. Public Sector Management		
Source: adapted from <i>ADB Portfolio at Risk</i> , (updated to 2009 Sector classification)		

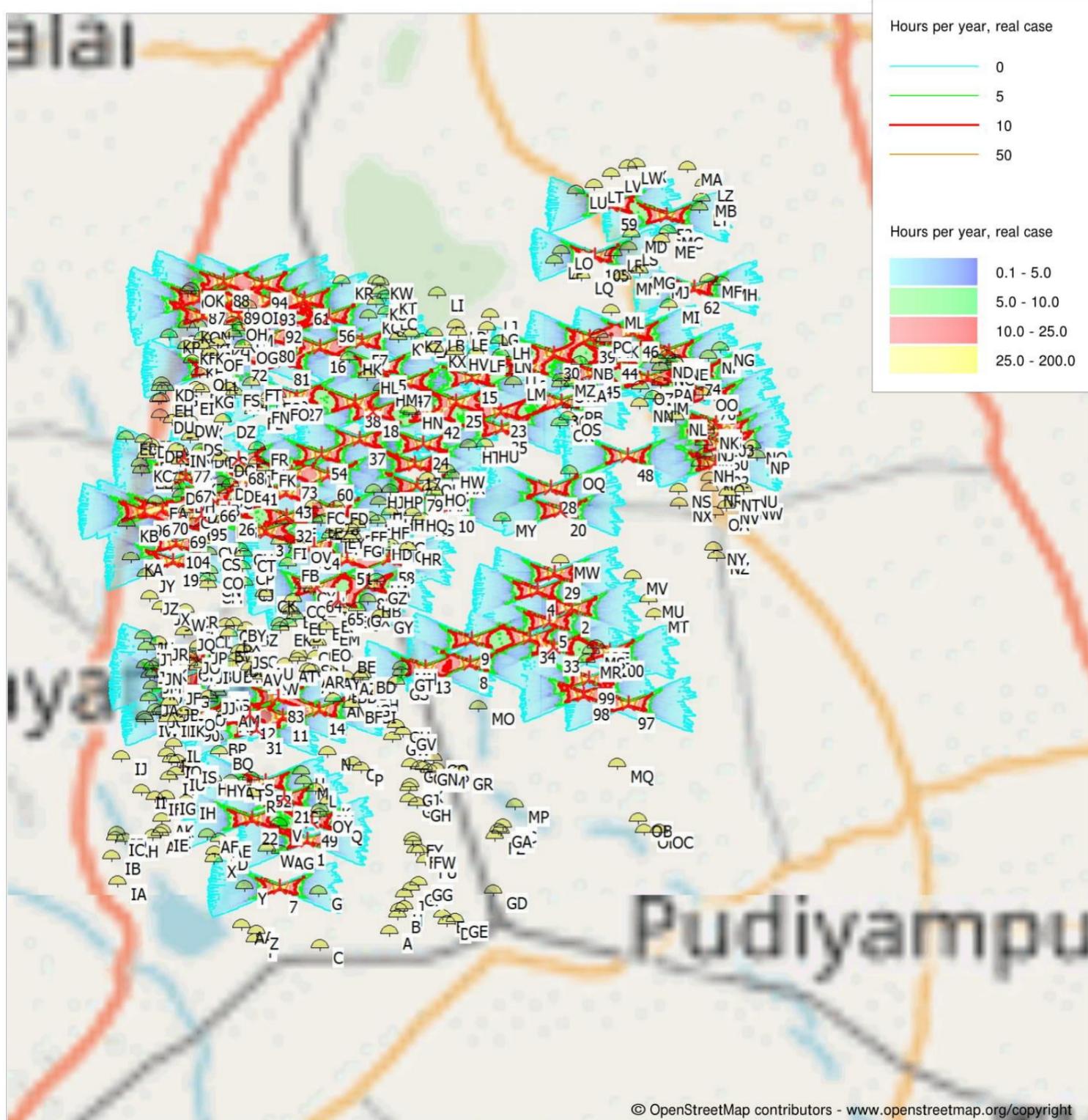
APPENDIX Q: SHADOW FLICKER MAP

Project:
New 105WTG Maniyachi Project

Licensed user:
Arcadis India Private Limited
3rd Floor, Logix techno park, tower B, sector 127, Noida
IN-201304 Noida
01204368426
Lala Ram / lala.ram@arcadis.com
Calculated:
2/27/2018 2:12 PM/3.1.597

SHADOW - Map

Calculation: 105WTG Location Result



New WTG

Map: Open Street Map 003 , Print scale 1:200,000, Map center UTM (north)-WGS84 Zone: 43 East: 819,780 North: 993,810
Shadow receptor
Flicker map level: Project Wizard Elevation Data Grid (SRTM: Shuttle DTM 1 arc-second)

APPENDIX R: VEGETATIONAL SURVEY-

Location 1

SL. No	Scientific Name	RF	RA	RD	IVI
1.	<i>Abutilon indicum</i>	3.05	1.5	1.4	5.9
2.	<i>Acacia leucophloea</i>	1.52	4.4	1.6	7.6
3.	<i>Acalypha sp.</i>	3.05	4.0	3.8	10.9
4.	<i>Achyranthus aspera</i>	3.05	1.8	2.2	7.1
5.	<i>Ageratina adenophora</i>	3.55	2.6	4.4	10.6
6.	<i>Amaranthus viridis</i>	2.28	2.0	1.6	5.9
7.	<i>Andropogon sp.</i>	3.05	2.2	3.3	8.5
8.	<i>Argemone mexicana</i>	3.55	1.5	1.6	6.7
9.	<i>Aristida sp.</i>	2.28	2.5	1.6	6.4
10.	<i>Azima tetracantha</i>	2.28	2.5	2.2	6.9
11.	<i>Boerhaavia diffusa</i>	3.05	2.9	2.2	8.2
12.	<i>Borassus flabellifer</i>	3.81	5.0	6.5	15.3
13.	<i>Calotropis gigantea</i>	3.05	2.6	3.3	8.9
14.	<i>Calotropis procera</i>	2.28	2.0	1.6	5.9
15.	<i>Canthium parviflorum</i>	3.81	2.9	4.9	11.7
16.	<i>Capparis decidua</i>	2.28	2.0	1.6	5.9
17.	<i>Cassia auriculata</i>	4.57	3.2	7.1	14.8
18.	<i>Celosia argentea</i>	0.76	1.5	0.5	2.8
19.	<i>Cleome gynandra</i>	3.05	2.0	1.6	6.6
20.	<i>Croton bonplandianum</i>	2.28	2.0	2.2	6.4
21.	<i>Cynodon dactylon</i>	3.81	4.1	3.8	11.7
22.	<i>Cyperus triceps</i>	3.05	2.0	2.2	7.2
23.	<i>Datura metel</i>	4.57	2.2	4.4	11.1
24.	<i>Jatropha gossypifolia</i>	1.52	1.5	1.1	4.1
25.	<i>Martynia annua</i>	3.05	2.6	2.7	8.3
26.	<i>Morinda tinctoria</i>	5.33	8.2	7.6	21.2
27.	<i>Opuntia sp</i>	2.28	3.4	2.2	7.9
28.	<i>Sida acuta</i>	3.81	3.2	2.7	9.8
29.	<i>Solanum indicum</i>	3.05	2.9	3.8	9.8
30.	<i>Tephrosia purpurea</i>	3.81	9.4	3.8	17.0
31.	<i>Tribulus terrestris</i>	3.81	2.1	3.3	9.1
32.	<i>Tridax procumbens</i>	3.05	2.6	3.3	8.9
33.	<i>Xanthium indicum</i>	2.28	4.9	3.8	11.0

Shannon diversity index (H) = 3.41

Location 2

SL. No	Scientific Name	RF	RA	RD	IVI
1.	<i>Calotropis gigantea</i>	4.40	3.0	6.1	13.6
2.	<i>Canthium parviflorum</i>	5.49	3.5	9.2	18.1
3.	<i>Capparis decidua</i>	3.30	2.3	3.1	8.7
4.	<i>Cassia auriculata</i>	6.59	3.8	4.1	14.4
5.	<i>Celosia argentea</i>	1.10	1.7	1.0	3.9
6.	<i>Cissus quadrangularis</i>	3.30	2.3	3.1	8.7
7.	<i>Cyperus triceps</i>	4.40	2.3	4.1	10.8
8.	<i>Datura metel</i>	6.59	2.6	4.1	13.3
9.	<i>Eclipta prostrata</i>	3.30	2.9	4.1	10.3
10.	<i>Euphorbia hirta</i>	4.40	3.0	5.1	12.5
11.	<i>Jatropha gossypifolia</i>	2.20	1.7	2.0	6.0
12.	<i>Launaea sarmentosa</i>	4.40	3.5	4.1	11.9
13.	<i>Lepidagathis pungens</i>	4.40	16.9	4.1	25.4

SL. No	Scientific Name	RF	RA	RD	IVI
14.	<i>Martynia annua</i>	4.40	3.0	4.1	11.5
15.	<i>Mimosa pudica</i>	4.40	4.8	5.1	14.3
16.	<i>Morinda tinctoria</i>	7.69	9.7	7.1	24.5
17.	<i>Solanum indicum</i>	4.40	3.5	7.1	15.0
18.	<i>Tephrosia purpurea</i>	5.49	11.1	7.1	23.7
19.	<i>Tribulus terrestris</i>	5.49	2.4	4.1	12.0
20.	<i>Tridax procumbens</i>	4.40	3.0	5.1	12.5
21.	<i>Xanthium indicum</i>	3.30	5.8	3.1	12.1
22.	<i>Zizyphus oenoplia</i>	6.59	7.2	3.1	16.9

Shannon diversity index (H) = 3.01

Location 3

SL. No	Scientific Name	RF	RA	RD	IVI
1.	<i>Abutilon indicum</i>	4.60	1.8	1.8	8.2
2.	<i>Acacia nilotica</i>	3.45	1.8	1.4	6.7
3.	<i>Achyranthus aspera</i>	4.60	2.3	2.8	9.7
4.	<i>Aerva lanata</i>	3.45	2.4	2.1	8.0
5.	<i>Azima tetracantha</i>	3.45	3.1	2.8	9.3
6.	<i>Boerhaavia diffusa</i>	4.60	3.7	2.8	11.1
7.	<i>Borassus flabellifer</i>	5.75	6.2	8.4	20.4
8.	<i>Calotropis gigantea</i>	4.60	3.2	4.2	12.0
9.	<i>Capparis decidua</i>	3.45	2.4	2.1	8.0
10.	<i>Cassia auriculata</i>	6.90	4.0	9.1	20.0
11.	<i>Croton bonplandianum</i>	3.45	2.4	2.8	8.7
12.	<i>Cynodon dactylon</i>	5.75	5.1	5.6	16.5
13.	<i>Cyperus triceps</i>	4.60	2.4	2.8	9.8
14.	<i>Lepidagathis pungens</i>	4.60	17.9	11.2	33.7
15.	<i>Martynia annua</i>	4.60	3.2	4.2	12.0
16.	<i>Mimosa pudica</i>	4.60	5.0	5.6	15.3
17.	<i>Prosopis juliflora</i>	8.05	7.3	11.9	27.3
18.	<i>Sida acuta</i>	5.75	4.0	3.5	13.3
19.	<i>Solanum indicum</i>	4.60	3.7	4.9	13.2
20.	<i>Tephrosia purpurea</i>	5.75	11.7	4.9	22.4
21.	<i>Xanthium indicum</i>	3.45	6.1	4.9	14.5

Shannon diversity index (H) = 2.94

Location 4

SL. No	Scientific Name	RF	RA	RD	IVI
1.	<i>Abutilon indicum</i>	2.24	1.0	1.0	4.2
2.	<i>Acacia nilotica</i>	1.68	1.0	0.7	3.4
3.	<i>Acacia sps</i>	1.12	2.9	1.9	5.9
4.	<i>Acalypha sp.</i>	2.24	2.7	2.6	7.5
5.	<i>Achyranthus aspera</i>	2.24	1.2	1.5	5.0
6.	<i>Aerva lanata</i>	1.68	1.3	1.1	4.1
7.	<i>Ageratina adenophora</i>	2.62	1.8	3.0	7.3
8.	<i>Amaranthus viridis</i>	1.68	1.3	1.1	4.1
9.	<i>Andropogon sp.</i>	2.24	1.5	2.2	5.9
10.	<i>Argemone mexicana</i>	2.62	1.0	1.1	4.7
11.	<i>Aristida sp.</i>	1.68	1.6	1.1	4.4
12.	<i>Azima tetracantha</i>	1.68	1.6	1.5	4.8
13.	<i>Boerhaavia diffusa</i>	2.24	2.0	1.5	5.7
14.	<i>Borassus flabellifer</i>	2.80	3.3	4.5	10.6
15.	<i>Calotropis gigantea</i>	2.24	1.7	2.2	6.2
16.	<i>Calotropis procera</i>	1.68	1.3	1.1	4.1
17.	<i>Canthium parviflorum</i>	2.80	2.0	3.3	8.1

SL. No	Scientific Name	RF	RA	RD	IVI
18.	<i>Capparis decidua</i>	1.68	1.3	1.1	4.1
19.	<i>Cassia auriculata</i>	3.36	2.1	4.8	10.3
20.	<i>Celosia argentea</i>	0.56	1.0	0.4	1.9
21.	<i>Cissus quadrangularis</i>	1.68	1.3	1.1	4.1
22.	<i>Cleome gynandra</i>	2.24	1.3	1.1	4.7
23.	<i>Corchorus tridens</i>	1.12	2.5	1.9	5.4
24.	<i>Croton bonplandianum</i>	1.68	1.3	1.5	4.5
25.	<i>Cynodon dactylon</i>	2.80	2.7	4.8	10.4
26.	<i>Cyperus triceps</i>	2.24	1.3	1.5	5.0
27.	<i>Datura metel</i>	3.36	1.5	3.0	7.8
28.	<i>Eclipta prostrata</i>	1.68	1.6	1.5	4.8
29.	<i>Euphorbia hirta</i>	2.24	1.7	1.9	5.8
30.	<i>Jatropha gossypifolia</i>	1.12	1.0	0.7	2.8
31.	<i>Launaea sarmentosa</i>	2.24	2.0	1.5	5.7
32.	<i>Lepidagathis pungens</i>	2.24	9.6	1.9	13.7
33.	<i>Martynia annua</i>	2.24	1.7	2.2	6.2
34.	<i>Mimosa pudica</i>	2.24	2.7	3.0	7.9
35.	<i>Morinda tinctoria</i>	3.93	5.5	5.2	14.6
36.	<i>Oldenlandia sps</i>	2.24	1.7	2.6	6.6
37.	<i>Opuntia sp</i>	1.68	2.3	2.2	6.2
38.	<i>Prosopis juliflora</i>	3.93	3.9	6.3	14.2
39.	<i>Sida acuta</i>	2.80	2.2	1.9	6.8
40.	<i>Solanum indicum</i>	2.24	2.0	2.6	6.8
41.	<i>Tephrosia purpurea</i>	2.80	6.3	2.6	11.7
42.	<i>Tribulus terrestris</i>	2.80	1.4	2.2	6.4
43.	<i>Tridax procumbens</i>	2.24	1.7	2.2	6.2
44.	<i>Xanthium indicum</i>	1.68	3.3	2.6	7.5
45.	<i>Zizyphus oenoplia</i>	3.36	4.1	4.5	11.9

Shannon diversity index (H) = 3.71

Location 5

SL. No	Scientific Name	RF	RA	RD	IVI
1.	<i>Acacia nilotica</i>	2.24	1.2	1.0	4.5
2.	<i>Acacia sps</i>	1.50	3.7	2.6	7.8
3.	<i>Amaranthus viridis</i>	2.24	1.6	1.5	5.4
4.	<i>Andropogon sp.</i>	2.99	1.8	3.1	7.9
5.	<i>Argemone mexicana</i>	3.49	1.2	1.5	6.3
6.	<i>Aristida sp.</i>	2.24	2.0	1.5	5.8
7.	<i>Azima tetraacantha</i>	2.24	2.0	2.1	6.4
8.	<i>Boerhaavia diffusa</i>	2.99	2.5	2.1	7.5
9.	<i>Borassus flabellifer</i>	3.74	4.2	3.1	11.0
10.	<i>Calotropis procera</i>	2.24	1.6	1.5	5.4
11.	<i>Canthium parviflorum</i>	3.74	2.5	2.6	8.8
12.	<i>Cassia auriculata</i>	4.49	2.7	3.6	10.8
13.	<i>Celosia argentea</i>	0.75	1.2	0.5	2.5
14.	<i>Cissus quadrangularis</i>	2.24	1.6	1.5	5.4
15.	<i>Datura metel</i>	4.49	1.8	4.1	10.5
16.	<i>Eclipta prostrata</i>	2.24	2.0	2.1	6.4
17.	<i>Euphorbia hirta</i>	2.99	2.1	2.6	7.7
18.	<i>Jatropha gossypifolia</i>	1.50	1.2	1.0	3.8
19.	<i>Launaea sarmentosa</i>	2.99	2.5	2.1	7.5
20.	<i>Lepidagathis pungens</i>	2.99	12.0	2.6	17.5

SL. No	Scientific Name	RF	RA	RD	IVI
21.	<i>Martynia annua</i>	2.99	2.1	4.1	9.3
22.	<i>Mimosa pudica</i>	2.99	3.4	2.1	8.4
23.	<i>Morinda tinctoria</i>	5.24	6.8	5.7	17.7
24.	<i>Oldenlandia sps</i>	2.99	2.1	3.6	8.7
25.	<i>Opuntia sp</i>	2.24	2.9	4.1	9.2
26.	<i>Prosopis juliflora</i>	5.24	4.9	15.5	25.6
27.	<i>Sida acuta</i>	3.74	2.7	2.6	9.0
28.	<i>Solanum indicum</i>	2.99	2.5	2.6	8.0
29.	<i>Tephrosia purpurea</i>	3.74	7.9	3.6	15.2
30.	<i>Tribulus terrestris</i>	3.74	1.7	3.1	8.6
31.	<i>Tridax procumbens</i>	2.99	2.1	3.1	8.2
32.	<i>Xanthium indicum</i>	2.24	4.1	2.1	8.4
33.	<i>Zizyphus oenoplia</i>	4.49	5.1	5.2	14.8

Shannon diversity index (H) = 3.38

Location 6

SL. No	Scientific Name	RF	RA	RD	IVI
1.	<i>Abutilon indicum</i>	3.88	1.8	4.7	10.4
2.	<i>Acacia nilotica</i>	2.91	1.8	1.2	6.0
3.	<i>Acacia sps</i>	1.94	5.5	1.2	8.6
4.	<i>Azima tetraacantha</i>	2.91	3.0	2.5	8.4
5.	<i>Boerhaavia diffusa</i>	3.88	3.6	2.5	10.0
6.	<i>Calotropis gigantea</i>	3.88	3.2	3.7	10.8
7.	<i>Calotropis procera</i>	2.91	2.4	1.8	7.2
8.	<i>Canthium parviflorum</i>	4.85	3.6	5.5	14.0
9.	<i>Capparis decidua</i>	2.91	2.4	8.0	13.3
10.	<i>Cassia auriculata</i>	5.83	3.9	8.6	18.4
11.	<i>Datura metel</i>	5.83	2.7	4.9	13.5
12.	<i>Eclipta prostrata</i>	2.91	3.0	2.5	8.4
13.	<i>Euphorbia hirta</i>	3.88	3.2	3.1	10.1
14.	<i>Jatropha gossypifolia</i>	1.94	1.8	1.2	5.0
15.	<i>Launaea sarmentosa</i>	3.88	3.6	2.5	10.0
16.	<i>Martynia annua</i>	3.88	3.2	3.7	10.8
17.	<i>Morinda tinctoria</i>	3.88	5.0	7.4	16.3
18.	<i>Prosopis juliflora</i>	6.80	7.3	4.3	18.4
19.	<i>Sida acuta</i>	4.85	4.0	3.1	11.9
20.	<i>Solanum indicum</i>	3.88	3.6	4.3	11.8
21.	<i>Tephrosia purpurea</i>	4.85	11.7	4.3	20.8
22.	<i>Tribulus terrestris</i>	4.85	2.5	3.7	11.1
23.	<i>Tridax procumbens</i>	3.88	3.2	3.7	10.8
24.	<i>Xanthium indicum</i>	2.91	6.1	4.3	13.3
25.	<i>Zizyphus oenoplia</i>	5.83	7.6	7.4	20.8

Shannon diversity index (H) = 3.16

APPENDIX S: SAMPLE SALE DEED



தமிழ்நாடு தமில்நாடு TAMILNADU

சா. எண். 7635
மொத்த பங்களிகள் 1000
தேதி 4.12.2017

M/S. Mytra Vayu (Parbati) Pvt. Ltd.
Hyderabad.

BS 985101
S. செல்வையா
சார் பதிவை முத்திரைத்தான்
விற்பனையாளர்
கம்ப்யூர்
செய்தாண்டு உரிமை எண் B7. 3446/1971

SALE DEED
(For Rs.6,75,000/-)

This Sale Deed is executed on this 05th day of December 2017, by Mrs.Dhanalakshmi D/o. Ayyappa Naicker (Aathar Card No.8812 5669 4646), residing at Door No:33, North Street, K.Chithambarapuram, Kayathar Taluk, Thoothukudi District (VENDOR 1), Mrs.Shanthi D/o. Ayyappa Naicker (Aathar Card No.5189 8872 9589), residing at Door No:498A, Thirumalainaicker Nagar, Kongalapuram, Sidhurajapuram, Virudhunagar, District (VENDOR 2), Mrs.Padmavathi D/o. Ayyappa Naicker (Aathar Card No. 5593 4035 7235), residing at Door No:26, Kulakkal Street, Karutha Oorani, Devakkottai, Sivagangai District (VENDOR 3), Mrs.Alagammal D/o. Ayyappa Naicker (Aathar Card No.8876 1507 1456), residing at Door No:514/9, East Street, K.Kalusalapuram,, Kurumalai, Kayathar Taluk, Thoothukudi District (VENDOR 4),

For MYTRAH VAYU (PARBATI) PVT LTD

E. Aravinda
(VENDORS)
(Through Their POA)

Authorized Signatory
PURCHASER

சா. எண். 1761/2017
பக்க எண்
மொத்த பங்களிகள் 19
தேதி 17.12.2017

TP/208390/2017

3

- C. **WHEREAS** the **VENDORS** herein is desirous of selling an extent of **97.5 Cents (Approximately Equivalent to 0.39.5 Hectare) of dry Agricultural (Punjai) Land** in **S.F. No. 237/1 at K.Chithambarapuram Village**, Kayathar Taluk, Thoothukudi District, schedule hereunder and hereinafter referred to as the “Schedule Property” and the Purchaser is willing to purchase the same for a sale consideration of **Rs.6,75,000/- (Rupees Six Lakhs Seventy Five Thousand only)**, free from all encumbrances, liens, demands and claims whatsoever.
- D. **WHEREAS** in consideration of the purchaser having paid the entire sale consideration **Rs.6,75,000/- (Rupees Six Lakhs Seventy Five Thousand only)**,as aforesaid the receipt of which has been duly acknowledged by the Vendors, who acquits the purchaser from making any further payment towards sale consideration, the Vendor, as beneficial owner, **DOES HEREBY GRANT,CONVEY, TRANSFER, BY WAY SALE AND ASSIGN** unto and in favour of the Purchaser of the schedule property and every part thereof together with the right, title and interest therein, with all the benefits advantages, concessions, licenses, hereditaments, easementary rights, equities, claims, demands, privileges, appurtenances or any other things hidden in the earth belonging to or appurtenant thereto etc., attached to belonging to and reputed to belong to the Schedule Property **TO HOLD, TO POSSESS AND TO ENJOY** the same forever free from all encumbrances, charges, all kinds of mortgage, agreement to sell, court litigations and any other statutory charges.

E. Aravindan
(VENDORS)
(Through Their POA)

For MYTRAH VAYU (PARBATI) PVT LTD

[Signature]
Authorized Signatory
PURCHASER

3



TP/208390/2017

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E. **AND WHEREAS** the Vendors hereby declare and covenants with the purchaser that they are the sole and absolute owners of the Schedule Property and has a clear, legally valid and marketable title thereto and therefore, an absolute right to sell and convey the same to the purchaser in terms of this deed. The Vendors further declare that they have not done any acts, deeds or things so as to curtail restrict or prejudice his right to convey or prevent him from selling the Schedule Property in terms of this deed.

NOW THEREFORE THIS DEED OF ABSOLUTE SALE WITNESSETH AS HEREUNDER

1. That in pursuance of the above representation of the Vendors and the sale consideration of **Rs.6,75,000/- (Rupees Six Lakhs Seventy Five Thousand only)** paid by the Purchaser to the Vendors, the sufficiency and receipt of which is hereby admitted and acknowledged by the Vendors, the Vendors hereby transfer, sell, grant and convey unto the Purchaser together with the right, title and interest of the Vendors pertaining to the Schedule Property for Purchaser to have and hold the same absolutely forever and to be enjoyed with full rights.
2. That the Vendor hereby covenant that,
 - a. the Vendors are the absolute owners of the Schedule Property having a good and subsisting right and title to convey to the Purchaser the Schedule Property;
 - b. the Schedule Property is not subject to any encumbrance, charge, lien, claim, attachment, mortgage, injunctions, acquisition or requisition proceedings, Court proceedings, Revenue Recovery proceedings, Lis Pendens, arrears of tax, levy or rent due to the Government, local body or any other person(s) in any manner relating to the said Schedule Property whatsoever, and

E. Aravindan
(VENDORS)
(Through Their POA)

For MYTRAH VAYU (PARBATI) PVT LTD

[Signature]
Authorized Signatory
PURCHASER



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- c. the Vendors shall indemnify and keep the Purchaser, or his successors fully indemnified against any and all such encumbrances, charges, liens, claims, loss, damages, expenses, attachments or other proceedings or mortgages or any other defect in title whatsoever if any should arise, at any time in future against him owing to any defect in or for want of clear, absolute and marketable title or due to any defect, violation or non-compliance of any of the declarations or covenants herein.
3. That the Purchaser shall absolutely and quietly possess, enter into, hold, use and enjoy the Schedule Property without any hindrance, interruption, claim and demand whatsoever by and from the Vendors or from any other person or persons claiming through, under or in trust for the Vendors or otherwise.
 4. That the Vendors doth hereby covenant that the Vendors have not done or caused to be done or knowingly suffered any act or deed whereby he is prevented or hindered from conveying the Schedule Property or whereby the Schedule Property may be encumbered, affected or impeached in title or otherwise.
 5. That the possession of the Schedule Property has been delivered to the Purchaser by the Vendors on the date of this Deed. The Vendors doth hereby declare that the Vendors or their legal heirs shall have no right or claim whatsoever in or over the Schedule Property henceforth.
 6. That the Vendors hereby declare and covenants with the Purchaser that he shall do or cause to be done all acts, deeds and things which are legally or reasonably required to be done at the instance of the Purchaser for more fully and perfectly assuring the right, title and interest of the Purchaser in the Schedule Property.
 7. The Vendors will execute and / or register any Deed or document that the Purchaser may require at the Purchaser's expense to bear, strengthen or confirm Purchaser's title to the Schedule Property.

E. Aravindan
(VENDORS)
(Through Their POA)

For MYTRAH VAYU (PARBATI) PVT LTD

[Signature]
Authorized Signatory
PURCHASER



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8. The Vendors hereby declare that they have not received any notice under the Land Acquisition Act, Grama Panchayat Act, Epidemic Diseases Act, Defense of India Act, or any other statutory enactments or any other Public Act, declaring any part of the said property to have been acquired or requisitioned for any purpose.
9. The Vendors hereby assure the Purchaser that the Vendors have fully discharged or shall fully discharge all rates, taxes and other outgoings presently payable in respect of the Schedule Property up to this date of sale and the Purchaser shall be liable to pay all rates, taxes and other outgoings from this date. The Vendors further indemnify the Purchaser from and against any and all claims for such rates, taxes and other outgoings payable in respect of the Schedule Property for any past period up to the date of this sale.
10. PURCHASER shall be the sole and absolute owner of the schedule property with attendant rights of ownership, possession, enjoyment and shall be entitled to deal with and dispose of the Schedule property as deems fit without any interference, obstruction or hindrance from the VENDORS or any one claiming under, through or in trust for him.
11. That the Vendors have handed over to the Purchaser, on this day, the original title deeds and all necessary original documents in respect of the Schedule Property for the purpose of possession pertaining to or in relation to the Schedule Property and in support of this sale.
12. That the Schedule Property is coloured in Green in the FMB sketch attached herewith.
13. That necessary application for the transfer of Patta in the name of the Purchaser is tendered herewith.
14. That the Schedule Property herein conveyed by the Vendor are within the limits prescribed under the Tamil Nadu Land Reforms (Fixation of Ceiling) Act, 1961 and no proceedings either under the Tamil Nadu Land Reforms (Fixation of Ceiling) Act, 1961 or under the Land Acquisition Act is pending in relation to and/or against the Schedule Property.

E. Aravindan
(VENDORS)
(Through Their POA)

For MYTRAH VAYU (PARBATI) PVT LTD

[Signature]
Authorized Signatory
PURCHASER

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SCHEDULE OF THE PROPERTY

Revenue District : Thoothukkudi
Taluk : Kayathar
Registration District : Palayamkottai
Sub-Registration Office : Kadambur
Village : K.Chithambarapuram

An extent of 97.5 Cents (Approximately Equivalent to 0.39.5 Hectare) dry Agricultural (Punjai) Land within the following boundaries comprised in the survey field bearing S.F. No. 237/1.

On the North : Land in SF No.237/2
On the South : Land in SF No. 251
On the East : Land in SF No.237/2
On the West : Land in SF No. 250

The Market Value of the Schedule Property conveyed under this Deed is **Rs.6,75,000/- (Rupees Six Lakhs Seventy-Five Thousand only)** The stamp duty is paid on the market value as computed above.

IN WITNESS WHEREOF, the VENDOR and the PURCHASER have affixed their respective signatures to this SALE DEED on the day, month and year first hereinabove mentioned.

For MYTRAH VAYU (PARBATI) PVT LTD

E. Aravindan
(VENDORS)
(Through Their POA)

[Signature]
Authorized Signatory
PURCHASER

Witnesses:

1. *M. Dada Natar S/o MUNIRANDI KANNANALUR 6/6*
2. *K. S. S. (Prabhu Devalessi S/o Koil Pillai 244/1 Ann Man Munur .*

Prepared by: *Self.*

E. Aravindan



APPENDIX T: MEIPL'S ON SITE AND OFF SITE

 MYTRAH	Mytrah Energy (India) Private Limited	ON SITE EMERGENCY PLAN QSHE –OEP
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INTRODUCTION

It is an accepted fact that no matter how well a process is controlled and safeguarded by instruments and process safety procedures, it is inevitable that there is a residual risk, which is capable of causing a variety of emergencies. Such emergencies could be the result of malfunction or non-observance of operating instructions. It could at times, be the consequences of acts outside the control of people. Hence the need to prepare an ON-SITE EMERGENCY PLAN (OEP) for dealing with incidents which may still occur and are likely to affect Health, Safety, Life, Property and Environment both at site and in the immediate neighborhood. An OEP mitigates effects of a major accident / emergency, when these effects are contained within the boundary of the site.

An emergency is a situation, which may cause serious injury, loss of life, damage to property, environmental pollution etc., due to major accident, fire / explosion or any other calamity.



This plan is guideline for employees, contractors, visitors etc., also informs about prompt rescue operations, medical treatment, co-ordination and communication among various internal & external members.

For an OEP, speed is the essence. The plan should be such that it would avoid any confusion, panic during emergency at site.

Mytrah Management will plan into practice during an emergency. Mock drills and rehearsal will be conducted periodically (once in 6 months) to ensure of all those connected with implementation of the plan. The Mytrah management will also upgrade the plan continuously consistent with the changes in facilities and the manpower structure within the site.

Any change of the guideline shall be approved by the Director and Head Asset Management.

The management shall have the overriding right to withdraw and / or amend the guideline at its own discretion as it deems fit from time to time. The decision of the management shall be final and binding.

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GENERAL EMERGENCY SITUATIONS

This section provides a general emergency

<p>Fire at Work Places</p>		<p>Crane /Structure Topped</p>			
<p>Falling from Height</p>		<p>Snake Bite</p>			
<p>Electric Shock</p>		<p>Earth Quake</p>			
<p>Lightning/ Thunderstorm</p>		<p>Road Accident</p>			
<p>Prepared By Mr. Dhananjay Pawar Asset Management</p>	<p>Revised By Mr. Suranjan Sarkar Head-EHS</p>	<p>Approved By Mr. Bob Smith Director & Head - Asset Management</p>	<p>Release Date 12.02.2016 Revision. Date</p>	<p>Issue No.01 Revision No.00</p>	<p>Page 3 of 21</p>

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OBEJECTIVES

The overall objectives of an Emergency preparedness are:

- To control the emergency, localize it and if possible, terminate it
- To avoid confusion / panic and to handle the emergency with clear instructions
- To minimize the effects of the incidence on people and property and also to minimize the damage to the environment in and around our premises.
- To preserve records and take appropriate steps to prevent recurrence
- To restore normalcy.

SCOPE

All site function including Project and O&M.

DEFINITIONS

- **Emergency:** Undesired and imposed hazardous situation, which can cause LOSS in the form of injuries and property damage.
- **On-Site Emergency:** Emergency inside the site boundaries which demands the stoppage of all activities and total or partial evacuation.
- **Off-Site Emergency:** Emergency which spills outside the site boundaries and affects neighboring areas and general public. Information to regulatory bodies and seeking help from them.
- **Assembly Point:** Safe area for the assembly of persons requiring evacuation after accounting for the missing persons. This is done through a **Head count**.
- **Emergency Exits:** Passages and walkways leading to Assemble point.

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IDENTIFICATION OF EMERGENCIES

Sr. No.	NATURE OF EMERGENCIES
1.	Incidents <ul style="list-style-type: none"> • Fire • Panel blast (Power panel / Capacitor) & flash cover • Health Emergency inside WEC • Collapse of structure & Crane • Road incident • Electrocutation • Electrical flash over (HT line) • Crane / Vehicle topple (Plain Road, Turn, Hill)
2.	Environmental Emergencies <ul style="list-style-type: none"> • Flood • Thunder storm • Lightning • Cyclone • Earth quake • Insect & Snake Bite

IDENTIFICATION OF HAZARDOUS AREAS

Sr. NO.	ACTIVITY	HAZARDOUS ASPECTS
1.	Working at height	Any emergency during height work activity
2.	D.G. operation/ Hot work & Power tools application	Electrical shock, Electrocutation/Fire
3.	Crane functions	Any major/minor incident / Electrical shock, Electrocutation
4.	Men/Material transportation by Vehicles	Road incident
5.	Civil Construction work/Blasting	Any major / minor accident / Fire Activity
6.	Electrical Construction & Commissioning work	Any major / minor incident / Electrical shock, Electrocutation

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7.	WEC-Tower installation / Machine Installation / Electrical &	Any major / minor incident / Electrical shock, Electrocutation / Fire
8.	Service, Substation, External electrical activities.	Any major / minor incident / Electrical shock, Electrocutation
9.	Handling & Storage of Diesel, Petrol, kerosene or other lubricants	Fire
10.	Preparation of food	Food poisoning

FACILITIES / EQUIPMENTS FOR EMERGENCIES

a. Emergency Control Centre (ECC)

Emergency Control center is arranged in Container / First aid center / Site offices/Substation as per the availability of resources at sites.

List of Equipment's shall be provided in ECCs.

Sr. No.	Items
1	On site Emergency plan
2.	Material Safety Data Sheet (MSDS)
3.	Rescue kit (Applicable for WTG)
4.	Stretcher
5.	Barricade tape
6.	PPE – Electrical gloves (HT), Goggles etc.
7.	First Aid Box
8.	Fire Extinguishers
9.	Earth rod
10.	Emergency Contact numbers display board

b. Fire Fighting Facilities

Different types of fire extinguishers are strategically located at Site locations, Containers, Site offices, Substation, WTGs, etc. Periodical firefighting training shall be provided for Site personnel.

c. Medical facilities

First aid boxes are available at Site Containers, Offices, Substation, WTG locations, 4 wheelers and Guest houses. The stock of First Aid material shall be replenished by a designated person. In case of

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emergencies, the affected personnel can also be transported to near-by hospital. Periodical First Aid training is provided to all site personnel.

d. Rescue System

Periodical training for rescue is provided for Site personnel (technician & Engineers). Rescue kit shall be available at site office for rescue operation. During emergency, ambulance or available vehicle at site can be used for transport the injured persons to the First aid center or nearby hospital.

INCIDENT REPORTING

Anybody seeing an incident situation shall report to his colleagues / site in charge / team leader / department giving his identity.

COMMUNICATION FACILITIES

a. Emergency Contact Display Board

Emergency Contact Display Board shall be provided in the project office area for immediate contact of key personnel. (Internal key personnel, nearby hospital, Fire stations, Ambulance details).

b. Emergency exit plan displayed at respective locations as per the applicability.

EMERGENCY CONTACT DISPLAY BOARD:

Contact Person

Phone No

- Site Supervisor/Engineer(Team Leader)
- Site In charge
- Safety Officer
- Ambulance Service
- District Govt. Hospital
- Nearest Hospital

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- Fire Station
- Police Station
- HR /FMS Site Contact Person
- Department HOD

External communication

Site is very well connected with corporate office through Mobile.

Internal communication

Site is very well connected with internal by way of Mobiles.

ROLES & RESPONSIBILITY OF PERSONNEL

- a. Contractor workmen / wind sites Technician**
 1. Anybody seeing an incident / abnormal fire/situation shall report to his colleagues / site in charge / team leader/department and giving his identity.
 2. Do evacuation if possible by using available emergency equipment's or call colleagues or other personnel for assistance / help / need of rescue device.
- b. Team Leader / Engineer / Contract Supervisor**
 1. Provide proper guidance to contract workmen / technician for evacuation.
 2. Inform to Site in charge / HOD about evacuation.
- c. Site In charge / Head Operation**
 1. On receiving information, inform to site key personnel for evacuation.
 2. Reach emergency sport and arrange required help for evacuation.
 3. Co-ordinate with admin department for external agency help (Ambulance, Fire brigades etc.)
 4. Inform to function head / Site FMS / FMS and HR head.
- d. Head Operation**

On receiving information from Site in charge / Site representative arrange required support.

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1. Depute technical expert if required.
2. Inform to Director and Head Asset Management if required.

e. FMS /HR Head

They shall co-ordinate and arrange the following:

1. Collect head count if required.
2. Transport arrangement
3. Additional security if required
4. Food /Water or any other welfare facility.
5. Liaise with outside agencies like Hospitals, Fire brigades, Ambulance etc for referral.

f. Security

1. Follow instruction from FMS / HR Head
2. Allow only authorized personnel in the emergency area
3. Make entries of men, material & vehicle entering and leaving form emergency area.

MOCK DRILL

Success of an OEP depends on planned and unplanned MOCK DRILLS, if conducted regularly. MOCK drill helps all employees to get familiarized with the OEP and also check the accuracy of their roles.



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Procedure for Mock Drills (planned):

- a. Inform all employees about MOCK DRILLS
- b. Fix a date and location of the emergency site for MOCKDRILL
- c. MOCKDRILLS will be monitored by observers giving due importance to response time and proper procedure (Who would be senior officers not involved in the exercise).
- d. All members would follow instructions as per OEP.
- e. After emergency clear the all employees shall return to their respective work place and take the supervisor's instructions Such mock drills shall be documented. (Annexure 2 & 3)

ASSEMBLY POINT

Assembly points shall be identified in the project site, service offices, for assembly of persons during emergency. A board is to be provided for easy identification of assembly point, wherever feasible.



Do's & Don'ts

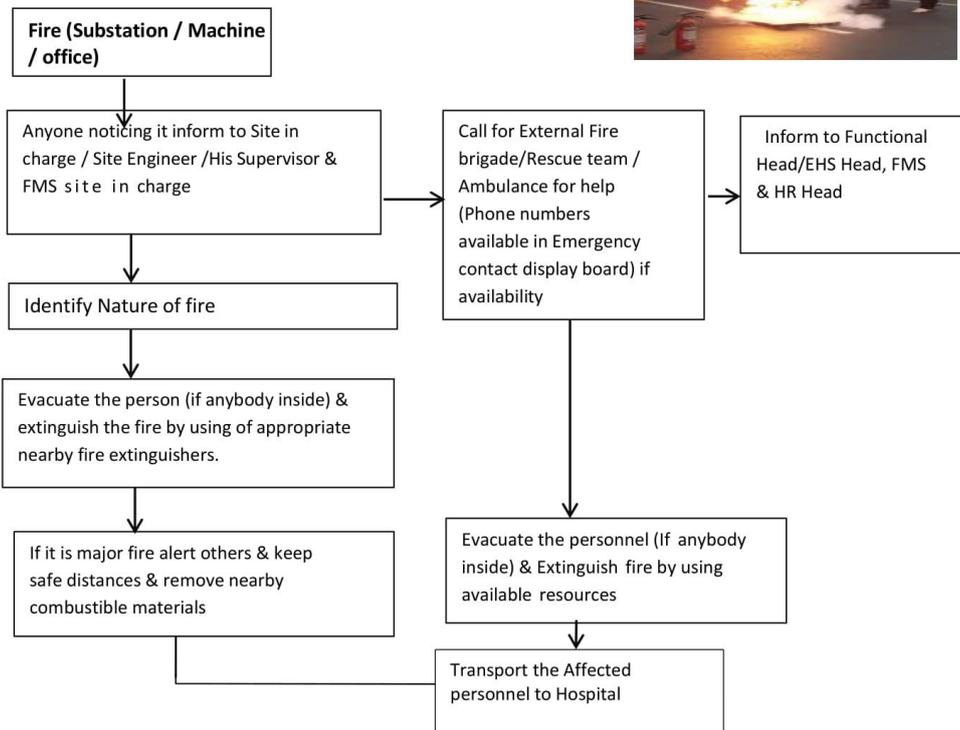
- a. **Do's**
 1. On seeing an incident / abnormal fire / situation shall report to concern person.
 2. Do evacuation or need help for evacuation, follow supervisor instructed
 3. Assembled in assembled point if required.
 4. Take head count if required.
- b. **Don'ts**
 1. Do not panic
 2. Do not communicate with any external agency, unless instructed
 3. Do not spread rumors
 4. Do not keep any telephone engaged for a long time
 5. Do not approach the emergency site as a spectator.

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PROCEDURE STEPS FOR HANDLING EMERGENCIES

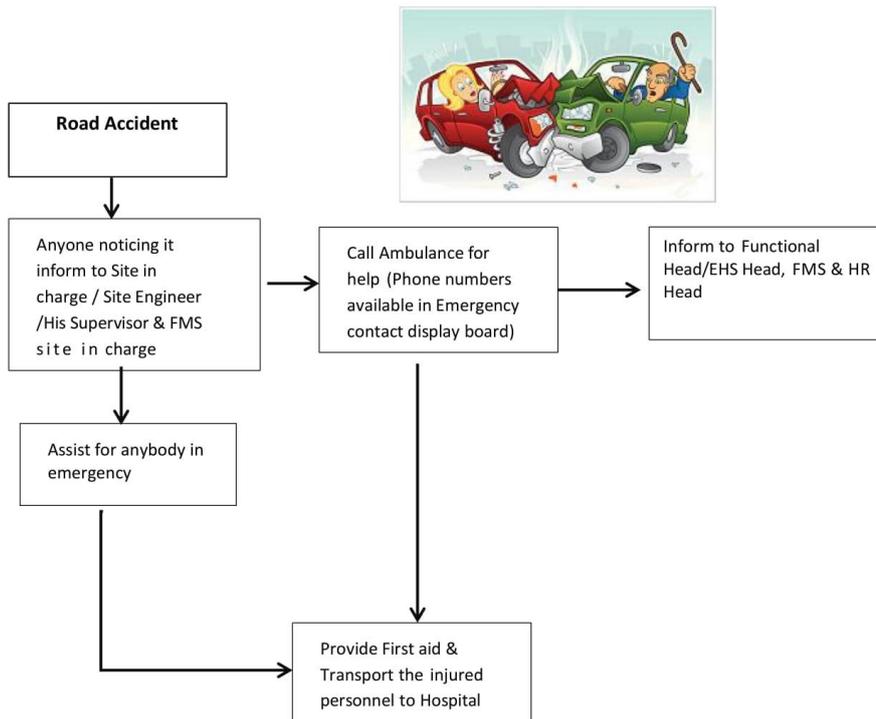
❖ *Fire at workplace*



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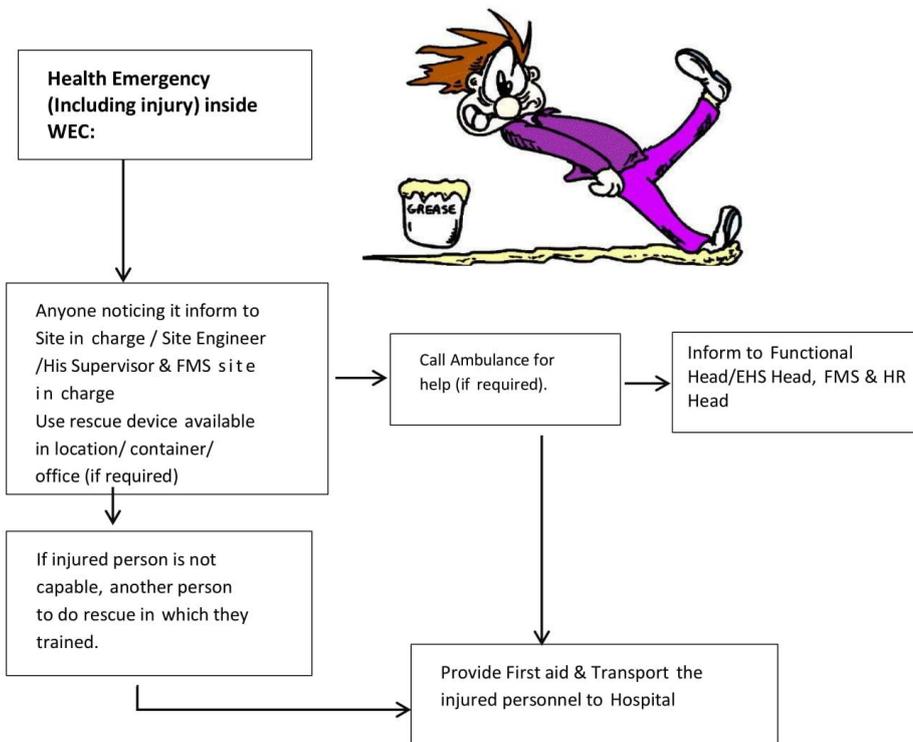
❖ Road Accident



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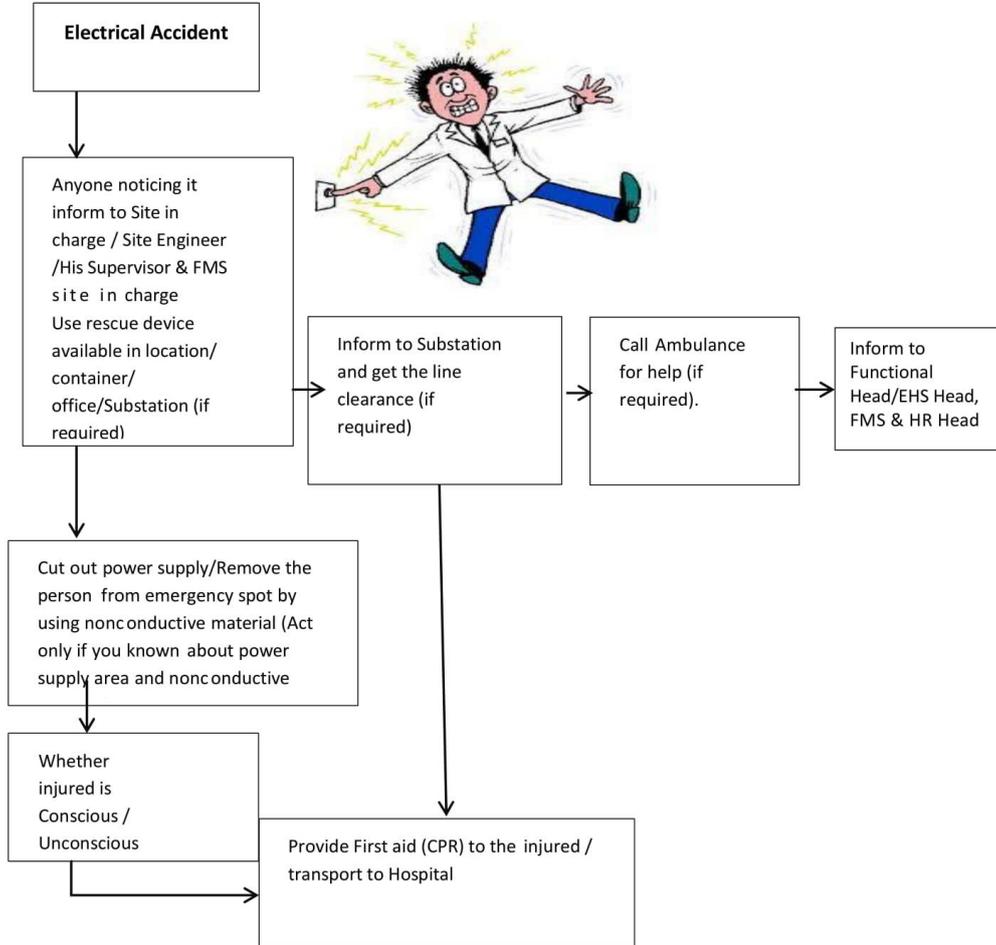
❖ *Health Emergency* (Including injury) inside WTG/Substation



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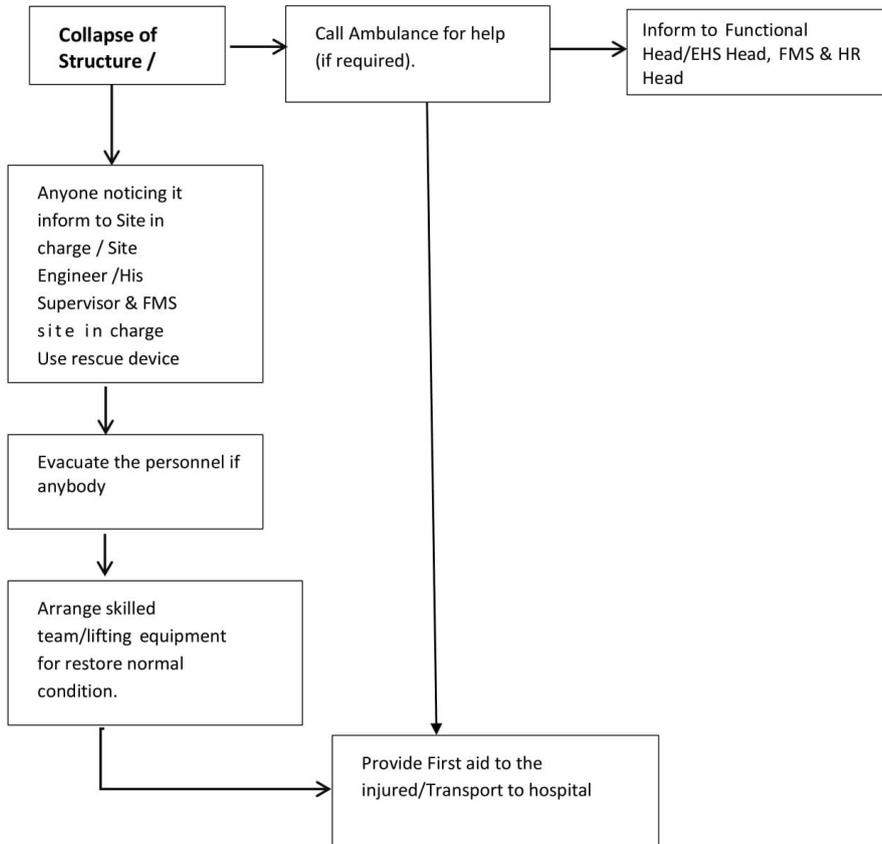
❖ *Electrical Accident*



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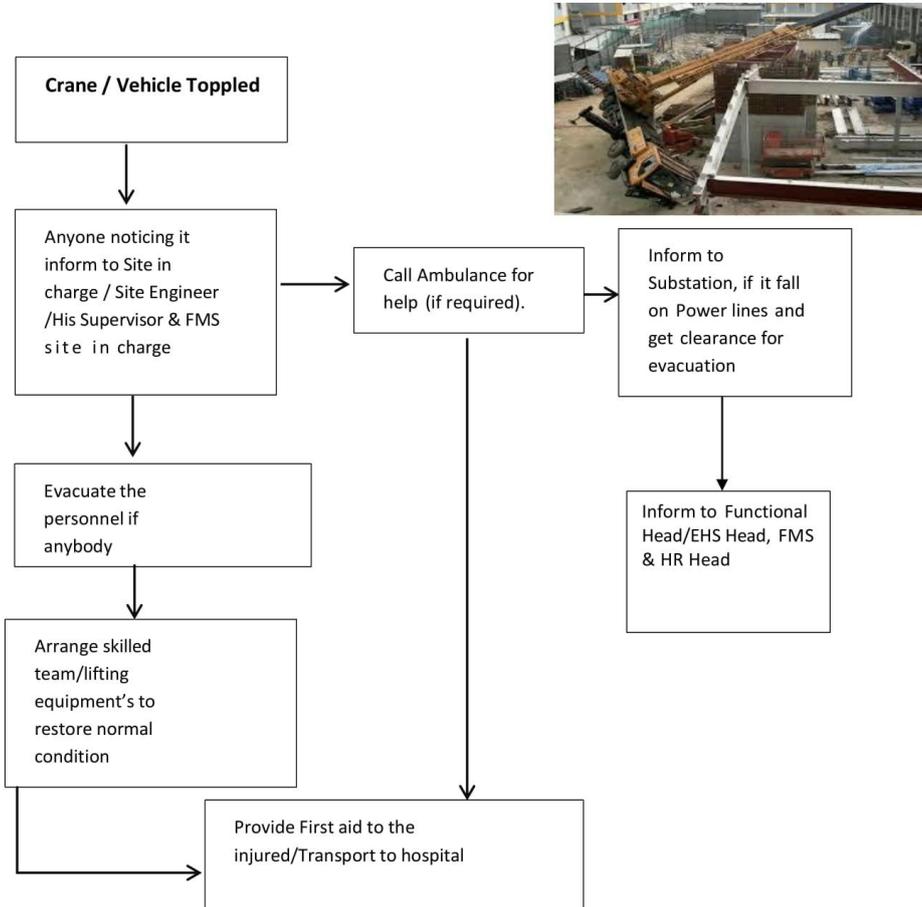
❖ Collapse of structure / Crane



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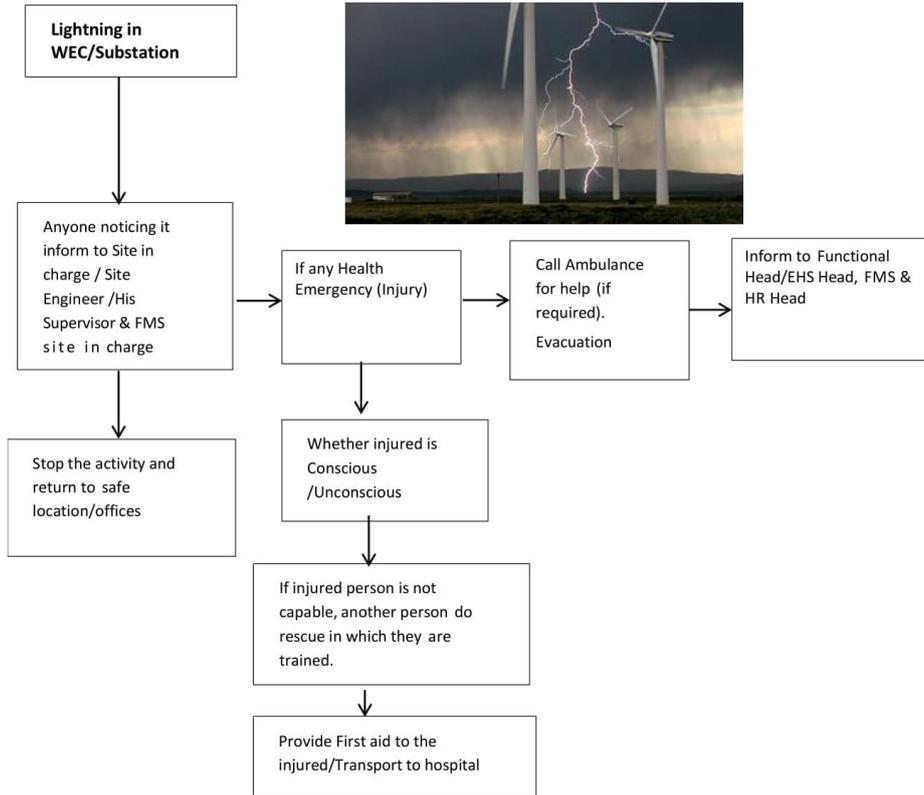
❖ Crane / Vehicle Topples (Plain Road, Hill)



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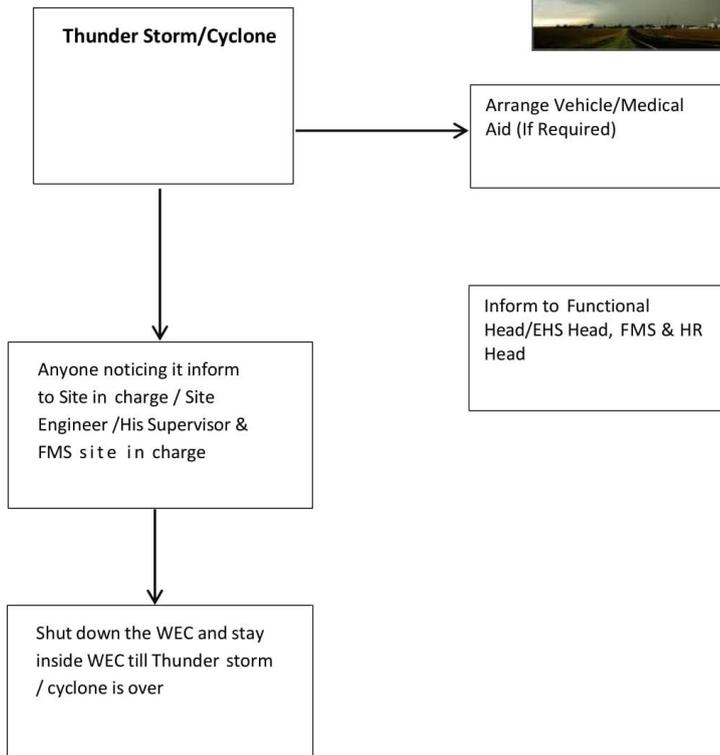
❖ *Lightning strike while working in WTG/Substation*



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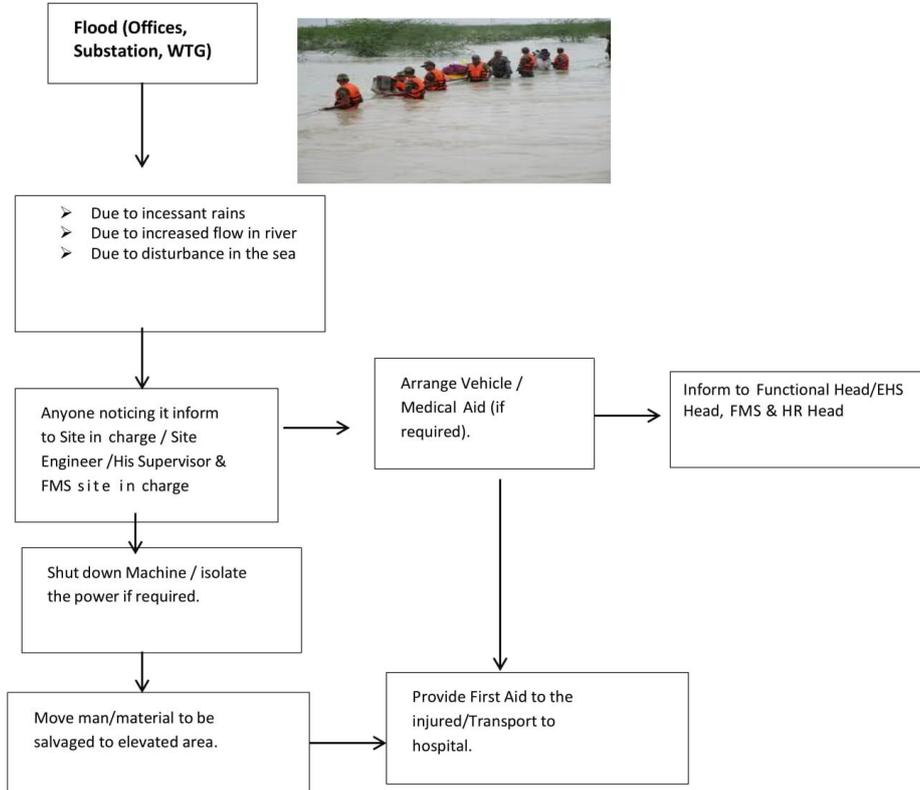
❖ *Thunder storm / Cyclone while working on WTG*



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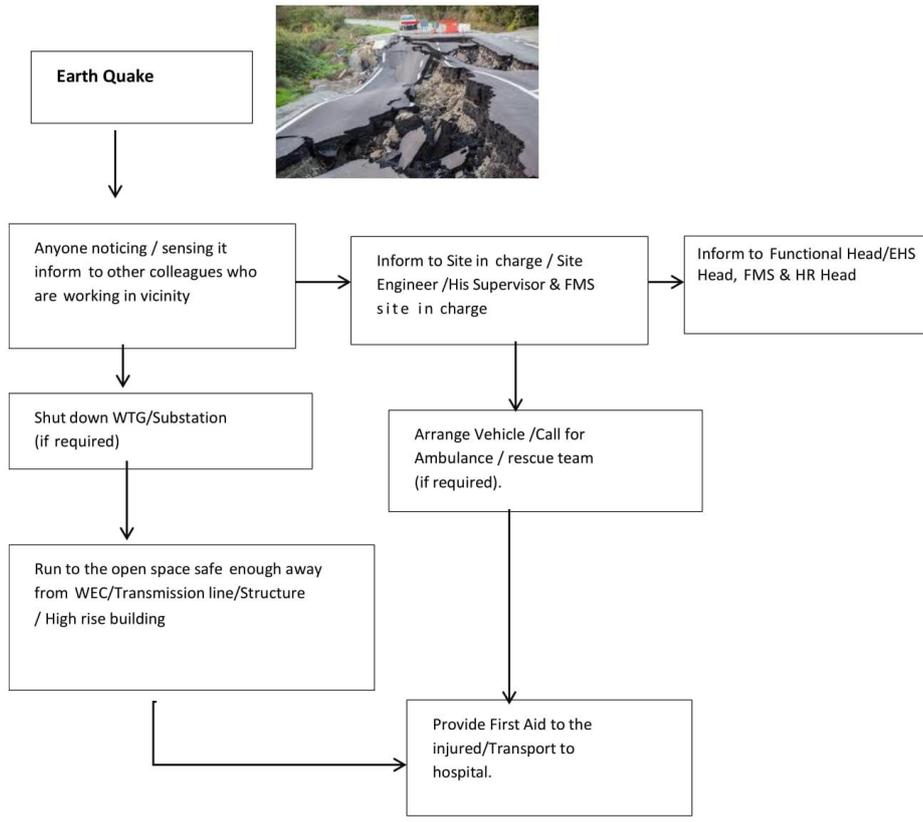
❖ Flood (Offices / Substations / WTG)



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Mr. Dhananjay Pawar Asset Management	Mr. Suranjan Sarkar Head-EHS	Mr. Bob Smith Director & Head - Asset Management	Revision. Date		Revision No.00	

	Mytrah Energy (India) Private Limited	ON SITE EMERGENCY PLAN QSHE –OEP
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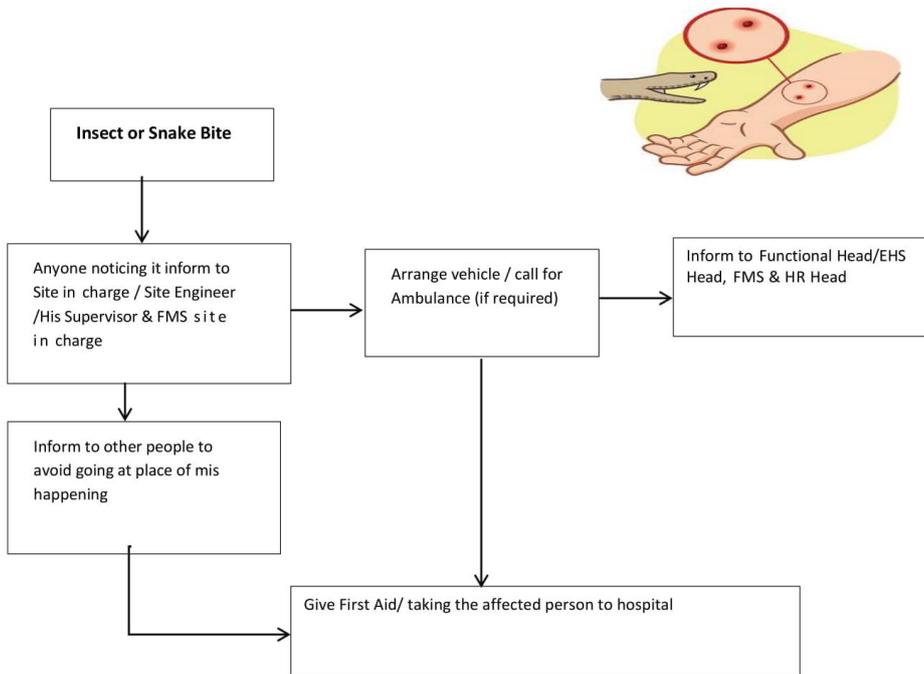
❖ Earth Quake



Prepared By	Revised By	Approved By	Release Date	12.02. 2016	Issue No.01	Page 20 of 21
Mr. Dhananjay Pawar Asset Management	Mr. Suranjan Sarkar Head-EHS	Mr. Bob Smith Director & Head - Asset Management	Revision. Date		Revision No.00	

	Mytrah Energy (India) Private Limited	ON SITE EMERGENCY PLAN QSHE –OEP
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❖ *Insect or Snake Bite*



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Mr. Dhananjay Pawar Asset Management	Mr. Suranjan Sarkar Head-EHS	Mr. Bob Smith Director & Head - Asset Management	Revision. Date		Revision No.00	

Off Site Emergency Plan



1.0 Off-Site Emergency Preparedness Plan

1.1 Introduction

The task of preparing the Off-Site Emergency Plan lies with the district collector, however the off-site plan will be prepared with the help of the local district authorities. The plan is based on the following guidelines.

Off-site emergency plan follows the on-site emergency plan. When the consequences of an emergency situation go beyond the boundaries, it becomes an off-site emergency. Off-site emergency is essentially the responsibility of the public administration. However, the management will provide the public administration with the technical information relating to the nature, quantum and probable consequences on the neighbouring population.

The roles of the various parties who will be involved in the implementation of an off-site plan are described below. Depending on local arrangements, the responsibility for the off-site plan shall be either rest with the works management or, with the local authority. Either way, the plan shall identify an emergency coordinating officer, who would take the overall command of the off-site activities. As with the on-site plan, an emergency control center shall be setup within which the emergency coordinating officer can operate.

1.2 Role of the Emergency Coordinating Officer

The various emergency services shall be co-ordinated by an Emergency Coordinating Officer (ECO), who will be designated by the district collector. The ECO shall liaise closely with the site Incharge. Again, depending on local arrangements, for very severe incidents with major or prolonged off-site consequences, the external control shall be passed to a senior local authority administrator or even an administrator appointed by the central or state government.



1.3 Role of the Local Authority

The duty to prepare the off-site plan lies with the local authorities. The Emergency Planning Officer (EPO) appointed shall carry out his duty in preparing for a whole range of different emergencies within the local authority area. The EPO shall liaise with the works, to obtain the information to provide the basis for the plan. This liaison shall ensure that the plan is continually kept up to date.

It will be the responsibility of the EPO to ensure that all those organizations, which will be involved off site in, handling the emergency, know their role and are able to accept it. For example, sufficient staff and appropriate equipment to cover their particular responsibilities. Rehearsals for off-site plans should be organized by the EPO.

1.4 Role of Police

Formal duties of the police during an emergency include protecting life and property and controlling traffic movements. Their functions shall include controlling bystanders evacuating the public, identifying the dead and dealing with casualties, and informing relatives of death or injury.

1.5 Role of Fire Authorities

The control of a fire shall be normally the responsibility of the senior fire brigade officer who would take over the handling of the fire from the site incident controller on arrival at the site. The senior fire brigade officer shall also have a similar responsibility for other events, such as explosions and toxic release. Fire authorities in the region shall be appraised about the location of all stores of flammable materials, water and foam supply points, and fire-fighting equipment. They shall be involved in on-site emergency rehearsals both as participants and, on occasion, as observers of exercises involving only site personnel.



1.6 Role of Health Authorities

Health authorities, including doctors, surgeons, hospitals, ambulances, and so on, shall have a vital part to play following a major accident, and they shall form an integral part of the emergency plan.

Major off-site incidents are likely to require medical equipment and facilities additional to those available locally, and a medical “mutual aid” scheme shall exist to enable the assistance of neighbouring authorities to be obtained in the event of an emergency.

1.7 Role of Neighboring Industries

Other major industries such as Thermal power plants, cement plants etc existing within the study area with fire fighting facilities, ambulance facilities etc would also play role in managing the emergency as per the Off-site emergency plan.

1.8 Important Information

Contact numbers of the key personnel are given below:

Sr. No	Designation	Telephone No.
1	District Collector, Tirunelveli	0462-2501222
2	Pollution Control Board, Regional officer, Tirunelveli	0462 - 2342931
3	Nearest Fire station - Kovilpatti	0461-2326501
4	Nearest Police Station - Kadambur	04295-200771
5	Nearest Hospital – Meena Hospital, Kayathar	93448 78570

APPENDIX U:: MANIYACHI NORTH 252 MW DETAILED LAND STATUS

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
1	MAN-125	811777	984636	K.V chandran	5/1A	Kothali	Kayathar	Tuticorin	3.87	3.87	3.87
				Marimuthu	5/2				5.15	0.98	0.98
				Total					9.02	4.85	4.85
2	MAN-322	820766	992594	T. Kumar	342/3	Kudhiraikulam	Kayathar	Tuticorin	9.51	4.50	5.25
				Total					9.51	4.50	5.25
3	MAN-158	810306	995127	Palakkul Kodathinkal Ratha	35/8	Akilandapuram	Kayathar	Tuticorin	2.85	2.85	2.85
				Palakkul Kodathinkal Ratha	35/9				2.03	2.03	2.03
				Total					4.88	4.88	4.88
4	MAN-321	819582	993172	Austin gunasekaran	364/1	Kudhiraikulam	Kayathar	Tuticorin	4.7	2.23	2.23
				Austin gunasekaran	365/1				1.49	1.19	1.19
				Austin gunasekaran	365/2				1.62	1.08	1.08
				shanmuga reddyar	367/1				3.8	0.10	0.10
				Total					11.61	4.60	4.60
5	MAN - 222	820012	992114	Kannan	195/1A2	Malaipatti	Ottapidaram	Tuticorin	5.38	0.33	0.33
					195/1B				7.51	4.89	4.17
					195/1B						0.72
					Total				12.89	5.22	5.22
6	MAN-310	819228	1000788	Chakkammal	8/2	Vdaku Vandanam	Kayathar	Tuticorin	12.34	4.05	4.05
					8/4					0.25	0.25
					8/2						0.73
					Total				12.34	4.30	5.03

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
7	MAN-126	810865	983032		2/1(p)	Keelakottai	Kayathar	Tuticorin		4.70	
					Total					4.70	
8	MAN-215	817306	990692	Paulpandian	154/2A	Ilavelangal	Kayathar	Tuticorin	1.22	1.22	1.22
				Paulpandian	154/2B				1.62	1.62	1.62
				Paulpandian	154/3				1.66	1.66	1.66
					Total				4.50	4.50	4.50
9	MAN-323	817356	991505	Agastin Gunaseelan	251/1	Malaipatti	Ottapidaram	Tuticorin	4.07	4.07	4.07
				Nagarajan	251/3				2.79	0.55	0.55
					Total				6.86	4.62	4.62
10	MAN-199	816538	996011	Arunachalam	334/2E	Ottudanpatti	Kayathar	Tuticorin	3.68	3.68	3.68
				Kaliappan	334/2D				1.08	0.25	0.25
				Chellathurai	340/1				1.8	0.50	0.50
					Total				6.56	4.43	4.43
11	MAN-135	810925	988843		60/1B	Pannikulam	Kovilpatti	Tuticorin		1.31	
					60/2					1.06	
					Total					2.37	
12	MAN-138	809792	988917		72/6	Pannikulam	Kovilpatti	Tuticorin		1.91	
					73/3B2					1.06	
					Total					2.97	
13	MAN-324	815786	990531	Ramasubbu Nayakkar	189/2	Ilavelangal	Kayathar	Tuticorin	2.6	2.08	2.08
				Ramasubbu Nayakkar	190B/5				2.22	2.22	2.22
					Total				4.82	4.30	4.30
14	MAN-136	812172	989090		297/1	Thennampatti	Kayathar	Tuticorin		2.68	

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
					297/2					2.57	
					Total					5.25	
15	MAN-307	817306	1000392	Karuppasamy	218/1B	Koppampatti	Kayathar	Tuticorin	1.88	0.95	0.95
				paramasivan	227/3A				2.72	1.20	1.20
				karuppasamy	227/3B				1.83	2.30	2.30
					Total				6.43	4.45	4.45
16	MAN-301	812097	1001412	Devasagayam	8/2	Sundaresawarapuram	Kayathar	Tuticorin	5.74	5.74	3.81
				T R Alagarsami	8/1				1.75	1.75	0.70
					Total				7.49	7.49	4.51
17	MAN-197	815368	997457	Geetha	79/1	Kadambur	Kayathar	Tuticorin	2.22	1.40	1.40
				Geetha	79/2				1.74	1.74	1.74
				Geetha	79/3				1.04	0.24	0.24
				Geetha	80/3				3.46	1.10	1.10
					Total				8.46	4.48	4.48
18	MAN-188	813932	999215		7/3	Ottudanpatti	Kayathar	Tuticorin		4.53	
					Total					4.53	
19	MAN-280	807143	994093	Varalekshmi	278/6A1A	Akilandapuram	Kayathar	Tuticorin	2.2	2.20	2.20
				Varalekshmi	278/6A1B				1.94	1.94	1.94
				Varalekshmi	278/6A1C				0.04	0.03	0.025
					Total				4.18	4.17	4.165
20	MAN-319	820357	995922	Mutharasi, Pappu Raj, Naagammal, Ramasubbu	122/1	K.Kumarapuram	Kayathar	Tuticorin	6.42	4.30	4.30
					Total					4.30	4.30

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
21	MAN-123	810991	986076	Soundara Rajan	414/3	Kalapaipatti	Kayathar	Tuticorin	5.43	5.43	4.47
					Total					5.43	4.47
22	MAN-127	809888	985348		361/1	Kalapaipatti	Kayathar	Tuticorin		0.70	
					362/1					0.96	
					363/1					0.70	
					367/2					3.26	
					368/5					0.32	
					Total					5.94	
23	MAN-328	818302	999265	Guruvalakshmi, mahendran	190/6	Koppampatti	Kayathar	Tuticorin	3.285	1.00	1.00
				Guruvalakshmi, mahendran	190/7				1.59	0.53	0.53
				sekar	190/8				3.27	2.80	2.80
					Total				8.145	4.33	4.33
24	MAN-196	815660	998146	Nixeon Paul Wesley & R Peterson Paul Ebenezer	173/3	Ottudanpatti	Kayathar	Tuticorin	0.94	0.27	0.27
					173/4				5.2	0.90	0.90
					173/5				3.58	3.13	3.13
					Total				9.72	4.30	4.30
25	MAN-194	816770	999568		200/1	Koppampatti	Kayathar	Tuticorin		2.66	
					200/3					1.38	
					200/4					0.73	
					Total					4.77	
26	MAN-146	809041	995856		252/1	Kapulingampatti	Kayathar	Tuticorin		2.52	2.52
					252/2					2.30	2.30
					Total					4.82	4.82

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
27	MAN-297	811317	999757	Suseela	282/1	Sivagnanapuram	Kayathar	Tuticorin	0.15	0.15	0.15
				Suseela	287/1B				1.58	1.58	1.58
				Suseela	287/4				0.31	0.31	0.31
				Suseela	287/5				0.80	0.80	0.80
				Suseela	287/6				2.16	2.16	2.16
					Total				5.00	5.00	5.00
28	MAN-326	820022	996672	George Edwin	51/4	K.Kumarapuram	Kayathar	Tuticorin	4	3.23	3.23
				George Edwin	51/6A				1.24	0.60	0.60
				Gurusamy	51/6B				1.48	0.65	0.65
					Total				6.72	4.48	4.48
29	MAN-320	820169	993759	shanmuga reddiar	31/2	Kudiraikulam	Kayathar	Tuticorin	2	1.00	1.00
				bala chandra reddiar	31/3A				0.91	0.91	0.91
				bala chandra reddiar	31/3B				0.84	0.84	0.84
				Ganga devi, Senthil kumar and raj kumar	31/3D				0.91	0.90	0.90
				Ganga devi, Senthil kumar and raj kumar	31/3C				0.9	0.91	0.91
					Total				5.56	4.56	4.56
30	MAN-346	820089	1001245		59/3	Vadaku Vandanam	Kayathar	Tuticorin		1.69	
					60/1					3.43	
					61/1B					1.67	
					Total					6.79	
31	MAN-355	810018	988401	Letchumy Iya & Rajeswari	497/3	Terku mailodai	Kayathar	Tuticorin	2.56	2.56	2.56
				Arunthuyil Vadivu	497/4				2.28	2.28	2.28

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
					Total				4.84	4.84	4.84
32	MAN-159	811005	995642	Muthaiah konar	125/5	Thirumalapuram	Kayathar	Tuticorin	1.3	0.85	0.85
				Sankarraja	125/6				5.14	3.44	3.44
					Total				6.44	4.29	4.29
33	MAN-353	820167	991285	Gobalasley & Athilakshmi	173/3B	Malaipatti	Ottapidaram	Tuticorin	2.08	1.50	1.50
				Kombaya Reddiar & Suseela	173/4				4.16	3.00	3.00
					Total				6.24	4.50	4.50
34	MAN-380	819352	991563	Muniasamy	178/2	Malaipatti	Ottapidaram	Tuticorin	3.01	2.18	2.18
				Subburaj	178/3				3.01	2.00	2.00
				Ayappa Nayakar	184/2				3.57	0.20	0.20
					Total				9.59	4.38	4.38
35	MAN-311	818339	998690	Ramalingam	50/2	Kuppanapuram	Kayathar	Tuticorin	1.06	0.75	0.75
				madasy	50/7				1.62	1.62	1.62
				madasy	51/1				1.6	1.60	1.60
				balakrishnan	51/2				6.08	0.73	0.73
					Total				10.36	4.70	4.70
36	MAN-312	820370	999605	Kasiammal & Narayansamy	107/3B	Terku vandanam	Kayathar	Tuticorin	0.33	0.33	0.33
				Gurusamy	107/3C				0.51	0.51	0.51
				Gurusamy	107/3D				0.11	0.11	0.11
				Kasiammal & Narayansamy	107/3E				0.51	0.51	0.51
				Ragavan	107/4				0.40	0.40	0.40
				Ragavan	107/5				1.53	1.53	1.53

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
				Kasiammal & Narayansamy	107/8B				0.14	0.14	0.14
				Gurusamy	107/8C				0.42	0.42	0.42
				Kasiammal & Narayansamy	107/8D				0.37	0.37	0.37
				Total					4.32	4.32	4.31
37	MAN-189	813472	998267	Sankara Narayanan, velusamy, Nachiyarammal	65/1	K.Chidambarapuram	Kayathar	Tuticorin	2.85	2.54	2.54
				ayyammal	65/2				2.81	1.96	1.96
				Total					5.66	4.50	4.50
38	MAN-299	813308	999538	Ramasubbalakshmi, ramamoorthi	18/1	K.Chidambarapuram	Kayathar	Tuticorin	4.52	3.14	3.14
				Venkadaswamy nayaker, venkadeswaran	18/2				2.69	1.80	1.80
				Total					7.21	4.94	4.94
39	MAN-349	821322	1001818	Madasamy	85/2A	Vadaku vandanam	Kayathar	Tuticorin	3.72	2.87	2.87
					85/2B				3.48	1.63	1.63
				Total					7.20	4.50	4.50
40	MAN-361	824016	1001364	Visuvasa Nadar	172/2	Achankulam	Kayathar	Tuticorin	3.01	1.72	1.72
				Visuvasa Nadar	173/1				5.13	2.74	2.74
				Visuvasa Nadar	173/2				1.93	0.26	0.26
				Total					10.07	4.72	4.72
41	MAN-161	809818	996870	Selvam Kappukaren Selva Kumar Bala Subramanian	190/2A1	Kappulingampatti	Kayathar	Tuticorin	2.79	2.420	2.420
				Shunmugaiah velar Ramaiah Velar	190/2A2				2.35	2.02	2.02

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
					Total				5.14	4.44	4.44
42	MAN-379	816023	999177	Subramani	139/1	Ottudanpatti	Kayathar	Tuticorin	3.83	1.930	1.930
					139/2				2.37	2.37	2.37
					Total				6.20	4.30	4.30
43	MAN-160	810978	996446	Radhakrishnan	114/6	Tirumalapuram	Kayathar	Tuticorin	0.64	0.640	0.640
				Krishnaswamy	114/7A				0.19	0.19	0.19
				Krishnaswamy	114/7B				3.81	3.81	3.81
					Total				4.64	4.64	4.64
44	MAN-350	822093	1001229	M/s Bharathi Agro Bio farm pvt ltd	10/1A	Achankulam	Kayathar	Tuticorin	1.04	1.04	1.04
				M/s Bharathi Agro Bio farm pvt ltd	10/1B				0.66	0.66	0.66
				M/s Bharathi Agro Bio farm pvt ltd	10/2				1.23	1.23	1.23
				M/s Bharathi Agro Bio farm pvt ltd	11/1				0.30	0.30	0.30
				M/s Bharathi Agro Bio farm pvt ltd	12/1				1.16	1.16	1.16
					Total				4.39	4.39	4.39
45	MAN-345	821494	1000590	M/s Bharathi Agro Bio farm pvt ltd	118/6	Vadakku vandanam	Kayathar	Tuticorin	0.98	0.22	0.22
				M/s Bharathi Agro Bio farm pvt ltd	118/7				0.89	0.56	0.56
				M/s Bharathi Agro Bio farm pvt ltd	118/8				0.96	0.96	0.96
				M/s Bharathi Agro Bio farm pvt ltd	118/9				0.7	0.43	0.43

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
				M/s Bharathi Agro Bio farm pvt ltd	118/10				0.89	0.63	0.63
				M/s Bharathi Agro Bio farm pvt ltd	118/11				2.21	1.45	1.45
					Total				6.63	4.25	4.25
46	MAN-362	822783	1001996		21/1	Achankulam	Kayathar	Tuticorin		0.50	0.50
					21/2					0.70	0.70
					21/3					0.66	0.66
					21/4					0.61	0.61
					21/5					0.68	0.68
					21/8					0.65	0.65
					21/9					0.65	0.65
					22/2					0.12	0.12
					Total					4.57	4.57
47	MAN-305	815032	1000238	Prabhu Devadass	130/1K	Melparaipatti	Kayathar	Tuticorin	10.2	4.50	4.50
					Total				10.2	4.50	4.50
48	MAN-340	822636	997787	Murugan	63/1	Theethampatti	Kayathar	Tuticorin	4.22	4.22	2.86
					63/2				2.83	2.83	1.79
					Total				7.05	7.05	4.65
49	MAN-124	811942	985275	Azhagesan	63/20A	Kothali	Kayathar	Tuticorin	2.98	2.96	
				K.V.chandran	63/20B				3.16	3.16	
					Total				6.14	6.12	
50	MAN-356	825881	998206		51/1	pasuvandhanai	Ottapidaram	Tuticorin		4.200	
					Total					4.20	

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
51	MAN-415	813078	994190	Balasubramanian, muthuvinayagam	376/3	K.Chidambarapuram	Kayathar	Tuticorin	0.8	0.60	0.60
				Muthulakshmi	377/4				3.8	3.80	3.80
				Total					4.6	4.40	4.40
52	MAN-352	810353	986610		398/3A	Kalappaipatti	Kayathar	Tuticorin		0.94	
					398/3B					1.03	
					398/3C					1.09	
					398/3D					2.63	
					Total					5.69	
53	MAN-366	821463	1004591		418/2	Thuraiyur	Kovilpatti	Tuticorin		2.29	
					418/4					1.17	
					418/5					0.13	
					417/5					0.31	
					Total					3.90	
54	MAN-378	823908	1005970	Shaunmugasundari	31/3(p)	Kamanaikanpatti	Kayathar	Tuticorin	5.52	4.50	4.50
				Total					4.50	4.50	
55	MAN-185	812187	997753	Dhanalakshmi, Santhi, Padmavathi, Alagammal, Ramasamy, Sasirega	237/1	K.Chidambarapuram	Kayathar	Tuticorin	0.975	0.975	0.975
				Veeralakshmi, Rajalakshmi, Kalaivani, Gayathri, Velammal	237/2(p)				4.24	3.31	3.31
				Total					5.215	4.285	4.285
56	MAN-304	814167	1000770		110/1	Melparaipatti	Kayathar	Tuticorin		1.040	
					110/6A					0.440	
					111/4					2.83	

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
					Total					4.310	
57	MAN-302	812409	1002465	Maheswari	32/2A	Kurumalai	Kayathar	Tuticorin	3.41	3.410	3.410
				Paulraj	32/2B				2.865	1.16	1.16
					Total				6.275	4.570	4.570
58	MAN-201	814499	994230	Anthony ammal	94/1A	Sankaraperi	Kayathar	Tuticorin	1.88	1.320	1.320
				Suthalaikani	94/2A				4.14	3.18	3.18
					Total				6.020	4.500	4.500
59	MAN-303	1001626	813536	Ramasamy Thevar	120/1(p)	Kurumalai	Kayathar	Tuticorin	6.41	4.400	4.400
					Total				6.41	4.400	4.400
60	MAN-368	822032	1006315		194/2(p)	thuraiyur	kovilpatti	Tuticorin		3.810	
					Total					3.810	
61	MAN-184	812387	997062	Ramasamy	256/8	K.chidambarapuram	Kayathar	Tuticorin	2.25	2.250	2.250
				Kandhasamy	36/7A	Thirumalapuram			1.7	1.680	1.680
					Total				3.95	3.930	3.930
62	MAN-384	811558	1003023	Vijayakumar	18/2	kurumalai	Kayathar	Tuticorin	1.91	1.910	
				Thangaraj	18/3				1.68	0.300	
				Vijayakumar	18/4				1.54	1.540	
				Kaliraj	18/5				1.69	0.650	
					Total				6.82	4.400	
63	MAN-377	824883	1003520	gnana selvam, vincent mary, arockiya mary	226/2B	Kamanaikanpatti	kayathar	Tuticorin	6.3	3.660	3.660
				soosai micheal raj, john vincent, anthony francis	226/2C				2.23	0.840	0.840
					Total				8.53	4.500	4.500

SL No	Loc No	UTM co-ordinates		Name of Land Owner	SF NO.	Village	Taluk	District	Total Land	Lease Extent in acres	Saled Extent in acres
		Easting	Northing								
64	MAN-388	807678	990926	Madasamy P	208/1A(P)	Pannikulam	Kovilapatti	Tuticorin	12.74	4.720	4.720
					Total				12.74	4.720	4.720
65	MAN-412	812034	993253	Ramasubbu	4/3	Sankaraperi	Kayathar	Tuticorin	8.11	4.640	4.640
					4/4				0.66	0.360	0.360
					Total				8.77	5	5
66	MAN-417	812775	992818	Ramarpandian	8/2B2	Sankaraperi	Kayathar	Tuticorin	3.35	0.65	0.65
					8/2B3				4.95	3.26	3.26
					8/2B4				1.85	0.89	0.89
					Total				10.150	4.800	4.800

Temporary Land Agreement						
S.No	SF. No.	Village name	Land Owner name	Area (in Acre)	Duration(Month)	Purpose of Land
1	78/7	South Vandanam	Chelliya	1.11	12	Road
2	203/1	Ottudenpatti	Mariyappan, Shanmugaraj M, karuppasamy, Subbiya Valaiyar, Chelladurai, arumugadever	0.62	12	Road
	203/3A			2.35		
	203/3B			0.05		
	203/3C			0.28		
	204/2			1.58		
	205/1			0.6		
	205/2			0.58		

Temporary Land Agreement						
S.No	SF. No.	Village name	Land Owner name	Area (in Acre)	Duration(Month)	Purpose of Land
	205/3			2.89		
3	232/3	Ottudenpatti	Karuppasamy	1.23	12	Road
	232/2			4.75		
	235/1			2.8		
	235/2			0.83		
	157/1			7.2		
	157/2			4.01		
	158/2			5.22		
	158/4			5.73		
4	224/2B	Ottudenpatti	Mariyappan	2.2	12	Road
	224/3			1.23		
	219/1			1.42		
5	120/2A	kuppanapuram	Ravi	1.68	12	Zeropoint
	120/2B			0.98		
	126/1B			1.355		
	126/2			0.935		
	127/3			4.395		
	168/1			3.505		
	168/2			4.605		
169/3	2.62					

Temporary Land Agreement						
S.No	SF. No.	Village name	Land Owner name	Area (in Acre)	Duration(Month)	Purpose of Land
6	48/10B	Muthuramalingapuram	Ramasamy Ponnaiyan	0.91	12	Road
7	54/2	Muthuramalingapuram	Karuppasamy		12	Road
8	48/6	Muthuramalingapuram	Muniasami V	0.5	12	Road
9	48/7	Muthuramalingapuram	Santhi	1	12	Road
	53/3			1.87		
10	48/10 A	Muthuramalingapuram	Palsamy nadar	0.765	12	Road
11	220/4	Meenakshipuram	Gandhi muthuraj	0.97	12	
	220/7			1.23		
12	90/1	Ottudenpatti	Ponnusami, Jagatheesan	0.64	12	Road
	90/3			1.06		
	90/5			0.73		
	240/2			1.96		
	250/2			2.91		
	239/1			5.52		
13	286/10A	Ottudenpatti	Selladurai	0.99	12	Road
	286/7			0.605		
14	203/4	Ottudenpatti	Karuthapandi L	0.78	12	Road
15	222/4	Ottudenpatti	Udaiyar Pandiyan	2.14	12	Road
16	286/5	South Vandanam	Krishnammal	0.48	12	Road

Temporary Land Agreement						
S.No	SF. No.	Village name	Land Owner name	Area (in Acre)	Duration(Month)	Purpose of Land
	286/6			0.56		
17	259	Theetampatti	Maharajan S	0.865	12	Road
18	257/1	kuppanapuram	Kumarasami	3.42	12	Road
19	347/4A	kuppanapuram	Kandhasamy Rediyar	3.21	12	Road
	347/4B			3.46		
20	347/1	kuppanapuram	Vellaisamy	1.7	12	Road
21	351/5	kuppanapuram	Nagammal	5.6	12	Road
22		kuppanapuram	Mariyappan		12	Using the Existing private road
23	133/1B	Kadambur	Pappiya	0.05	12	Road
	52/3			0.32		
24	101/9	Nagampatti	Arunachala Devar	0.51	12	Road
	391			0.36		
25	376/1	K Chitharabapuram	Alagusundari	1.98	12	Road
26	218/5	Meenakshipuram	Kanmani	1.1	12	Road
27	105/7	South Vandanam	Srinivasaga Perumal	1.42	12	Road
	105/8			1.21		
28	43/1	Pasuvanthani	Ashok	4.2	12	Road
	51/1			10.22		
	256/3			3.96		

Temporary Land Agreement						
S.No	SF. No.	Village name	Land Owner name	Area (in Acre)	Duration(Month)	Purpose of Land
29	131/1B	Achankulam	Perumal	1.49	12	Road
30	131/3A1	Achankulam	Santharaj	2.51	12	Road
	131/3A2			0.93		
	131/3B			1.14		
	131/4			0.27		
	131/5			0.28		
31	286/2	Ottudenpatti	Shanmugarasu	1.9	12	Road
	287/1			1.79		
32	134/2	thoothampatti	Ethiraj	0.05	12	Road
	118/2B			5.86		
	134/4A			32.74		
33	183/17	Koppampatti	Nadarajan	1.16	12	Road
	183/1S			0.91		
	183/1N			0.81		
	183/1L			0.27		
	183/1J			0.1		
	183/1R			0.49		
	183/1E			0.35		
	183/1"O"			0.35		
	183/1D			0.35		

Temporary Land Agreement						
S.No	SF. No.	Village name	Land Owner name	Area (in Acre)	Duration(Month)	Purpose of Land
	183/1C			0.2		
	183/1K			0.32		
	183/1B			0.17		
	183/1P			0.35		
	183/2			0.35		

