Environmental and Social Impact Assessment (ESIA) – Huong Linh 1 Wind Farm Project, Quang Tri Province, Vietnam

Prepared for:
Tan Hoan Cau Joint Stock Company

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www.erm.com

Contents

Executive Summary

The Huong Linh 30 MW Wind Power Project ("Huong Linh 1" or "the Project") involves the development of a wind power generation facility at Hoong Village, Cooc Village and Miet Village, Huong Hoa District, Quang Tri Province, Vietnam. The Project is being developed and will be operated by Tan Hoan Cau Corporation Joint Stock Company (THC JSC) who is also operating the Huong Linh 2 Wind Power Project within the area. The Project location is shown in **Figure ES1.**

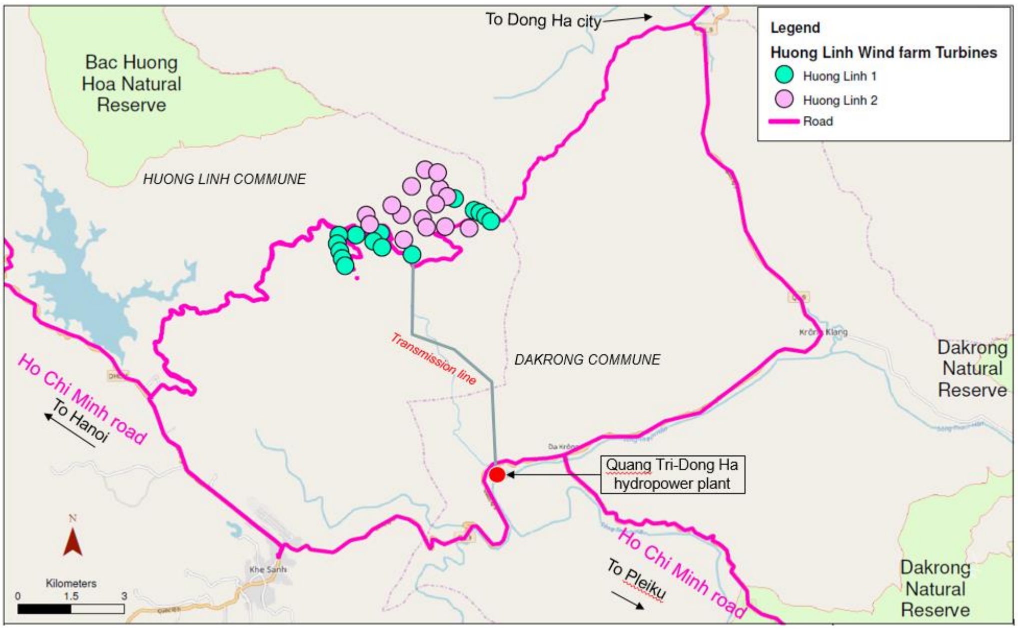


Figure ES1 Site Location and Surrounds

The proposed Project will be developed on approximately 9 hectares (Ha) of agricultural land with the nearest villages being at Hoong Village, Cooc Village and Miet Village approximately 125m to 198m m from the nearest turbines. The land is being acquired from local land users following the government-led land acquisition process. The land acquisition process has completed almost 80% and at current stage, 8.4 Ha of land have been acquired and 15 households . The Project will acquire further 0.6 Ha from three other households, and thus, the total number of directly affected households will be 18. Project construction is expected to require approximately 18 months with the wind power plant commencing operations in Quarter 4, 2019.

The construction consists of developing 15 wind turbines, transformer 110/22kV) and operating office and also access roads. Internal 22kV transmission lines will be installed and will connect to the existing 110kV line.

A local Environmental Impact Assessment (EIA) has been conducted on behalf of the Project proponent. the local EIA has been approved by the People Committee of Quang Tri Provice (*Decision No. 54/QD-UBND*, dated 12 January 2016).

ERM Vietnam (ERM) was commissioned by THCJSC to undertake an Environmental and Social Impact Assessment (ESIA) of its Huong Linh 1 Wind Farm to compliment the local EIA. The purpose of the ESIA is to inform

THCJSC and their project partners of environmental and social impacts associated with the Project and in particular the extent to which the project aligns with the expectations of the International Finance Corporation (IFC) Performance Standards and associated World Bank Group Environmental, Health and Safety (EHS) Guidelines. As such the ESIA will focus primarily on the specific environmental and social risks that are relevant to the IFC Performance Standards (PS) and associated World Bank Group's EHS Guidelines.

The ESIA will assess these impacts based on the agreed scope of baseline data collection and impact assessment and will results in the preparation of an Environmental and Social Management Plan (ESMP). The scope of this ESIA considers the pre-construction (i.e. site selection and land acquisition), construction and operational phase of the Project. This document provides an overview of the Project as well as a summary of key impacts and suggested management measures to align the Project with the Applicable Standards. Certain aspects of the Project have already been assessed in the local EIA and as such have been excluded from the impact assessment process for this ESIA (i.e. to avoid duplication of efforts and confusion). Mitigation measures set out in the local EIA are included in the ESMP.

Given that the regulatory EIA has been produced for the project, ERM have used this data and information as the basis of the ESIA. ERM have conducted a socio-economic baseline survey of affected communities to support the ESIA, as well as a noise screening and biodiversity screening study. A blade throw, visual assessment and shadow flicker assessment have also been prepared to support the ESIA. Bird and bat surveys are being completed in March and July 2018 and the ESIA will be updated following completion of these studies.

This ESIA report presents the findings of these studies in the context of an updated project description and an assessment of potential impacts from the proposed project activities.

On the whole, environmental and social impacts were assessed as being of **Moderate – Minor** negative significance and thus can be readily managed through the implementation of appropriate management plans and appropriate follow up actions. **Major** impacts were identified in relation to biodiversity impacts as a result of blade strike and also noise impacts. This is due of the project being located within an area of conservation significanve (biodiversity) and also the proximity of turbines from both HL 1 and HL 2, to village households. A number of positive social benefits were also identified during the assessment process. A summary of environmental and social impacts deemed to be moderate or positive are shown in *Table ES1.* Following implementation of appropriate mitigation or management measures residual impacts were considered to be *Minor.*

The ESIA concludes with the Environmental and Social Management Plan (ESMP) which details the environmental and social management commitments required for implementation as part of the Project's regulatory approval, as well as those identified as being necessary as part of the ESIA process.

An example of these is provided in *Table ES1.*

The ESMP represents the management and mitigation measures necessary to appropriately manage the identified environmental and social impacts of the Project.

Table ES 1 - Summary of Environmental and Impacts and Mitigation

Receptor	Potential Impact	Impact Evaluation	Mitigation	Residual Impact
Human and ecological receptors	Fugitive Dust from Soil Disturbance (Construction and Decomissioning)	Moderate	• Water sprays at exposed surfaces • Control speed limit • Minimize vehicle movements over designated areas • No cleared vegetation to be burnt.	Minor
Local community	Noise impacts from plant, equipment and machinery, or vehicle emissions (Construction) and from wind turbine emissions (Operations)	Moderate - Major	*Construction* • Adopt good-practice construction noise mitigation and management measures • High noise generating construction limited to the IFC daytime period (7AM to 10PM) • Noise complaints to be validated and measures to be identified and evaluated *Operation* • A baseline noise monitoring campaign be considered and designed • Operating turbines in reduced noise mode • Building appropriate noise barriers around potentially affected buildings • Curtailing turbine operations above the wind speed where needed	Minor
Terrestrial Biodiversity, particularly avifauna	Barrier creation, fragmentation and edge effects (Construction)	Moderate	• Appropriate rehabilitation of disturbed areas during operation	Minor-Negligible
	Vehicle strike, hunting and poaching (Construction)	Moderate	• Hunting and poaching will be prohibited • All vehicles are to maintain a speed of a maximum of 20km/hr • Biodiversity Action Plan	Minor-Negligible
	Turbine strike causing injury or mortality to bird and bat species	Major	• All tower structures are to be free of holes • Shut down-on-demand enabled • Contrasting colours are to be trialled on wind turbines • Slower turbine cut in speed	Moderate-Minor

Receptor	Potential Impact	Impact Evaluation	Mitigation	Residual Impact
			• Seasonal bird and bat studies during the first two years of operation • A carcass monitoring program is to be conducted on a weekly basis • A review of the data collected from monitoring and carcasses is to be undertaken every 6 months for 2 year	
Local community	Shadow flicker	Moderate	• Close monitoring through engagement with residents during the operational phase • Screening like higher fencing and planting trees can be explored at problem locations • Pre-programming the turbine with dates and times when shadow flicker would cause a nuisance for nearby receptors	Minor
Local community	Blade throw	Moderate	• Selecting wind turbines that have been subject to independent design verification/ certification • Carry out periodic blade inspections and repair • Lightning protection systems are properly installed and maintained • Equipping wind turbines with vibration sensors • Awareness building amongst the community	Minor
Land Acquisition	Economic benefits to the affected land users land compensation	Positive	• Work with the authority to monitor the land acquisition and compensation process • Proper documentation • Consider additional support, if required to meet the requirements of IFC	n/a
Land Acquisition	Loss of income for land users as a result of the Project land acquisition	Moderate	• Work with the authority to monitor the Compensation, Support and Resettlement (CSR) process • If required, implement an extended Community Development Plan (CDP) that should incorporate the Livelihood Restoration Programs/ Initiatives specifically designed for households	Minor

Receptor	Potential Impact	Impact Evaluation	Mitigation	Residual Impact
			having agricultural land acquired.	
Local Economy and Livelihood	Economic benefit to locals as a result of the Project employment and business opportunities (Construction and Operation)	Positive	• Work with EPC contractor to synchronize the Project's needs and the local's capacity • To have a clear stipulation/commitments of using local labour in the EPC contract • Inform Project's requirement related to employment and business opportunities • Establish a clear grievance mechanism	n/a
Indigenous People	The impacts on lands, natural resources and critial cultural heritage subject to traditional ownership or under customary use	Moderate	• Establish a stakeholder engagement plan and grievance mechanism • Review all public consultation process and compensation packages • Implement an expanded Community Development Plan (if necessary) which includes the Indigenous People Development Programs/ Initiatives and includes the mutually agreed supports with Indigenous People	Minor
Community safety	Potential transportation safety incident with community as a result of increase in Project traffic on a public road (Construction)	Moderate	• Disclosure and Consultation with the communities through corporation with local police • Enforce speed limit regulations, signage and flagman. Also emergency response procedure • Develop and implement Safety Transportation Management Plan, Traffic Management Plan • The proposed grievance mechanism should be accessible and implemented	Negligible

1 INTRODUCTION

Huong Linh 1 Windfarm Project (hereinafter to referred as "Huong Linh 1" or "the Project") involves the development of a wind power generation facilities in Huong Linh and Dakrong District, Quang Tri Province of central Vietnam. The project will be developed and operated by Tan Hoan Cau Corporation Join Stock Company ("THCJSC"). The Project is being developed to include the following:

- Construction and operation of 15 wind turbines covering an area of approximately 12 ha;
- Construction and operation of internal transmission lines connecting to an exiting 110 kV line; and
- Construction and operation of other auxiliary facilities.

The Project location map and overview of the area is provided in *Figure 1.1*.

The Project has completed the Vietnamese regulatory environmental approval process, and an Environmental Impact Assessment (EIA) report was prepared to support this. The EIA Approval Decision No. 54/QD-UBND, dated 12 January 2016 was issued by the People's Committee of Quang Tri Province.

In addition to the local EIA report, this Environmental and Social Impact Assessment (ESIA) has been developed to inform THCJSC and their project partners Vestas of environmental and social risks that are relevant to the Project. The ESIA will assess these risks based on the agreed scope of baseline data collection and impact assessment. The ESIA will focus primarily on the specific environmental and social risks that are relevant to the IFC Performance Standards and World Bank EHS Guidelines.

Figure 1.1 Project Location and Overview

Figure 1: Hong Phong 1A Solar Power Project Location Map

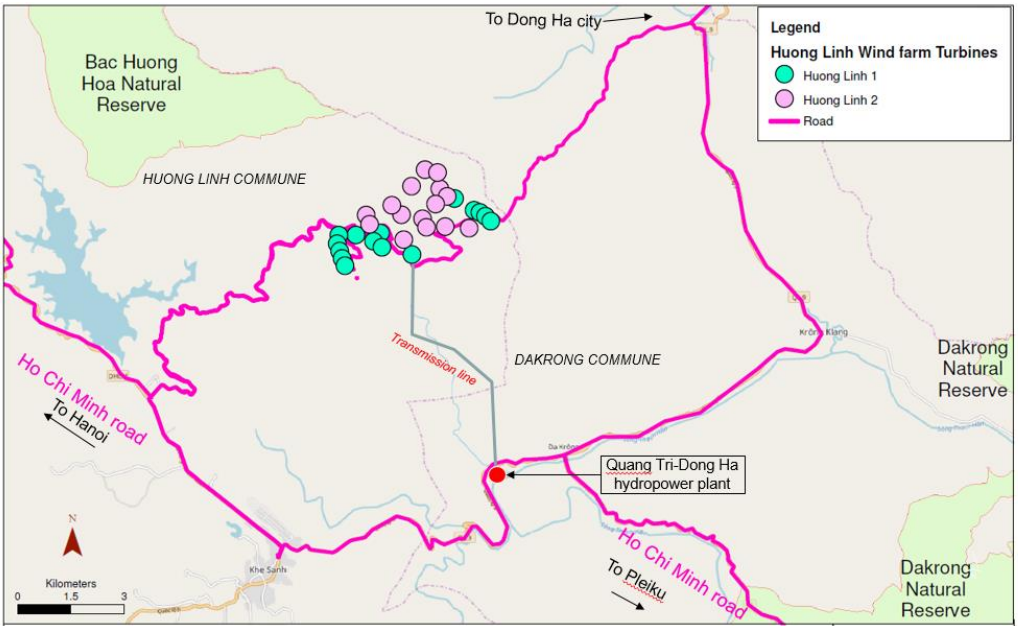
Environmental Resources
Management Vietnam
7 Floor, SFC Building
9 Dinh Tien Hoang, Da Kao
District 1, HCM City Vietnam

1.1 *PROJECT LOCATION*

Huong Linh 1 Wind Farm Project is located in Huong Linh Commune, Huong Hoa District and Dakrong Commune, Dakrong District of Quang Tri Province. The Wind Turbine Generators (WTGs) and the 110kV transmission line is in Hoong, Miet, Pa Cong and Cooc Hamlet of Huong Linh Commune, Huong Hoa District, and the rest of the transmission line goes through Vung Kho Hamlet, Dakrong Commune, Dakrong District.

These locations are depicted on *Figure 1.2.*

Figure 1.2 Project Location



The Project coordinates are presented as below *Table 1.1*

Table 1.1 Project Coordinates

Landmark	**Coordinate (VN2000, KTT 106⁰15', 3⁰)**	
	X (m)	Y (m)
1	1,848,900	554,100
2	1,850,500	557,200
3	1,847,800	558,300
4	1,847,000	555,100

Source: Feasibility Study Report of the Project

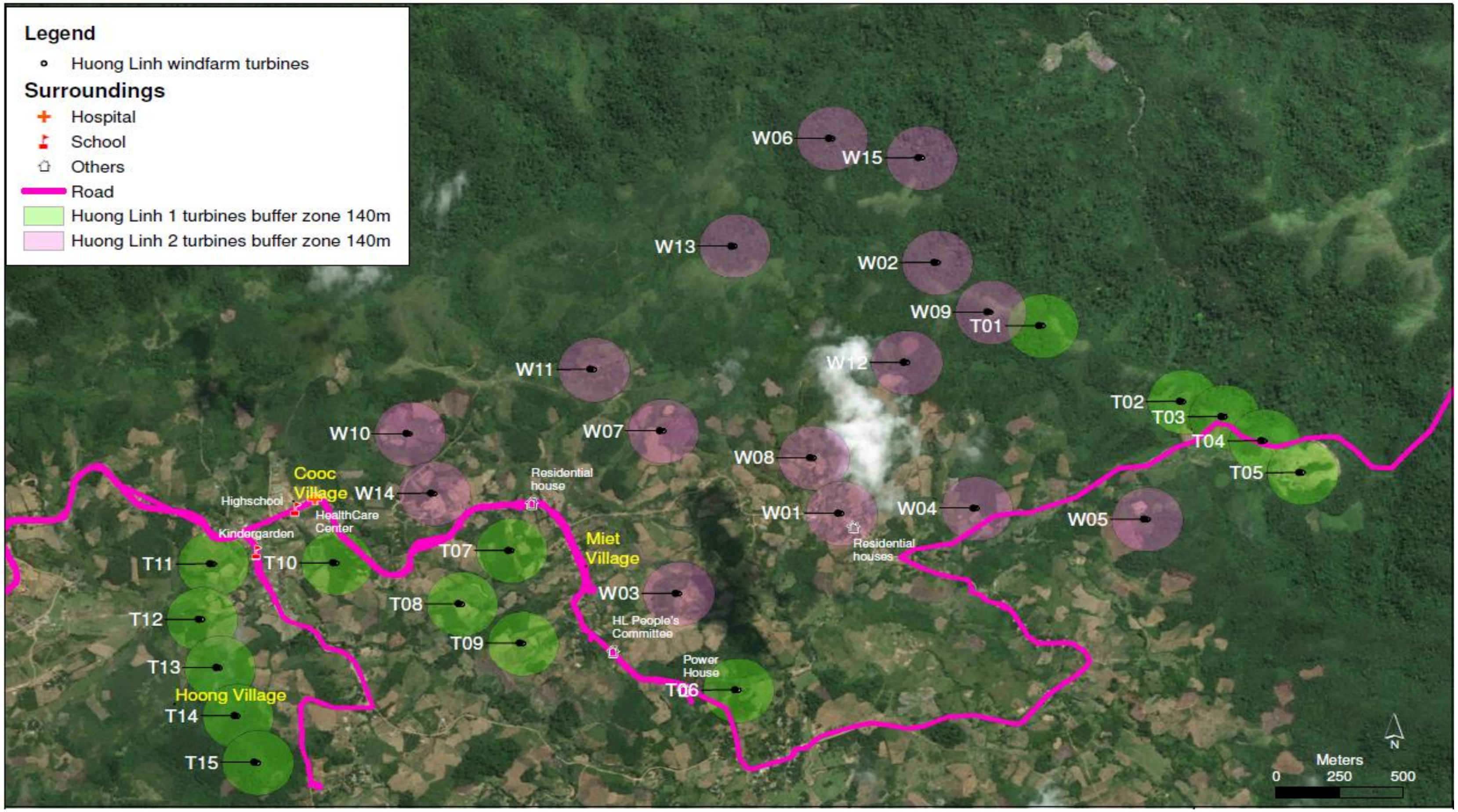
The Project is designed with 15 wind turbines located at the positions as presented in below *Table 1.2*. The specifications of wind turbines are described in *Table* 2.3 of Chapter 2. The location of the turbines in relation to surrounding villages is shown at *Figure 1.3*.

Table 1.2 Turbines Coordinates

No.	Elevation	Coordinate (VN2000, KTT 106°15′, 3°)		Height (m)
	(m)	Northing (m)	Easting (m)	
TB 1	504	1849839	690603	80
TB2	510	1849510	691156	80
TB3	490	1849444	691319	80
TB4	500	1849339	691476	80
TB5	504	1849201	691625	80
TB6	470	1848257	689407	80
TB7	470	1848863	688516	80
TB8	479	1848631	688321	80
TB9	470	1848460	688561	80
TB10	481	1848809	687828	80
TB11	475	1848805	687344	80
TB12	476	1848564	687299	80
TB13	490	1848354	687369	80
TB14	498	1848145	687440	80
TB15	510	1847943	687518	80

Source: Tan Hoan Cau (updated in December 2017)

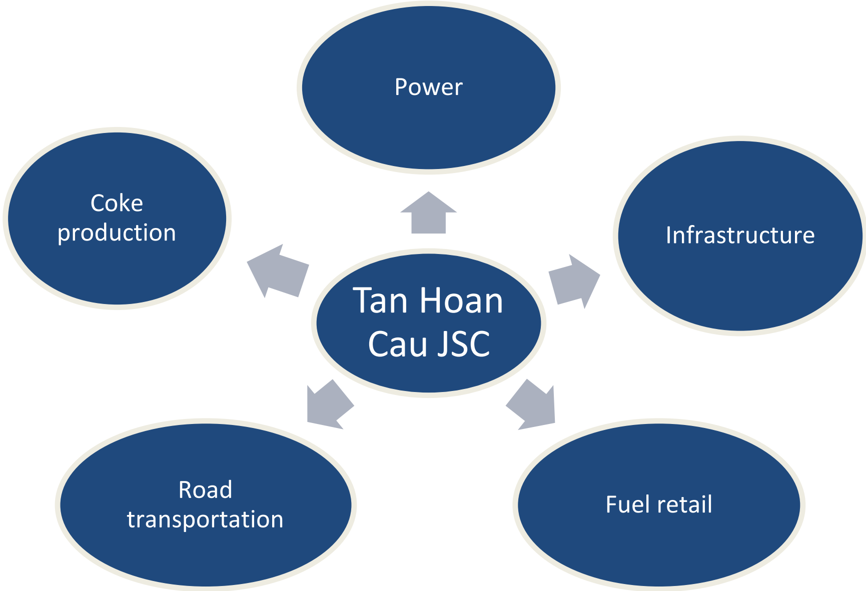
Figure 1.3 Project layout



1.2 *Project Proponent*

The develper of the Project, Tan Hoan Cau Joint Stock Company is headquartered in Dong Hoi Northwest Industrial Park, Bac Ly ward, Dong Hoi city, Quang Binh province. The company has diversified business interests with a major presence in the following business areas is as shown as below in *Figure 1.4*. .

Figure 1.4 Tan Hoan Cau JSC Portfolio



Currently THC JSCoperates the 30 MW Huong Linh 2 Windfarm project located in close proximity to the Project location (*Figure 1.3*). Moreover, the company has commissioned an additional 180 MW of wind projects. The list of wind projects owned by THC JSC is provided at *Table 1.3*. All of these projects is located in Quang Tri province.

Table 1.3 Tan Hoan Cau JSC Wind power projects

No	Project name	Project capacity (MW)	Status
1	Huong Linh 1	30	Under development
2	Huong Linh 2	30	Operation
3	Huong Linh 3	30	Under development
4	Huong Linh 4	30	Under development
5	Huong Linh 5	30	Under development
6	Huong Hiep 1	30	Under development
7	Huong Hiep 2	30	Under development
8	Huong Hiep 3	30	Under development

1.3 *PROJECT OBJECTIVES AND JUSTIFICATION*

According to the local EIA report of the Project, Vietnam has at least 100,000 MW wind power sources, mainly from the Vietnam's central coastal areas, southern areas, highland areas and islands.

The investment and development of renewable power projects plays an important roles in terms of economic growth, social development, energy security as well as environmental protection. With the issuance of Decision No. 1208/QD-TTg dated 21 July 2011, issued by the Prime Minister *Approving the National Power Development Scheme for the period of 2011 – 2020 with consideration to 2030*, the Government has also shown interest in renewable power sources, in which 1,000MW and 6,200MW of wind power shall be generated up to 2020 and 2030 respectively.

In 2015, under the Government's scheme, Ministry of Industry and Trade announced its decision No. 6185/QD-BCT dated 19 June 2015 *Approving "The Plan for Development of Wind Power in Quang Tri Province to 2020, Vision to 2030"*, in which the capacity of 287 million kWh will be expectedly achieved by 2020 from the wind power projects. In response to the Government's decision, THCJSC has made a decision of investment of "Huong Linh 1 Wind Farm Project" to take advantage of this opportunity.

The Project aims to supply renewable power to the local and surrounding areas. Huong Linh 1 Wind Farm Project might therefore result in the following environmental and social benefits:

- Producing enough power for local households that are connected to the grid;
- Reducing greenhouse gases generation in comparison to conventional hydropower plants or thermal power plants;
- Providing employment opportunities for local residents in Huong Hoa District and also Quang Tri Province;
- Contributing in the economic growth and making Vietnam and Quang Tri Province in particular an attractive target for the investors.

1.4 *PURPOSE AND SCOPE OF THE ESIA*

ERM Vietnam (ERM) was commissioned by THCJSC to undertake an Environmental and Social Impact Assessment (ESIA) of its Huong Linh 1 Wind Farm. The purpose of the ESIA is to inform THCJSC and their project partners of environmental and social impacts associated with the Project and in particular the extent to which the project aligns with the expectations of the International Finance Corporation (IFC) Performance Standards and associated World Bank Group Environmental, Health and Safety (EHS) Guidelines.

The ESIA will assess these impacts based on the agreed scope of baseline data collection and impact assessment and will results in the preparation of an Environmental and Social Management Plan (ESMP).

Given that the regulatory EIA has been produced for the project, ERM will use the data and information within this documents as the basis of the ESIA. ERM have conducted a socio-economic baseline survey of affected communities to support the ESIA, as well as a noise screening and biodiversity screening study. Biird and bat surveus are being completed in March and July 2018 and the ESIA will be updated following completion of these studies. The ESIA will focus primarily on the specific environmental and social risks that are relevant to the IFC Performance Standards (PS) and associated World Bank Group's EHS Guidelines.

1.5 ESIA STRUCTURE

The structure and contents of the ESIA is as follows;

- Chapter 1: Introduction;
- Chapter 2: Project Description
- Chapter 3: Applicable Standards and Regulatory Framework;
- Chapter 4: Analysis of Alternatives;
- Chapter 5: Impact Assessment Methodology;
- Chapter 6: ESIA Screening and Scoping;
- Chapter 7: Environmental Baseline;
- Chapter 9: Socio-economic Baseline;
- Chapter 10: Stakeholder Engagement
- Chapter 11: Environmental Impact Assessment
- Chapter 12: Social Impact Assessment;
- Chapter 13: Cumulative Impact Assessment; and
- Chapter 14: Environmental and Social Management Plan.

2 *PROJECT DESCRIPTION*

2.1 *INTRODUCTION*

This chapter provides a detailed description of the Project development assessed within this ESIA.

The Project will have a power capacity of 30 MW and is expected to be operational for a period of 50 years. As of February 2018, THCJSC has;

i. Been approved for the investment of the Project according to the Decision No. 2800/QD_UBND dated 16 December 2015 issued by the People's Committee of Quang Tri Province;

ii. Completed the regulatory EIA report as per the Vietnamese regulations; and

iii. Obtained the approval for its EIA report according to Decision No. 54/QD-UBND, dated 12 January 2016, issued by the People's Committee of Quang Tri Province.

The Project will require the construction and operation of the following key elements, which are depicted in *Figure 1.2* and *Figure 1.3.*

- Installation of 15 wind turbines;
- Installation of internal 22 kV transmission line which will connext to the existing 110 kV transmission line;
- Installation of transformer station 110/22kV; and
- Construction of internal access roads to each WTG location.

2.1.1 *Location and Site Setting*

The Project will be developed within a 9 ha area of Huong Hoa and Dakrong Districts, at the villages of Cooc, Miet and Hoong. The site is located within a mountainous region and the topography is generally undulating.The site rests within a mountain valley with steep forested hillsides on either side. A number of small streams occur and Rao Quan lake is also located 3.5 km north of the Project area and is being used for water supply for Quang Tri hydro power plant.

The project area contains the small villages of Cooc, Miet and Hoong within which approximately 239 households of Bru-Van Kieu people reside. The project area has been subject to past clearing and ongoing agricultural use, such as raising of livestock. The Bac Huong Hoa nature reserve is located 1.7km southeast of the Project.

The Project located 8km northeast of National Road No. 9. There is an asphalt road connecting National Road No. 9 and Huong Linh Commune, while a series of inter-hamlet roads and other tracks serving farming purposes occur within the area.

The site setting is depicted in the photos below.

Figure 2.1 *Site setting*

2.1.2 *Area of Project Disturbance*

The wind farm and all associated infrastructure will occupy approximately 9.4 ha while the other areas for temporary construction works will occupy the area of 17.8ha. The approximate area of the main components is summarized in Table *2.1*, along with a brief description of each of the main components.

Table 2.1 Approximated Area Required

Project Component	Land Required (Ha)	Remark
Internal road	1.50	
Tranformer (110/22kV) and operating office	1.43	
Foundation of transmission line 110kV	0.26	
Foundation of transmission line 22kV	0.22	
Foundation of wind turbines and construction area	6.00	
Lay-down area (closed area)	0.05	Temporarily occupied by the project
Lay-down area (open area)	0.20	Temporarily occupied by the project
Parking lot and construction equipment	0.20	Temporarily occupied by the project
Worker camp	0.15	Temporarily occupied by the project
Construction contractor office	0.15	Temporarily occupied by the project
Onsite lab	0.02	Temporarily occupied by the project
Safety corridor for transmission line 110kV	10.30	Temporarily occupied by the project
Safety corridor for transmission line 22kV	6.7	Temporarily occupied by the project
Total	**27.23**	

Source: Feasibility Study Report of the Project

2.1.3 Current Project Status and Schedule

The project is aiming to commence construction in Q2-2018 and be operational by Q4 2019. Project schedule is presented in *Table 2.2.*

Table 2.2 Project Schedule

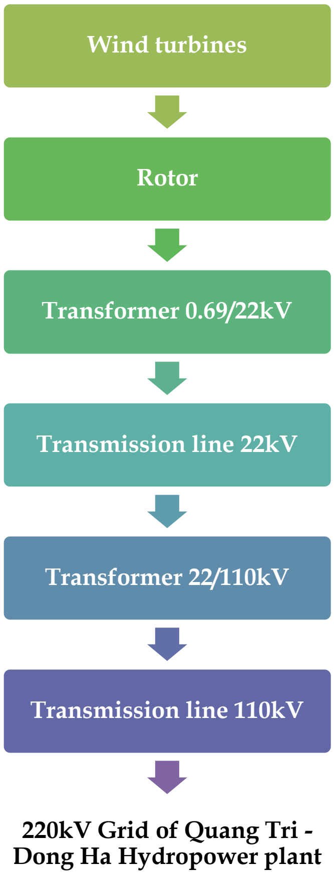
Phase	Time
Preparation	2015 – 2018
Construction	2018 – 2019 (approximately 18 months)
Operation	Commence in Q4 of 2019

2.2 DESCRIPTION OF PROJECT FACILITIES AND COMPONENTS

2.2.1 Main Project Components

A process flow diagram of the Project indicating main components is provided in *Figure 2.2* below. Specifications of each main component are described under the following sub headings.

Figure 2.2 Process Flow Diagram of the Project



Wind turbines operate on a simple principle. The energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity (3 phase, alternating current, 690 V). The transformers will increase the electricity to 22kV, the transformers connect with each other through the medium voltage line 22kV which then connects to the transformers 22/110kV and to the grid of Quang Tri- Dong Ha through the existing 7km line.

The WTG specifications are provided at *Table 2.3*.

Table 2.3 Wind turbines

Items	Specification
Number of blade	3
Rotor diameter	116m
Swept area	10,568m^2
Operational interval	7.6 – 13.4 rpm
Frequency of generator	50/60Hz
Hub height	80m

2.3 PROJECT ACTIVITIES

2.3.1 *Construction Phase*

For the wind farm, construction phase activities will include:

- Site preparation including subcontractor mobilization, construction of site compound and lay down areas. A workforce of approximately 100 people will be required during construction;
- Upgrading and construction of internal roads including laying of cables;
- Site clearance;
- Laying of turbine foundations, turbine delivery and installation;
- Completion of internal electrical connections;
- Turbine testing to verify proper operation of the facility; and
- Commissioning.

It is noted that the construction materials are transported to the Site by trucks via roads as below:

- Stones and gravels are carried from Cam Lo district to the Site via National Road No.9 and Khe Sanh town. The distance is approximately 45km;
- Sand will be mobilized from Ba Long river at Krong Klang town to the Site via National Road No.9. Transport distance is approximately 35km;
- Cement and steel are mobilized from agencies at Khe Sanh town to the Site. Transport distance is approximately 15km;
- Machinery is transported from Chan May port (Hue) to the Site via National Road No.1 and No.9 and Khe Sanh town to the Site. Transport distance is approximately 150km; and
- A concrete batching plant was developed for HL 2 and is located in close proximity to the site.

2.3.2 *Operation Phase*

The list of activities to be carried out in the operation and maintenance phase would be:

- Half yearly and annual maintenance scheduled activities at each WTG location as per the supplier specifications;
- Routine inspection of all WTGs as per supplier specifications;
- Operation and maintenance of ancillary facilities such as yards, stores, Central Monitoring System (CMS) building facilities;
- Inspection and maintenance of transmission lines; and
- Inspection and maintenance of intra-site pathways/ access roads.

The wind turbines will operate at all times provided wind speeds are suitable with the exception of downtime required for maintenance activities. For the most part, day to day facility operations will be automated through the use of computerized networking systems. A team of technical wind farm maintenance specialists would be employed by the Project during the operation phases. The team will also comprise of suitable Operation & Maintenance (O&M) for general maintenance of the wind farm site.

2.4 EMPLOYMENT AND ACCOMMODATION

- No. working day/year: 365 days
- No. of shift/day: 3 shifts/day
- No. of employees during the construction phase: 100 persons
- No. of employees during the operation phase: 30 persons

2.5 WASTE MANAGEMENT AND STORAGE

2.5.1 Construction Phase

The solid waste generated by the project will consist of general domestic waste assocated with the workforce,metal scrap, and excess construction materials. The main types of waste that will be generated and sources and show in the below table.

Table 2.4 Waste generated, sources and disposal method

No	Waste type	Source	Estimated quantity	Method of disposal
Non-hazardous waste				
1	Domestic solid waste	Labour activities	~60kg/day	Waste will be segregated onsite and will be disposed of at site through scientific manner
2	Construction debris (excavated soil)	Construction of WTGs, access roads, substations, storage yards…	0.5-1.0 ton/day	Excavated materials to be used for backfilling and levelling and other debris shall be used for road construction
3	Packing waste containing wood, cardboard and other recyclables	Packing material for WTGs and accessories	~10kg per WTG	Sold to recyclers
4	Sludge from wastewater septic tanks	Labour camp	~10kg/month	Collected and disposed off through contractors
5	All non-recyclables	Construction activities and Labour camps	5-10kg/day	Collected and disposed by the contractor at designated landfill sites
Hazardous waste				
1	Used oil/waste oil and Oil contaminated rags	Diesel generators set, construction machinery	5-10litres/month	Collected and disposed off through approved recyclers in accordance to Circular No. 36/2015/TT-BTNMT of MONRE on the management of hazardous waste.

2.5.2 Operation Phase

- During operation phase, the waste generated from Project will include domestic solid waste from the Monitoring and Control facilities and hazardous waste such as waste oil, lubricants and oil contaminated rags generated during maintenance activities;

- The hazardous waste will be stored onsite at designated covered areas provided with impervious flooring. The storage containers will be clearly marked and identified for their hazards;

- The hazardous wastes will be disposed of in accordance to Circular No. 36/2015/TT-BTNMT of MONRE on the management of hazardous waste;
- Non-recyclable wastes will be collected, segregated onsite and handed over to local collectors for disposal;
- Sewage will be disposed off through septic tanks and soak pits.

2.6 *WATER USE SUPPLY AND STORAGE*

2.6.1 *Construction Phase*

Water supply for domestic use will be drawn from an onsite well (80m deep), the well location will be considered for latter operation of the Project. The water consumption for 100 workers is estimated at 8 m^3/day.

Water for construction activities is sourced from Nghi Stream.

2.6.2 *Operation Phase*

During operations water for domestic and cotune maintenance activities will be drawn from the existing well.

3 *APPLICABLE STANDARDS AND REGULATORY FRAMWORK*

3.1 *INTRODUCTION*

There are two levels of regulatory provisions applicable to the Project. The first is the Vietnamese assessment and approvals process which must be followed to achieve regulator environmental approval. Secondly, as the proponent seeks to adhere to meeting international standards, the 2012 IFC Performance Standards 1-8 (IFC PS) and the World Bank Group EHS Guidelines are also applicable. The primary means of integrating the IFC PS and EHS expectations into the construction and operational phase of the Project is through the preparation of this ESIA.

The Project has obtained regulatory environmental approvalhowever in applying international standards to the Project there are additional international standards and expectations which the Project will be required to fulfil throughout the construction and operational scope. While some synergies exist between Vietnamese regulatory EIA and ESIA, there are also some key differences which have necessitated the preparation of this ESIA.

The EIA and ESIA processes and their relevance to the Project are described in detail below.

3.2 *VIETNAMESE REGULATORY FRAMEWORK*

3.2.1 *Overview of Vietnamese Legislation*

The National Assembly is the highest legislative body in Vietnam and is responsible for enacting framework legislation. The Government uses the legislation as a framework to develop policies, decisions, decrees and directives. Ministries (at the National level) within their area of competence issue guidelines and standards and ensure implementation of the same. The guidelines and standards issued by the Ministries are in line with Government policies and within the legislative framework issued by the National Assembly. At the provincial level, People’s Committees take the role of Ministries.

3.2.2 *Summary of Applicable Standards*

National environmental and social standards and targets in Vietnam are mainly derived from the *Law of Environmental Protection 2014 (LEP)*. The LEP’s associated Decrees, Decisions and Circulars prescribe the various environmental and social regulations’. Some relevant standards and targets are also contained in health and safety legislation.

These regulations refer to the official Vietnamese standards and national technical regulations abbreviated as TCVNs (Tieu Chuan Viet Nam) and QCVNs (Quy Chuan Viet Nam). The national standards and technical regulations generally prescribe maximum permissible levels of pollutants, such as emissions or waste streams. Individual provinces can establish their own standards but these must be more stringent that the national standards.

Table 3.1 Vietnamese Legislation, Standards, Decrees & Circulars Applicable to the Project

Legislation, Decrees, Circulars & Standards	Issued by	Issued date	Name/ Description
Legislation			
Law on Environmental Protection	National Assembly	29-Nov-2005	Framework environmental law
Law on Water Resources	National Assembly	21-Jun-2012	Framework law on the management and protection of water resource
Law on Biodiversity	National Assembly	13-Nov-2008	Requirement for biodiversity conservation and sustainable development
Law on Chemical	National Assembly	21-Nov-2007	Framework law on handling, use, storage, transport, trading manufacturing of chemicals.
Law on inland waterway navigation	National Assembly	24-Jun-2004	Requirements for inland waterway navigation activities
The Maritime Code 2005	National Assembly	14-Jun-2005	The legal requirements for use of ships and vessels for economic, scientific, technological, cultural, sport, and social purposes.
Law on Cultural Protection No. 28/2001/QH10	National Assembly	29-Jun-2001	Providing the activities of protecting and promoting the values of cultural heritages;
Labour Code 2012	National Assembly	18-Jun-2012	Framework law on health and safety
Law on Grievance and Denouncement 1998 (amended 2005)			Requirements for the general grievance mechanism
Land Law 2003 and Land Law 2013	National Assembly	29-Nov-2013	Framework law on the powers and responsibilities of the State as representative of the ownership of land
Directives			
Directive No. 35/2005/CT/TTg	The Prime Minister	17-October-2005	Implementation of Kyoto Protocol
Decrees			
Decree No. 201/2013/ND-CP	Government	27-Nov-2013	Detailing the implementation of a number of articles of the Law on Water Resources
Decree No. 45/2013/ND-CP	Government	10-May-2013	Providing the articles of the labor code on hours of work, hours of rest, occupational safety and occupational hygiene
Decree No. 29/2011/ND-CP	Government	18-Jul-2011	Regulation on Strategic Environmental Assessment, Environmental Impact Assessment, Commitment of Environmental Protection which took effect on 5th June 2011
Decree No. 26/2011/ND-CP	Government	8-Apr-2011	Amending and supplementing a number of articles of the Government's Decree No. 108/2008/ ND-CP of October 7, 2008, detailing and guiding a number of articles of the Chemical Law
Decree No. 65/2010/ND-CP	Government	11-Jun-2010	Guiding and detailing a number of articles of Biodiversity Law

Decree No. 108/2008/ND-CP	Government	28-Jun-2010	Detailing and guiding the implementation of a number of articles of the Chemical Law
Decree No. 21/2008/ND-CP	Government	28-Feb-2008	Amending some articles and supplements Decree No. 80/2006/ND-CP.
Decree No. 69/2009/ND-CP	Government	13-Aug-2009	Additionally providing for land use planning, land prices, land recovery, compensation, support and resettlement
Decree No. 84/2007/ND-CP	Government	25-May-2007	Adding provision on issuance of land use right certificate, on land recovery, on exercise of land use rights, on order and procedure for compensation, assistance and resettlement when the state recovers land, and on resolution of complaints about land.
Decree No. 59/2007/ND-CP	Government	9-Apr-2007	Regulations on hazardous waste management
Decree No. 80/2006/ND-CP	Government	9-Aug-2006	Guiding the implementation of LEP 2005
Decree No. 197/2004/ND-CP	Government	3-Dec-2004	provides for the compensation, support and resettlement when land is recovered by the State
Decree 109/2003/ND-CP	Government	23-Aug-2004	On the conservation and sustainable development of submerged areas
Decree No. 92/2002/ND-CP	Government		Guiding the implementation of Law on Cultural Protection
Decision			
Decision No. 50/2013/QD-TTg	The Prime Minister	9-Aug-2013	Regulation on collection and treatment of expired or used products
Decision No. 07/2010/QD-UBND	Ho Chi Minh City People's Committee	29-Jan-2010	Management of Can Gio biosphere reserve
Decision 82/2008/QD-BNN	Ministry of Agriculture & Rural Development	July 17, 2008	Providing list of endangered rare aquatic species need to be protected, recovered, and developed
Decision No. 15/2008/QD-BTNMT	Ministry of Natural Resources and Environment	31-Dec-2008	Underground water protection
Decision No. 130/2007/QD-TTg	The Prime Minister	2-Aug-2007	Approving a number of financial mechanisms and policies applicable to investment projects under the CDM.
Decision No. 104/2007/QD-BNN	Ministry of Agriculture & Rural Development	27-Dec-2007	Ecotourism activity at National Park, Natural Reserve
Decision No. 47/2007/QD-TTg	The Prime Minister	06-April-2007	Approval of the plan of organization of the implementation of the Kyoto Protocol under the United Nation Frame work Convention on Climate Change (UNFCCC) for 2007-2010
Decision 3733/2002/QD-BYT	The Ministry of Health	Hanoi, 10-Oct-2002	Providing allowed noise values at workplace

Decision No 60/2002/QD-BKHCNMT	Ministry of Science & Technology	7-Aug-2002	Technical Guidance on Burial of Hazardous Wastes;
Decision No. 1775/QD-TTg	The Prime Minister	21-Nov-2012	Approval of project of greenhouse gas emission management; management of carbon credit business activities to the world market
Decision 742/QD-TTg	The Prime Minister	Hanoi, 26-May-2010	Approving the planning on Vietnam marine protected area system up to 2020
Circular			
Circular No. 25/2013/TT-BLDTBXH	Ministry of Labour - Invalids and Social Affairs	18-Oct-2013	Guiding the regime of allowances in kind for laborers working in dangerous or hazardous conditions
Circular No. 20/2013/TT-BCT	Ministry of Industry & Trade	5-Aug-2013	Regulations on plan and measures to prevent and respond to incidents in the chemical industry
Circular No. 50/2012/TT-BGTVT	Ministry of Transport	19-Dec-2012	National Management on the treatment of liquid oily waste generated from at Port
Circular No. 26/2011/TT-BTNMT	Ministry of Natural Resources and Environment	18 –Jul – 2011	Guiding SEA, EIA and CoEP following Decree No. 29/2011/ND-CP.
Circular No. 15/ 2011/ TT-BTNMT	Ministry of Natural Resources and Environment	28-Apr-2011	Providing for the formulation, issuance of the Letter of certification, issuance of the Letter of approval of projects under the Clean Mechanism Regime in the frame of the Kyoto Protocol.
Circular No. 12/2011/TT-BTNMT	Ministry of Natural Resources and Environment	14-Apr-2011	Regulations on hazardous waste management
Circular 01/2011/TT-BNNPTNT	Ministry of Agriculture & Rural Development	5 – Jan - 2011	Providing list of endangered rare aquatic species need to be protected, recovered, and developed
Circular No. 27/2010/TT-BKHCN	Ministry of Science & Technology	30-Dec-2010	Guiding measure of radiation, nuclear and environmental radioactive monitoring network
Circular No. 26/2010/TT-BKHCN	Ministry of Science & Technology	29-Dec-2010	Guiding Decree No. 111/2009/ND-CP
Circular No. 15/2014/TT-BTNMT	Ministry of Natural Resources and Environment	24-Mar-2014	Prescribing the formulation and grant of letter of endorsement and letter of approval for projects under the clean development mechanism (CDM) within the framework of the Kyoto Protocol.
Circular 59/2010/TT-BNNPTNT	Ministry of Agriculture & Rural Development	19-Oct-2010	Providing list of wild fauna and flora under management of CITES
Circular No. 28/2010/TT-BCT	Ministry of Industry & Trade	28-Jun-2010	Specifying a number of articles of the Law on Chemical and the Government's Decree No. 108/2008/ND-CP of october 7, 2008, detailing and guiding a number of articles of the law on chemicals

Joint Circular No. 204/2010/TTLT-BTC-BTN&MT	Ministry of Finance - Ministry of Natural Resources and Environment	15-Dec-2010	Guiding a number of articles of the Prime Minister's Decision No. 130/2007/QD-TTg (dated 2 August 2007) on a number of financial mechanisms and policies applicable to investment projects under the CDM.
Joint Circular No. 58/2008/TTLT- BTC-BTNMT	Ministry of Finance - Ministry of Natural Resources and Environment	4-July-2008	Guiding the implementation of Decision No. 130/2007/QD-TTg on financial mechanisms and policies applicable to investment projects under the CDM.
Circular No. 13/2007/TT-BXD	Ministry of Construction	31-Dec-2007	Guiding some articles of Decree 59/2007/ND-CP
Circular No. 02/2005/TT-BTNMT	Ministry of Natural Resources and Environment	24-Jun-2005	Guiding the implementation of the government's decree no. 149/2004/ND - CP of July 27, 2004, on the issuance of permits for water resource exploration, exploitation and use, or for discharge of wastewater into water sources
Circular No. 18/2004/TT-BTNMT	Ministry of Natural Resources and Environment	23-Aug-2004	Guiding Decree 109/2003/ND-CP on conservation and sustainable development of wetlands
Joint Circular No 01/2001/TTLT-BKHCNMT-BXD	Ministry of Science & Technology - Ministry of Construction	18 – Jan - 2001	Regulation on the Environmental Protection for the Selection of Location for the Construction and Operation of Solid Waste Burial Sites
Standards			
QCVN 50:2013/BTNMT	Ministry of Natural Resources and Environment	25-Oct-2013	National Technical Regulation on Hazardous Thresholds for Sludges from Water Treatment Process
QCVN 40:2011/BTNMT	Ministry of Natural Resources and Environment	28-Dec-2011	National Technical Regulation on Industrial Wastewater
QCVN 38:2011/BTNMT	Ministry of Natural Resources and Environment	12-Dec-2011	National Technical Regulation on Surface Water Quality for Protection of Aquatic Life
QCVN 27:2010/BTNMT	Ministry of Natural Resources and Environment	16-Dec-2010	National Technical Regulation on Vibration
QCVN 26:2010/BTNMT	Ministry of Natural Resources and Environment	16-Dec-2010	National Technical Regulation on Noise
QCVN 22:2009/BTNMT	Ministry of Natural Resources and Environment	16-Nov-2009	National Technical Regulation on Emission of Thermal Power industry

QCVN 20:2009/BTNMT	Ministry of Natural Resources and Environment	16-Nov-2009	National Technical Regulation on Industrial Emission of Organic Substances
QCVN 19:2009/BTNMT	Ministry of Natural Resources and Environment	16-Nov-2009	National Technical Regulation on Industrial Emission of Inorganic Substances and Dusts
QCVN 07:2009/BTNMT	Ministry of Natural Resources and Environment	16-Nov-2009	Defining the threshold value of hazardous waste contents
QCVN 06:2009/BTNMT	Ministry of Natural Resources and Environment	7-Oct-2009	National Technical Regulation on Hazardous Substances in Ambient Air
QCVN 05:2013/BTNMT	Ministry of Natural Resources and Environment	25-Oct-2013	National Technical Regulation on Ambient Air Quality
QCVN 02:2009/BYT	Ministry of Health	17-June-2009	National Technical Regulation on Domestic Water Quality
QCVN 01:2009/BYT	Ministry of Health	17-June-2009	National Technical Regulation on Drinking Water Quality
QCVN 14:2008/BTNMT	Ministry of Natural Resources and Environment	31-Dec-2008	National Technical Regulation on Domestic Wastewater Discharge
QCVN 10:2008/BTNMT	Ministry of Natural Resources and Environment	31-Dec-2008	National Technical Regulation on Coastal Water Quality
QCVN 09:2008/BTNMT	Ministry of Natural Resources and Environment	31-Dec-2008	National Technical Regulation on Underground Water Quality
QCVN 08:2008/BTNMT	Ministry of Natural Resources and Environment	31-Dec-2008	National Technical Regulation on Surface Water Quality
TCVN 6707:2009	Ministry of Science and Technology	21-Dec-2009	Providing the requirement for warning sign for HW
TCVN 6706:2009	Ministry of Science and Technology	21-Dec-2009	Providing the requirement on classification of HW
TCVN 6705:2009	Ministry of Science and Technology	21-Dec-2009	Normal solid wastes. Classification
TCVN 5507 : 2002	Ministry of Science and Technology	2002	Hazardous chemicals – Code of practice for safety in production, commerce, use, handling and transportation
TCVN 5126:1990 (NA)	Ministry of Science and Technology	1990	Vibration. Permisible values at workplaces

Law on Environmental Protection

The *Law on Environmental Protection 2005* (*LEP 2005)* is the main piece of environmental legislation currently in force. The law assigns national responsibility for environmental strategy, drafting regulations and standards and monitoring to the Ministry of Natural Resources and Environment (MONRE), and the Vietnam Environment Protection Agency (VEPA). Responsibility for implementation of environmental policy at the local level is assigned to the provincial assemblies through their Department of Natural Resources and Environment (DONRE). *Decree No. 80/2006/ND-CP* dated 9th August 2006, issued by the Government guides the implementation of *LEP 2005* and *Decree No. 21/2008/ND-CP* amends some articles and supplements *Decree No. 80/2006/ND-CP*. The LEP is now under revision and is expected to be released by end of 2014. Implementation guidance for the new LEP can be expected to become available in 2015.

National Regulations on Environmental Impact Assessment

The *LEP 2005* states that all enterprises, as prescribed by the Government within the law, shall conduct a/a Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA) or Commitment to Environmental Protection (CoEP) and obtain approval prior to the development and operation of a facility. The main EIA regulations currently with regards to the EIA system are given below:

- *LEP 2005;*
- *Decree No. 29/2011/ND-CP - Regulation on SEA, EIA, CoEP which took effect on 5th June 2011;* and
- *Circular No. 26/2011/TT-BTNMT for guiding SEA, EIA and CoEP* following *Decree No. 29/2011/ND-CP.*

National Regulations on Public Consultation and Information Disclosure

Public Consultation

During EIA preparation, public consultation is required to be conducted as regulated in the Decree No. 29/2011/ND-CP. Public consultation involving all stakeholders is commonly not conducted because the regulation only requires a limited number of stakeholders that must be consulted (i.e. commune level People's Committee and Fatherland Front Committee which are considered to be the representatives of local authority and local affected community, respectively). Large scale public consultation that includes face-to-face meetings with affected community can be requested, upon decision of the commune level People's Committee. However, this practice has rarely happened.

Commonly, the Project Proponent is required to send a consultation request letter along with a written summary of project information, potential environmental and social impacts associated with mitigation measures proposed to relevant stakeholders. Within 15 working days upon receiving request from the Project Proponent, the relevant stakeholders shall provide their responses in writing. The forms of public consultation request and stakeholder's response are provided in Annexes 2.1 and 2.2 of Circular No. 26/2011/TT-BTNMT.

Consultation is not required in the following cases:

- An investment project in a consolidated production, business or service zone whose EIA report has been approved by a competent authority in the phase of building the zone's infrastructure facilities, provided that this project conforms with the sector and trade planning in the approved EIA report of such zone;
- An investment project in a sea area for which the administration responsibility has not yet been assigned to any commune level People's Committee;
- An investment project involving state secrets.

A Project Proponent investing in a consolidated production, business or service line unconformable with the sector and trade planning in the approved EIA report of such a zone shall consult the agency having approved the EIA report in the phase of building the zone's infrastructure facilities (i.e. MoNRE or local DoNRE).

<u>Information Disclosure</u>

As required by the *Decree No. 29/2011/ND-CP*, after the EIA report is approved by competent authority, the Project Proponent shall disclose their Environmental Management Plan (which is part of the EIA report) to local communities at the People's Committees of the communes where public consultations have been conducted.

When the project comes into operation, *Provision 105* of the *LEP 2005* prescribes the responsibility of the Project's owner in disclosing information relating to their on-going environmental management to their labours and local communities. Environmental status and mitigation measures implemented must be disclosed via either:

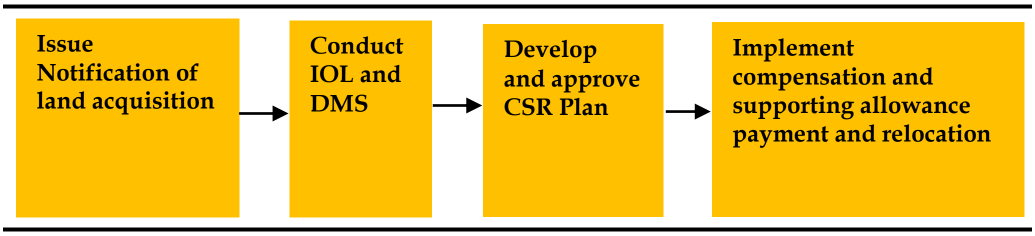
- Meetings with communities; or
- Written notices and announcements to communities.

However, this requirement is not enforced in practice as it has not been concretised in any by-law document which is the key guidance for local authorities in charge of enforcement.

Regulations on Land Acquisition, Compensation, Support and Resettlement

The *Land Law 2003* is the existing supreme legal regulation prescribing land use rights and land management in Vietnam, including land acquisition, compensation, support and resettlement. A typical land acquisition, compensation and resettlement process complied with Vietnamese regulation has the following main steps.

Figure 3.1 Land Acquisition, Compensation and Resettlement Process



Note: IOL: Inventory of Loss
DMS: Detailed Measurement Survey
CSR Plan: Compensation, Support and Resettlement Plan

There are number of related regulations including laws and by-law regulations have been issued to provide requirements and guidance for applicants to implement the process. Such regulations are discussed in the following sections in national and provincial levels.

It should be noted that the *Land Law 2003* will be replaced by the amended Land Law 2013 approved by the national assembly on 29 November 2013. This amended Law will come into force on the 1st of July 2014. It is expected that most of the existing by-law documents will be soon amended or replaced by new ones following the issuance of the amended *Land Law 2013*. Given the land acquisition, compensation and resettlement process of the Project has not yet been completed at the time of writing and is expected to be extended till the end of 2014, it may subject to some changes due to the effectiveness of the amended *Land Law 2013* by July this year.

National Regulations on Grievance Mechanism

The general grievance mechanism of the country follows the requirements of the *Law on Grievance and Denouncement 1998 (amended 2005)*. For grievances related to land acquisition, the process and requirements are stipulated in the *Decree No. 84/2007/ND-CP*.

In general, affected people can submit their grievances to the commune level People's Committee; if the grievance cannot be solved at the commune level, the grievance will be sent to the district level People's Committee, and then similarly the grievance will be sent to the provincial level if the problem cannot be resolved at the district level. In the event that the complainants are not satisfied with the resolutions of the provincial People's Committee, they can lodge their grievances at the provincial court.

It will take 30 days from the date of receiving the complaint / grievance for solving the complaints relevant to the administrative involving land administration. Where a complainant disagrees with the initial decision on the resolution of the complaint, it has the right to complain to the higher level or at a people's court as described above. This may take 45 days from the date of receipt of such decision to solve the complaints at a higher level.

National Regulations on Public Health and Safety

As regulated in *Decree 29/2011/ND-CP on Providing Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment*, during project development, any activities causing adverse impacts on the environment and public health and safety shall be suspended.

Emergency response action shall be prepared and carried out immediately. An immediate notice to the provincial environmental protection agency and related organizations shall also be made to seek guidance and collaboration for response.

Labor Right

The main legislation in Vietnam relating to labour rights, health and safety is the Labour Code which was issued on 18 June 2012 by the Vietnamese National Assembly. Everyone has the right to work without discrimination of sex, nationality, social background, belief or religion. Maltreatment of an employee and forcible labour in any form are forbidden. The government protects workers by its relevant legislations on employment, apprenticeship, labour contract, collective labour accord, salary, work and break time, labour discipline, material liability, specific provision on woman workers, minors and other types of workers (elderly labourer, disabled workers, high professional and technical skill workers, employees working for foreign organisations and individuals in Vietnam and foreigners working in Vietnam and Vietnamese employees working abroad and other types of labour), social insurance, trade union, settlement of labour disputes.

In addition, a number of decrees, circulars, decisions and standards have been issued relating to labour rights, health and safety as discussed in the appropriate sections such as labour safety and labour sanitation. *Decree No. 45/2013/ND-CP*, dated 10 May 2013, provides provisions of the Labor Code on occupational health and safety. The employer has the responsibility to fully provide the employees with technical equipment for labour safety and labour sanitation and to improve their working conditions. The employee must observe the regulation on labour safety, labour sanitation and the labour rules of the business. All organisations and individuals related to labour and production must observe legislation on labour safety, labour sanitation and environmental protection.

3.3 INTERNATIONAL REGULATORY FRAMEWORK

3.3.1 Equator Principles III

The Equator Principles (EPs) are the environmental and social risk management framework voluntarily adopted by 83 member financial institutions (Equator Principle Financial Institutions, EPFIs). They are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. The Equator Principles were developed by private-sector banks and launched in June 2003. They were first revised in July 2006 and new revisions, known as EP III, took effect on June 4, 2013.

The EPs established voluntary principles for addressing environmental and social risks and issues in global project finance transactions, including adherence to IFC PS. The EPs are designed to serve as a benchmark for the financial industry to manage social and environmental risks in project financing. They apply to all new project financings with total project capital costs of USD $10 million or more, and across all industry sectors. The Principles (EPs 1 to 10) are:

- Principle 1: Review and Categorisation;
- Principle 2: Environmental and Social Assessment;
- Principle 3: Applicable Environmental and Social Standards;
- Principle 4: Environmental and Social Management System and Equator Principles Action Plan;
- Principle 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent Review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting; and

Principle 10: Reporting and Transparency.

The EP III can be found on the Equator Principles website1.

Under Principle 1: Review and Categorisation, the Project is categorized to ensure that the required level of environmental and social due diligence is commensurate with the nature, scale and stage of the Project, and with the level of environmental and social risks and impacts. The categories are:

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

Under Principle 2: Environmental and Social Assessment, all Category A and Category B Projects are required to conduct an assessment process to address the relevant environmental and social risks and impacts of the proposed Project. The categorisation of this Project is provided in *Chapter 6.2.*

Principle 3: Applicable Environmental and Social Standards requires that the Project complies with relevant host country laws, regulations and permits that pertain to environmental and social issues. The principle also brings into consideration compliance with the IFC PS on Environmental and Social Sustainability and the World Bank EHS Guidelines.

- Principles 4 through 7 and Principles 9 and 10 apply to all Category A and, as appropriate, Category B Projects.

Principle 8 applies to all Category A and Category B Projects.

[1] http://www.equator-principles.com/resources/equator_principles_III.pdf

7.7.2.1 *Equator Principles Requirements Relevant to Stakeholder Engagement and Grievance Mechanism*

From the Lender's perspective, the Equator Principles III seek to ensure that the Project is developed in a manner that is socially responsible and reflects sound environmental management practices. Equator Principle III highlights that for a Category A project, a Social and Environment Assessment has to be conducted which should include "consultation and participation of affected parties in the design, review and implementation of the Project" (Exhibit II, Equator Principles III, 2013), and Principle 5, focusing on Stakeholder Engagement states that:

> *"For all Category A Projects, the EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to: the risks and impacts of the Project; the Project's phase of development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups. This process should be free from external manipulation, interference, coercion and intimidation.*
>
> *To facilitate Stakeholder Engagement, the client will, commensurate to the Project's risks and impacts, make the appropriate Assessment Documentation readily available to the Affected Communities, and where relevant Other Stakeholders, in the local language and in a culturally appropriate manner.*
>
> *The client will take account of, and document, the results of the Stakeholder Engagement process, including any actions agreed resulting from such process. For Projects with environmental or social risks and adverse impacts, disclosure should occur early in the Assessment process, in any event before the Project construction commences, and on an ongoing basis. Source: (Equator Principles, III, 2013).*

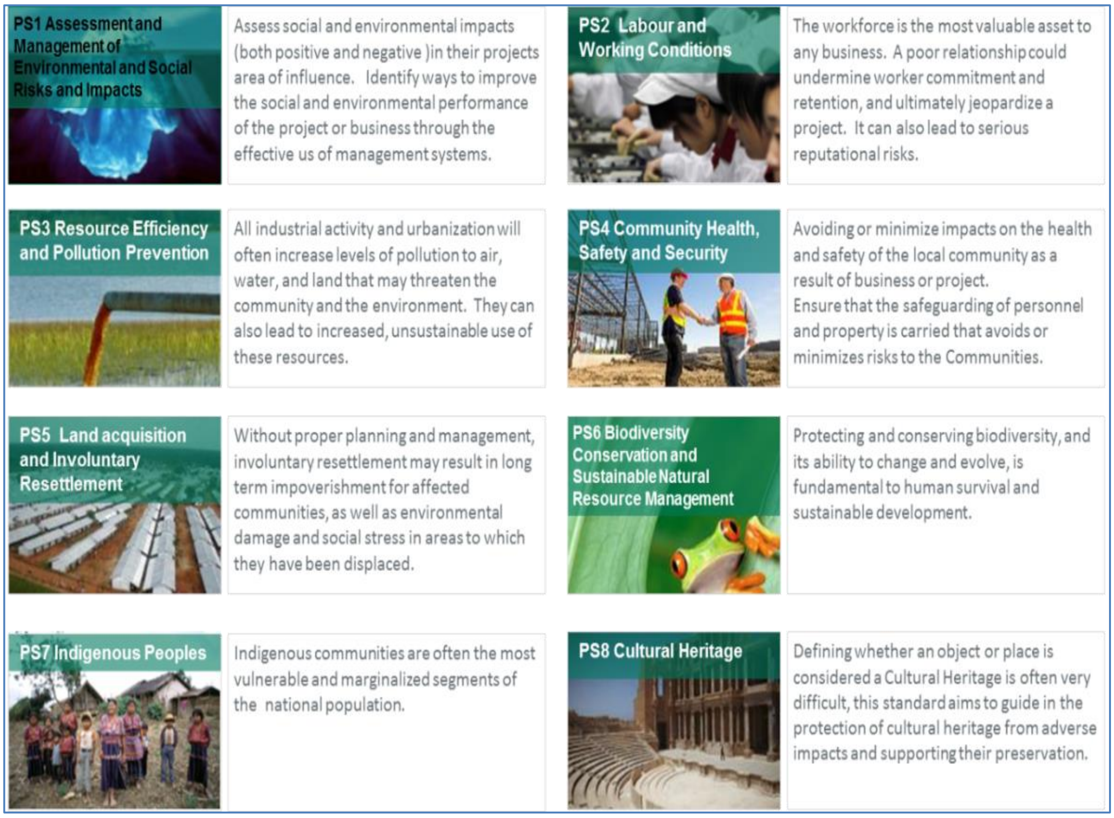
The Equator Principles also has specific requirements in relation to grievance mechanisms. Equator Principle 6: Grievance Mechanism states that:

> *"For all Category A Projects, the EPFI will require the client, as part of the ESMS, to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance.*
>
> *The grievance mechanism is required to be scaled to the risks and impacts of the Project and have Affected Communities as its primary user. It will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, readily accessible, at no cost, and without retribution to the party that originated the issue or concern. 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 the Stakeholder Engagement process." Source: (Equator Principles III, 2013).*

3.3.2 *IFC Performance Standards*

In April 2006, the IFC, a member of the World Bank Group, released a set of Performance Standards (PSs) based upon the original World Bank Group Safeguard Policies, which recognized further the specific issues associated with private sector projects. EP Three: Applicable Social and Environmental Standards requires that projects in non-OECD countries be undertaken in accordance with IFC Performance Standards, General EHS Guidelines and Industry Specific Guidelines. The IFC PSs have been broadened to include issues such as greenhouse gases, human rights, community health, and safety and security. A revised set of Performance Standards came into force on January 1, 2012. The complete list of PS's is provided in Figure 3.2.

Figure 3.2 IFC Performance Standards



The IFC PS can be found on the IFC website[1] .

PS1: Social and Environmental Assessment and Management Systems are the key driver behind the development of this ESIA and associated management framework. In particular, the following key steps, as outlined within PS1, have been adhered to as basic principles within the ESIA preparation:

- Project definition;
- Initial screening and risk assessment of the project;

[1] http://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/IFC+Sustainability/Sustainability+Framework/Sustainability+Framework+-+2012/Performance+Standards+and+Guidance+Notes+2012/

- Scoping of the assessment process based upon the outcomes of the initial screening and risk assessment;
- Stakeholder identification;
- Gathering of social and environmental baseline data;
- Impact identification and analysis;
- Generation of mitigation or management measures; and
- Development of management action plans.
- This ESIA has been prepared to be consistent with the expectations of the Performance Standards.

In August 2016 the World Bank's Board of Executive Directors approved a new Environmental and Social Framework (ESF) that expands protections for people and the environment. The new framework includes areas such as transparency, non-discrimination, social inclusion, public participation, and accountability. It also introduces comprehensive labour and working condition protection; an over-arching non-discrimination principle; community health and safety measures that address road safety, emergency response and disaster mitigation; and a responsibility to include stakeholder engagement throughout the project cycle. The framework is expected to come into effect in early 2018.

7.7.2.1 IFC Performance Standards on Stakeholder Engagement and Grievance Mechanism

The IFC Performance Standards (2012) that have been considered in developing this SEP include Performance Standards 1, 2 and 4 in respect of their guidance regarding participation. Development and implementation of a Grievance Mechanism is also a requirement of IFC Performance Standards 1, 2 and 5.

Public Consultation, Disclosure and Participation

The IFC PS1 provides an outline of public consultation, disclosure and participation, including requirements that:

- The range of stakeholders should be identified;
- Project information should be disclosed to affected communities and other stakeholders to understand the risks, impacts, and opportunities of the project;
- When affected communities are subject to identified risks and adverse impacts from a project, a process of Informed Consultation and Participation should be undertaken in a manner that provides the affected communities with opportunities to express their views on project risks, impacts and mitigation measures, and allows the client to consider and respond to them; and
- Project disclosure, informed consultation and participation processes should be documented.

Grievance Redress

The IFC PS1 requires the Project to establish a Grievance Mechanism to receive and facilitate resolution of affected communities' concerns and grievances regarding the Project's environmental and social performance. The Grievance Mechanism should be disclosed and clearly explained to the affected communities in the course of the stakeholder engagement process.

3.3.3 *World Bank Group Environmental, Health and Safety (EHS) Guidelines*

Supplementing the IFC PS's are the General EHS Guidelines that were released in April 2007. The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP), as defined in IFC's Performance Standard 3: Resource Efficiency and Pollution Prevention.

The EHS Guidelines contain performance levels and guidance measures that are generally considered to be achievable by new facilities using existing technology at a reasonable cost. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets with an appropriate timetable for achieving them. The following World Bank Group EHS Guidelines are applicable to the Project:

Environmental, Health, and Safety (EHS) Guidelines.

These Guidelines contain standards relating to:

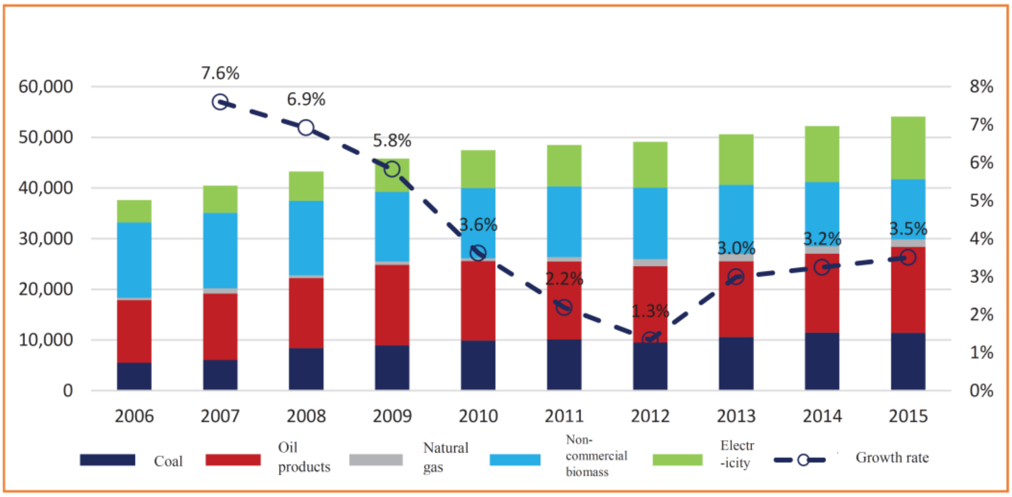
- Environment: air, energy, waste, hazardous materials management, noise and contaminated land;
- Ambient Air Quality;
- Occupational Health & Safety;
- Community Health & Safety; and
- Construction & Decommissioning.

The General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors.

4.1 NO PROJECT SCENARIO

Vietnam has large reserves of primary energy resources, such as coal, oil, natural gas, and water for hydropower generation. It also has a high potential for renewable energy resources, such as biomass, solar, and wind. In 2015, the share of total national primary energy by fuel type was coal (35%), crude oil and petroleum products (28%), gas (14%), and hydropower generation (7%). *Figure 4.1* shows the progress of primary energy supply mix from 2000 to 2015.

Figure 4.1 Progress of primary energy supply between 2000-2015

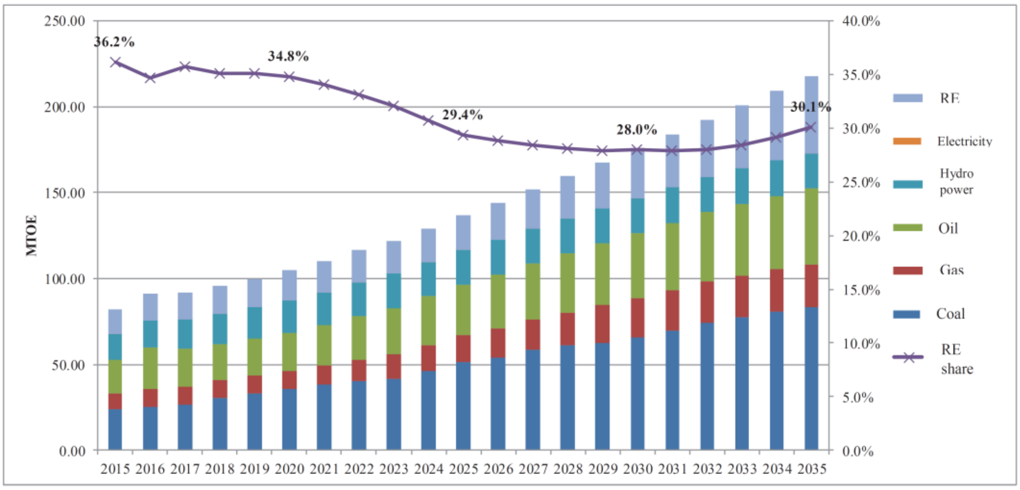


Source: Vietnam Energy Outlook Report, 2017

Vietnam's power demand has grown and will continue to grow rapidly, reflecting the country's economic development. As estimated, the non-commercial biomass energy has gradually been replaced by other commercial energy sources. The shift to fossil energy has been a key reason for the increase in greenhouse gas (GHG) emissions. In the past decade, Vietnam has had the highest GHG emissions in the ASEAN region. The total GHG emissions and GHG emissions per capita have increased nearly 3 times in a 10 year period, while the carbon intensity per GDP increased by 48%.

Figure 4.2 shows the predicted power generation make-up of Vietnam by fuel type to 2035. While this shows a heavy reliance on coal fired power generation, it also shows the growth in supply by renewables such as hydropower to remain relatively stable over that period.

Figure 4.2 Primary energy supply in the proposed scenario

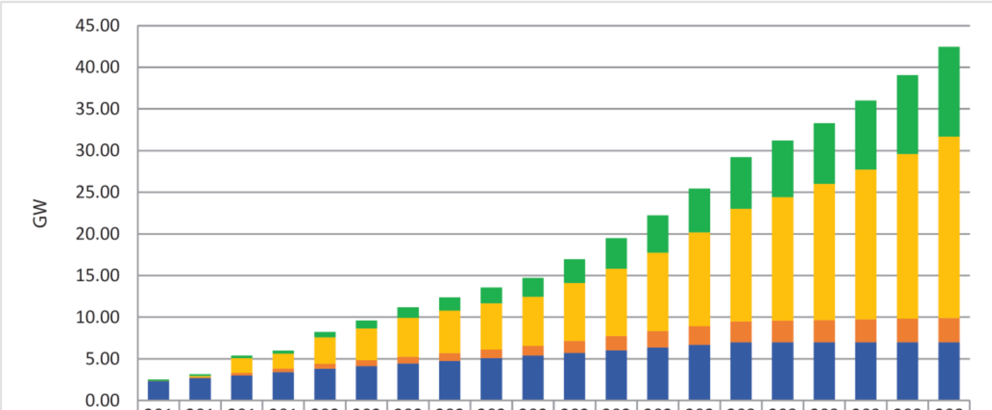


Source: Vietnam Energy Outlook Report, 2017

The revised National Power Development Plan in the period 2011-2020 with the vision to 2030 and the Renewable Energy (RE) Development Strategy together set relatively concrete directions for the development of the power sector in the coming years. Regarding the primary energy mix per fuel type, coal still covers the major part but tends to be stable in the following years with a proportion of 37.3% in 2025 and 38.4% in 2035. This is a result of applying low carbon policies to promote RE development. Hydro power experiences a significant reduction while gasoline and oil products cover over 20-22% and natural gas accounts for about 11-13% of the total primary energy.

as illustrated at *Figure 4.3*, the share of RE in the total primary energy supply could reach 28% in 2030, and then increase to 30.1% in 2035.

Figure 4.3 Growth of RE power capacity in the BaU scenario



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Wind	0.18	0.23	0.32	0.38	0.68	0.98	1.28	1.58	1.88	2.28	2.88	3.68	4.48	5.28	6.22	6.77	7.30	8.30	9.46	10.7
Solar	0.00	0.15	1.76	1.76	3.17	3.81	4.66	5.11	5.56	5.89	6.95	8.09	9.42	11.2	13.5	14.8	16.3	17.9	19.7	21.7
Biomass	0.05	0.08	0.32	0.45	0.60	0.71	0.82	0.93	1.04	1.16	1.42	1.69	1.96	2.23	2.49	2.57	2.65	2.74	2.82	2.90
Small hydro	2.30	2.70	3.00	3.40	3.80	4.12	4.44	4.76	5.08	5.40	5.72	6.04	6.36	6.68	7.00	7.00	7.00	7.00	7.00	7.00

Source: Vietnam Energy Outlook Report, 2017

The rapid expansion of Vietnam's energy sector is accompanied by significant environmental impacts. Without investments in efficient and clean thermal technologies, these will continue.

The project forms part of Vietnam's strategy to diversify the energy mix and promote renewable energy. Should the Project not proceed, power supply would continue to be met by other sources, and as noted there is clearly a current and future reliance on fossil fuel generated power, particularly coal.

4.2 *ALTERNATIVE SITE LOCATIONS*

The project site is dictated by the master planning process enacted by the Vietnam central government. During the final sighting of the WTG locations it is understood that a range of possible locations within the current project area were considered. The final sighting was guided by site access considerations, availability of land owned and acquired by the project as well as he modelled wind resource at each location.

4.3 *ALTERNATIVE METHODS OF POWER GENERATION*

Renewable energy projects and in particular wind projects have a limited and largely reversible impact on the environment. These technologies support economic growth without the social and environmental impacts of most other traditional power plants.

Concerns regarding supply fluctuations due to the intermittent nature of wind power generation can be accommodated by peaking power plants with quick demand response, such as nearby hydro power projects

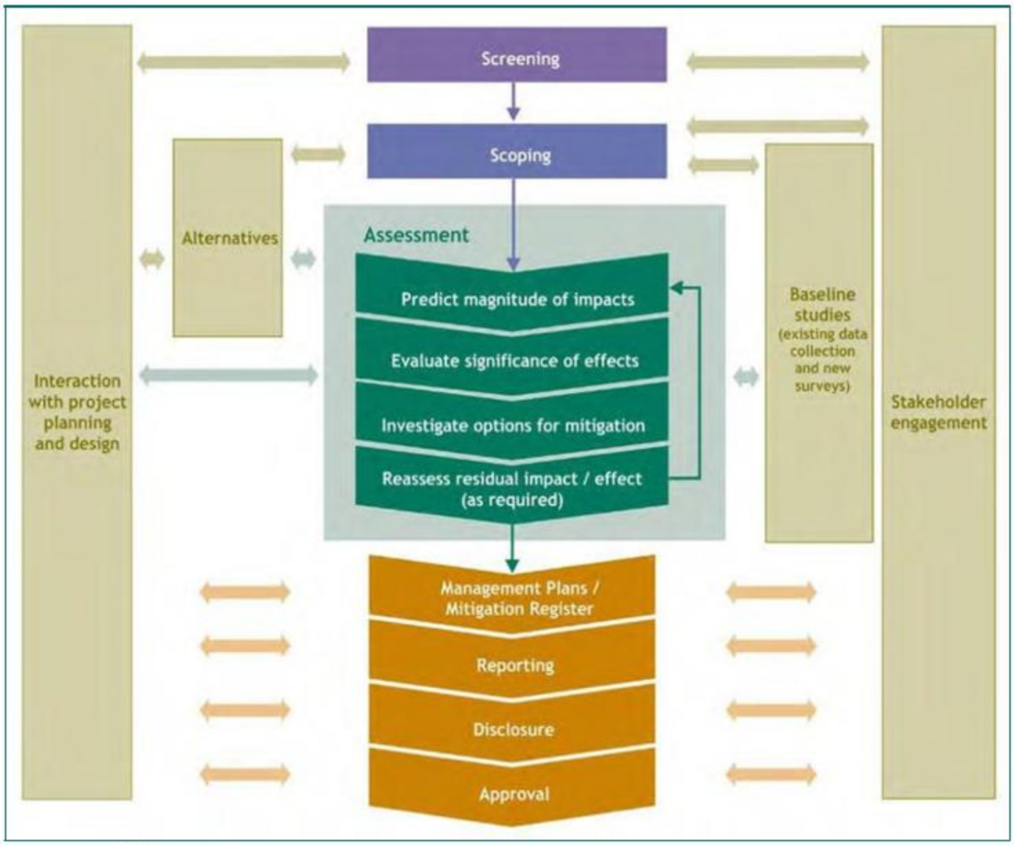
Table 4.1 Comparison of Power Generation Methods

System	Advantage	Disadvantage
Thermal Power	Large-scale production potential Moderate gestation period Wider distribution potential	High fossil fuel consumption Large quantities of water required for cooling High volume of emission from operation Accumulation of fly ash (in case of coal powered installations) Upstream impact from mining and oil exploration GHG emissions estimated as 228gCeq/kWh
Hydropower	GHG emission estimated as low as 1.1gCeq/kWh for run of river projects Do not create any waste by-products during conversion process Some hydropower facilities can quickly go from zero power to maximum output. Because hydropower plant can generate power to the grid immediately, they provide essential back-up power during major electricity outages or disruptions	Site specific, dependent on reservoir/ river Long gestation period Alteration of river flow regime Adverse social and ecological impacts due to inundation and downstream effects
Solar power	Pollution levels are insignificant Inexpensive power generation Inexhaustible solar resource GHG emissions as low as 8.2gCeq/kWh for the production chain	Large land requirement Site-specific, dependent on solar insolation Expensive installation
Wind power	Pollution levels are insignificant	Large land requirement

System	Advantage	Disadvantage
	Inexpensive power generation Inexhaustible wind resource GHG emissions as low as 2.5gCeq/kWh for the production chain	Site-specific, dependent on wind pattern Expensive installation
Nuclear power	GHG emissions as low as 2.5gCeq/kWh Low fuel cost The production of electric energy is continuous. A nuclear power plant generates electricity for almost 90% of annual time. It reduces the price volatility compared to other fuels Do not emit smoke particles or gases	Availability of fuel source Hazards associated with radioactive material High cost of project Disposal waste is expensive, as wastes are radioactive in nature Long gestation period Risk of fallout and meltdown scenarios and its impacts on the local population and environment

This section of the ESIA study presents the methodology that will be used to conduct the IA. The IA methodology follows the overall IA approach illustrated in Figure 5.1. The IA is undertaken following a systematic process that predicts and evaluates the impacts the Project could have on aspects of the physical, biological, social/ socio-economic and cultural environment, and identifies measures that the Project will take to avoid, reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the IA process are described below.

Figure 5.1 Impact Assessment Approach



Source: ERM, 2015

The adoption of a generic impact assessment methodology may not accommodate the identification or categorisation of impacts particular to a project of this type and location. The impact assessment methodology developed within this chapter has been developed with reference to internationally recognized best practice. It takes into account issues specifically associated with development of power and associated infrastructure to present impact identification and evaluation mechanism which is specific to the development type, thereby allowing for much more focused and refined assessment.

5.1 *SCREENING*

The first stage in any impact assessment is screening. The primary objective of screening is to identify what IA requirements apply to the Project. Scoping is then conducted to identify and develop the resulting terms of reference to provide the data needed to conduct an informed impact assessment. The results of the screening exercise are reported in *Chapter 6* of this ESIA Report.

5.2 *SCOPING*

Scoping is undertaken to identify the potential Area of Influence for the Project (and thus the appropriate Study Area), to identify potential interactions between the Project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, enabling these potential impacts to be evaluated in terms of their likely significance.

In order to have a an informed and Project specific impact assessment, it is important to select resources/receptors based on the understanding and evaluation of environmental, social and health conditions specific to the Project and proposed activities, with consideration of the potential Area of Influence. This stage is intended to ensure that the IA identifies and focuses on those issues that are most important for design, decision-making and stakeholder interest. The findings of the scoping exercise are reported in *Chapter 6.*

5.3 *PROJECT DESCRIPTION*

In order to set out the scope of the Project features and activities, with particular reference to the aspects which can impact on the environment, a Project Description is prepared. Details of the Project facilities' design characteristics, as well as planned and unplanned Project activities, are provided in *Chapter 2.*

5.4 *BASELINE CONDITIONS*

To provide a context within which the impacts of the Project can be assessed, a description of physical, biological, social / socio-economic and cultural conditions that would be expected to prevail in the absence of the Project is required. The Baseline includes information on all resources/receptors in the Project Area of Influence, i.e. as having the potential to be affected by the Project. The baseline characterisation is reported in *Chapter 7 - 9* of this ESIA Report.

5.5 *STAKEHOLDER ENGAGEMENT*

The Project recognizes that achieving effective stakeholder engagement involves building and maintaining constructive relationships over time. Therefore the Project has committed to an ongoing consultation and engagement process. The process focuses on a broad range of activities, including information sharing, consultation to negotiation and partnership building.

A Stakeholder Engagement Plan (SEP) is designed with the aim of providing a platform for consultation and disclosure with Project stakeholders throughout all phases of the development. The SEP sets out the approach which the Project will adopt in order to implement an effective engagement program with stakeholders over the life of the Project. Good relations between the Project and its surrounding communities and relevant stakeholders will be an essential condition for the Project to acquire social license to operate. It is also an important means of receiving community feedback on project related concerns and also disseminating project related information to the community. An SEP has been prepared for the Project and is attached at *Annex A* of this report.

5.6 *IMPACT ASSESSMENT*

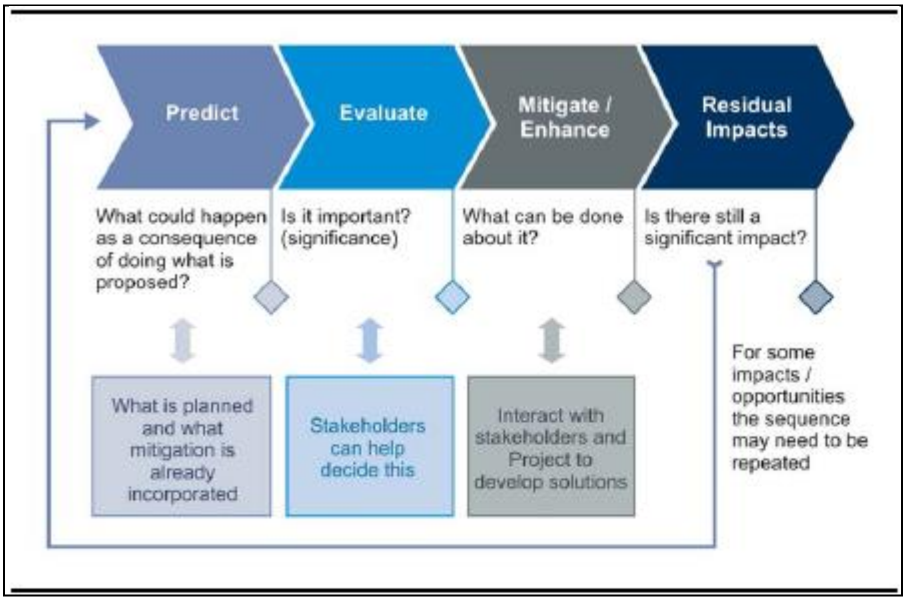
Impact identification and assessment starts with scoping and continues

through the remainder of the IA Process (*Figure 5.2*). The principle steps are:

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

Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

Figure 5.2 ESIA Impact Evaluation Process



5.6.1 *Impact Prediction*

Prediction of impacts is essentially an objective exercise to determine what is likely to happen to the environment as a consequence of the Project and its associated activities. From the potentially significant interactions identified in Scoping, the impacts to the various resources/receptors are elaborated and evaluated. The diverse range of potential impacts considered in the IA process typically results in a wide range of prediction methods being used, including quantitative, semi-quantitative and qualitative techniques.

5.6.2 *Impact Evaluation*

The purpose of the impact assessment is to identify and evaluate the significance of potential impacts on identified receptors and resources; to develop and describe mitigation measures that will be taken to minimize any potential adverse effects and enhance potential benefits; and to report the significance of the residual impacts that remain following mitigation.

Impact Magnitude

The term 'magnitude' covers all the dimensions of the predicted impact

including:

- The Type of impact: a description indicating the relationship of the impact to the Project (in terms of cause and effect) e.g. direct, indirect, induced;
- The Extent of the impact: the "reach" of the impact (for example confined to a small area around the Project Footprint, projected for several kilometres) e.g. Local, Regional, International; and

The Duration of the impact: the time period over which a resource / receptor is affected e.g. Temporary, Short-term, Long-term, Permanent.

The scale of the impact, the likelihood and the frequency of the impact will also be used to assess the magnitude of the impact.

An assessment of the overall magnitude of an impact is provided by taking into account all the dimensions of the impact described above to determine whether an impact is of negligible, small, medium or large magnitude.

Receptor sensitivity

The significance of the impacts resulting from an impact of a given magnitude will depend on the sensitivity (terms and definitions of vulnerability and importance may also be used with defining sensitivity) of resources and receptors to that impact, i.e. the extent to which the receptor will undergo a change – negative or positive – as a result of the Project.

The quality or importance of a resource will be judged taking into account, for example, national or international designation, its importance to the local or wider community, its ecosystem function or its economic value. The assessment of the sensitivity of human receptors, for example a fishing community or wider social group, will consider their likely response to the change and their ability to adapt to and manage the effects of the impact.

Evaluation of significance

The assessment of impacts aims at providing information to decision makers and other stakeholders on the importance of each impact, to facilitate decision-making on the Project, and to facilitate the identification and design of impact reduction or mitigation measures.

The evaluation of impacts presented in the ESIA is based on the judgement of the ESIA team, informed by legal standards, national and regional government policy, current industry good practice and the views of stakeholders. Where specific standards are either not available or provide insufficient information on their own to allow grading of significance, the evaluation of significance has taken into account the magnitude of the impact and the quality, importance or sensitivity of the affected resource or receptor.

Magnitude and receptor quality/importance/sensitivity are looked at in combination to evaluate whether an impact is, or is not, significant and if so its degree of significance (defined in terms of Negligible, Minor, Moderate or Major). Impacts classed as negligible include those that are slight or transitory, and those that are within the range of natural environmental and social change. This principle is illustrated schematically in Figure 5.3.

Figure 5.3 Impact Significance Matrix

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

Source: ERM, 2015

5.6.3 *Mitigation and Enhancement*

One of the key objectives of an ESIA is to identify and define environmentally acceptable, technically feasible and cost-effective mitigation measures. Mitigation measures are developed to reduce the significant negative impacts identified during the ESIA process to a point where they have no adverse effects, and to create or enhance positive impacts such as environmental and social benefits. In this context the term "mitigation measures" includes operational controls as well as management actions.

Where a significant impact is identified, a hierarchy of options for mitigation is explored in *Figure 5.4*

Figure 5.4 Impact Significance Matrix

- **Avoid at Source; Reduce at Source:** avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
- **Abate on Site:** add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening and landscaping).
- **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site).
- **Repair or Remedy***:* some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.
- **Compensate in Kind; Compensate Through Other Means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).

Source: ERM, 2015

5.6.4 *Residual Impact Evaluation*

Reporting the significance of a residual impact in the ESIA is based on:

- The predicted magnitude of an impact, taking into consideration all the mitigation measures; and

The quality/importance/sensitivity of the receptor.

Constraints arising from applicable regulations and standards are taken into account in the evaluation of residual impacts and their acceptability.

5.6.5 *Management, Monitoring and Audit*

The final stage in the IA Process is definition of the basic management and monitoring measures that are needed to identify whether:

- Impacts or their associated Project components remain in conformance with applicable standards; and
- Mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

An Environmental and Social Management framework is then compiled which summarizes all actions which the proponent and its EPC will commit to executing with respect to environmental/ social/ community health performance for the Project. The framework includes the mitigation measures, compensatory measures and offsets and management and monitoring activities together with details of who is responsible for implementation, how these measures are evaluated for performance, timing and reporting responsibilities.

6 ESIA SCREENING AND SCOPING

ESIA screening and scoping forms the basis of identifying important environmental and social impacts to be assessed in the ESIA and ideally, avoids detailed assessment of impacts which are deemed unlikely to be of significance or which can be easily addressed through implementation of appropriate management or mitigation measures.

The ESIA is prepared to target only the important environmental and social risks and to specifically target areas which fall out of the scope of the regulatory EIA process, or those impacts which we do not think are likely to be significant in the context of this project. . In relation to this Project, this primarily applies to the following:

- Absence of biodiversity and noise assessment within the regulatory EIA;
- Absence of assessment of wind farm specific concerns such as shadow flicker and blade throw;
- Absence of a social impact assessment within the regulatory EIA;
- ESIA consideration of cumulative impacts, associated facilities and non-routine events, which are not assessed in the EIA; and
- Consideration of impacts to indigenous peoples and cultural heritage which is also not considered within the EIA.

Based on the level of Project description information and available desktop information, ERM has a reasonable level of confidence regarding the important environmental and social interactions that have been identified and presented within this Chapter.

6.1 SCOPE OF THE ASSESSMENT

The ESIA covers the following project elements which have been described in detail and *Chapter 2;*

- Wind turbine transportation and construction;
- Site excavations for wind turbine foundation establishment, turbine site access and infield power evaluation;
- Wind turbine operation, maintenance and decommissioning; and
- Supporting facilities such as the exiting batching plant and office facilities.

6.2 SCREENING RESULTS

The requirements for whether an ESIA is required under IFC PS depend upon the nature and complexity of the project and prediction of impacts that are likely to occur. As discussed in *Chapter 3,* these are embodied within Equator Principle Number One – Review and Categorisation. As discussed previously the categories are Category A, Category B and Category C. Due to the scale of the Project and potential environmental impacts; it would likely be classified as a **Category A Project**. This is primarily determined on the basis of the following baseline information and the potential impacts that the project may result in;

- Known bird and bat sensitivities surrounding the project area;
- The proximity of the HL 1 turbines and existing HL2 turbines to receptors such as households;
- The know presence of Indigenous peoples within the project area, known as the *Van Kieu*;

Whilst no physical displacement had occurred, land acquisition may have resulted in economic displacement of local community members.

6.3 SCOPING RESULTS

Scoping was undertaken for the potential Area of Influence for the Project (and thus the appropriate Study Area), to identify potential interactions between the Project and resources/receptors in the Area of Influence and the impacts that could result from these interactions, and to prioritize these impacts in terms of their likely significance.

The area of influence for the project is defined as the villages of Cooc, Miet and Hoong which are located around the project area. A discreet management unit has been defined for the biodiversity assessment.

This is based on the likely extent of impacts such as from noise and a 2km buffer has been placed around the footprint of HL 1 and HL2. Receptors such as birds may warrant a larger AoI, given the sites proximity to nearby areas of conservation significance. The biodiversity assessment provides an assessment of likely impacts to bird species within the area.

6.3.1 Interaction Matrix

Potential impacts were identified through a systematic process whereby the features and activities (both planned and unplanned) associated with the construction, operation and decommissioning of the Project have been considered with respect to their potential to interact with resources/receptors. Potential impacts have each been classified in one of three categories:

- No interaction: where the Project is unlikely to interact with the resource/receptor;
- Interaction reasonably possible but which is unlikely to result in significant impacts; and
- Interaction reasonably possible and which has the potential to result in significant impacts.

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

Each resulting cell on the Potential Interactions Matrix thus represents a potential interaction between a Project activity and an environmental, social or health resource/receptor. Those cells that remain unchecked are 'scoped out' of further consideration in the IA Process. *Chapter 8* presents the appraisal of potential environmental and social impact evaluation.

6.3.2 *Impact Screening*

Environmental and social issues identification is conducted to ensure that all potential impacts from the proposed project and associated activities are identified as part of the impact assessment process. The completed screening of impacts is presented in *Table 5.1.*

ERM use the ESIA process to address the impacts which we have been screened as being particularly relevant to the Project, or which require particular scrutiny under the IFC framework.

The following information is provided for each of the Project activities which have been identified as potentially resulting in environmental or social impacts:

- Sources of impact: The potential causes concern, or the environmental and social receptors considered likely to be affected;
- Overview of potential impacts: Discussion of the types of impacts that could occur from construction or operation of the Project based on available information and existing environmental and social baseline data; and
- Proposed assessment approach: An outline of what will be taken into account as part of the assessment and if, for example modelling or specific data collection activities would occur.

The Project and receptor interactions that are likely to lead to significant impacts will form the focus of a detailed impact assessment. Based on ERM's current understanding of the Project these are likely to include:

- Land acquisition activities impacting the land users and their livelihoods;
- Impacts to social and cultural structure, particularly in relation to potential impacts to Indigenous Peoples occurring within the Project Area;
- Potential positive and negative impacts associated with access to employment and economic benefits to the local community;
- Biodiversity impacts as a result of turbine installation and operation; and
- Noise and other operational impacts such as blade throw and shadow flicker on local communities

Table 5.1 Preliminary Interactions Matrix

Activity/Aspect	Resource/Receptor	Initial Assessment	Proposed Assessment	Applicable Standard
Construction				
Workforce Mobilisation/presence	Social: - Economy and Livelihood (+/-) - Social/Cultural Structure - Resource use - Health: - Human health safety and security	The Project has the potential to have a positive impact on the community through generation of new employment and training opportunities. Improved disposable income also has the potential to improve employee lifestyle and create flow-on economic benefits in the community. While the construction period is relatively short (18 months) the presence of additional workers(approximately 100) in the community may also create negative impacts such as through causing or accentuating the following: ● Social/cultural tension from the introduction of workers from outside the area with different cultural values/characteristics ● Crime or sense of unsafety as a result of non-locals entering the community (even a perceived risk has the potential to disturb the community)	Undertake social field visit that includes consultation with affected communities and visual assessment of villages and existing environment. This will help to identify potential impacts, community concerns and build understanding on the areas of potential investment for the Project. Review of community social (demographic and economic structure) and health through primary and secondary sources. This information will be used to inform the Social Impact Assessment.	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS2: Labour and Working Conditions PS4: Community Health, Safety, and Security PS7: Indigenous Peoples
Land Preparation and Civil Works	Environment: - Soil; - Surface water; - Air - Vegetation; - Terrestrial Fauna; - Noise and vibration	The site has been subject to disturbance associated with dry land agriculture and community activities. Based on the site visit it appears unlikely the important biodiversity habitats or areas of primary forest would be affected by clearing for land preparation works.	Impacts to air quality and noise and vibration as a result of plant and equipment will be confined to the 18 month construction period. Community members live in close proximity to	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS4: Community Health, Safety, and Security; PS7: Indigenous Peoples PS8: Cultural Heritage

		Exhaust emissions from plant and equipment involved in site preparation as well as dust generation may temporarily impact air quality in the immediate area. Surface runoff also has the potential to affect surface water quality as a result of sediment runoff.	the construction areas and impacts are possible. . Surface water impacts would be expected to be temporary only and construction management measures would be capable of managing this.	
	Social - Cultural Heritage	No known cultural sites are located within the areas subject to disturbance, however a chance find procedure will be implemented as part of the ESMP.	Cultural heritage values are documented within the social baseline, particularly as these relate to the Van Kieu peoples. The ESIA will provide an overview of cultural resources and values known from the area and factor this into the project's management framework.	
	Health: - Human health safety and security - Environmental Quality	Based on publicly available Health data, Respiratory illness is the most common community disease in the area. Settlement areas are located close to the site and impacts as a result of dust will be considered.	Existing community health condition, particularly disease status will be considered as part of the assessment.	
Installation of WTG and substation, including foundation excavation and establishment of WTG foundations and underground transmission infrastructure.	Environment: - Air - Noise and vibration - Soils	Site construction has the potential to produce noise and air quality impacts. The construction period is 18 months and residents live in relatively close proximity to these areas, as a result impacts are possible. Large volumes of soil will also be excavated and erosion and runoff will	Assessment to be based on existing baseline assessments on Project area and surrounding environment. For noise and air quality, the ESIIA will be based on the EIA information	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS3: Resource Efficiency and Pollution Prevention PS4: Community Health, Safety, and Security

	occur if construction areas are not properly managed. It is expected that some basic construction management measures will be capable of reducing some impacts, while construction would be temporary only.	and will provide a quantitative assessment of the predicted impacts from construction. Mitigation measures will then be developed for implementation. For soil and runoff impacts, management measures are outlined in the ESMP and no specific assessment has been conducted.
Social: - Economy and livelihood -/+; Health: - Human health safety and security	There is the potential for negative impacts associated with general disturbance to the local community and impacts to environmental quality, however positive impacts such as employment opportunities and training. Given the proximity of the community to the construction areas, they may be placed at risk and appropriate safety measures should be implemented during construction .	Impacts will be considered, taking into account baseline community health conditions and the proposed construction time period.

Workforce Presence	Social: - Economy and livelihood - Social/cultural structure - Resource use	The influx of workers during construction has the potential to result in disturbance within the local community, particularly in the form of jealousy or cultural misunderstandings should a large foreign workforce be housed at the site. It is likely that a large proportion of the locally engaged workforce will stay in their current residences or other accommodation available within the local area. The presence of a workforce of up to 100 people is also likely to place pressure on local waste disposal facilities, roads and also public services.	The social baseline will be used to understand community experience with worker influx and to also understand their expectations with respect to access to employment opportunities.	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS2: Labour and Working Conditions PS3: Resource Efficiency and Pollution Prevention PS4: Community Health, Safety, and Security PS7: Indigenous Peoples
	Health: - Human health safety and security	The influx of workers has the potential to increase the risk of communicable disease and other health concerns. Construction will occur for 18 months and the workforce is likely to stay in the nearby accommodation.	Qualitative assessment to be conducted based on the social baseline results and experience from other projects.	
Wastes, emissions and discharges generation, handling and disposal	Environment: - Air - Soil - Surface Water - Groundwater	Construction will generate a variety of waste products (including hazardous wastes), which will require storage and disposal. If not properly managed, these can lead to contamination and unnecessary impacts to surrounding communities. The location of waste disposal sites will need to be confirmed as part of the follow-up construction management. It is expected that	Assessment of impacts to be developed based on likely waste and emission types and volumes and also management measures which would be expected to be implemented by the Project.	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS3: Resource Efficiency and Pollution Prevention PS4: Community Health, Safety, and Security

		impacts and risks to the community could be appropriately managed, through implementation of sound onsite waste management practices.		
	Social: - Environmental Quality Health: - Human health safety and security	Residents live in close proximity to the construction locations. There is however the potential for environmental quality to be affected if wastes are not properly managed and disposed of. This may also pose a risk to community health. It is expected that this could be readily managed through adoption of sound waste management and storage practices.	Assessment of impacts to be developed based on the likely waste and emission types, volumes, and disposal location, also management measures which would be expected to be implemented by the Project.	
Equipment transport and vehicle use	Environment: - Air - noise and vibration	Deliveries of equipment and materials will utilize existing community roads. The exact number of vehicle and truck movements is uncertain, however it is expected that construction would place additional strain on the local access roads. The additional vehicle movements would also contribute to existing dust and vehicle emissions within the local area.	The assessment will consist of a qualitative appraisal of expected impacts, based on projected vehicle movements and existing site conditions. Some basic management strategies would then be identified to help reduce potential impacts.	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS3: Resource Efficiency and Pollution Prevention PS4: Community Health, Safety, and Security
	Health: - Community safety and security	Local communities are likely to be exposed to noise and air quality impacts as a result of traffic within the local area. The assessment will consider the potential for the project to significantly contribute to the existing impacts and also the potential for additional traffic congestion to occur as a result of construction traffic.		
Operation of associated facilities such as the concrete batching plant.				
Construction Water Use	Environment: - Surface Water	It has been confirmed that construction water will be supplied	No Assessment Proposed	No Assessment proposed

	Social: - Public infrastructure and/ or transportation - General community disturbance	from a well and nearby stream. Project construction is limited to n 18 month period, while an offsite concrete batching plant will be used to supply construction concrete.		
Operations				
Workforce Presence	Social: Economy and Livelihood (+/-) Social/Cultural Structure	While only approximately 20 direct employment opportunities are expected to be generated during operations, the Project has the potential to have a positive impact on the community through generation of new employment and training opportunities. Improved disposable income also has the potential to improve employee lifestyles create flow-on economic benefits in the community such as through generating greater demand for local businesses/economic activity.	Impact from operational workforce presence will be assessed and will take into consideration Project plans for CSR and recruitment programs.	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS2: Labour and Working Conditions PS3: Resource Efficiency and Pollution Prevention PS4: Community Health, Safety, and Security
WTG Operation and Inspection and Maintenance	Environment: - Terrestrial fauna; - Noise	Significant impacts as a result of impacts to bird and bats and also increases in ambient noise conditions are possible, particularly given the proximity of the turbines to household.	Detailed assessments have been understand likely impacts to birds and bats as a result of strike, and also noise impacts to the community.	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS3: Resource Efficiency and Pollution Prevention PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
	Health - Environmental Quality - Community Health, Safety and Security	Wind farms are associated with community and health impacts such as noise, visual impacts and shadow flicker. Given the proximity of the community and households to the turbines, these impacts require further assessment.	Standalone assessments have been conducted for noise, shadow flicker and visual. Where possible mitigation measures have been proposed.	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS3: Resource Efficiency and Pollution Prevention
Wastes, emissions and discharges generation, handling and disposal	Environment: - Air - Soil - Surface Water	Operational waste volumes are unlikely to be significant, however if not handled properly, there is the	Waste inventories and disposal methods will be outlined in ESIA.	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS3: Resource Efficiency and Pollution Prevention

	- Groundwater Health - Environmental quality	potential for contamination or breaches of local regulations to occur. No direct emissions of wastes from the site to the surrounding environment are expected.	It is expected that industry standard waste and discharge disposal procedures will be capable of effectively managing impacts and no specific assessment has been undertaken.	PS4: Community Health, Safety, and Security PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
Non-Routine Events				
Spillage of fuel, oil, chemicals and hazardous materials	Environment - Surface water - Groundwater Health - Community health, safety and security; - Environmental Quality	The project has a range of potential spill sources during construction and operations. It is expected that smaller, land based spills could be readily contained and clean-up with appropriate equipment. It is expected that the project will implement and maintain industry practice emergency response provisions and that these would be capable of readily addressing and responding to most events.	Given the nature of the project, such risks are likely to be adequately managed through the adoption of industry standard construction and operational management measures	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS3: Resource Efficiency and Pollution Prevention PS4: Community Health, Safety, and Security
Vehicle, accident	Health Community safety and security	Increased road traffic will occur as a result of the project and may potentially increase the risk of accident	Qualitative assessment to be conducted based on an understanding of likely control and mitigation measures which would be expected to be implemented by the Project.	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS3: Resource Efficiency and Pollution Prevention PS4: Community Health, Safety, and Security

Blade throw	Health - Community health, safety and security;	Blade throw can occur when the blades disconnect from the WTG hub or fracture. This has occurred in the last on projects and poses a risk given the proximity of households to the WTGs	An assessment has been conducted and mitigation measures proposed.	PS1: Assessment and Management of Environmental and Social Risks and Impacts PS3: Resource Efficiency and Pollution Prevention PS4: Community Health, Safety, and Security

7 ENVIRONMENTAL BASELINE

7.1 INTRODUCTION

This section provides an understanding of climate baseline conditions such as rainfall, temperature and wind. The baseline condiction are taken from records from the Khe Sanh meteorological station for the period of 2008-2013. The Khe Sanh meteorological station is located approximately 25 km from the Project area.

7.1.1 Climate

Sunlight

Based on the information presented at *Table 7.1*. The highest sun radiation occurs in May with average 205.9 hours, and the lowest one happens in January, with average 81.2 hours. Sun radiation is fairly consistent throughout the year, with only limited variation between the highest and lowest months.

Table 7.1 Monthly sun hours

Unit: hour

Month	2008	2009	2010	2011	2012	2013
Total annual	1436.5	1780.8	1853.8	1381	1749	1616.9
January	113.4	80.8	111.9	32.5	53.9	94.7
February	8.5	174.9	167.7	130.4	112.2	153.5
March	135.2	173	160.8	69.5	140	182.7
April	183.6	140.4	167.5	140.3	205.6	176.8
May	150.8	189.3	206.1	248.6	217.7	223.2
June	144.3	152.6	228.1	161.3	112.1	181
July	187.7	147.4	222.4	178.5	160.2	148.3
August	168.1	158.1	112.1	142	115.4	101.9
September	110.2	132.5	178.3	57.2	133.9	99
October	100.1	146.8	94	74.2	196.8	121.8
November	74.4	131.1	70	123.2	160.5	72.2
December	60.2	153.9	134.9	23.3	140.7	61.8

Source: Khe Sanh meteorological station, Quang Tri Hydro meteorological center

Rainfall

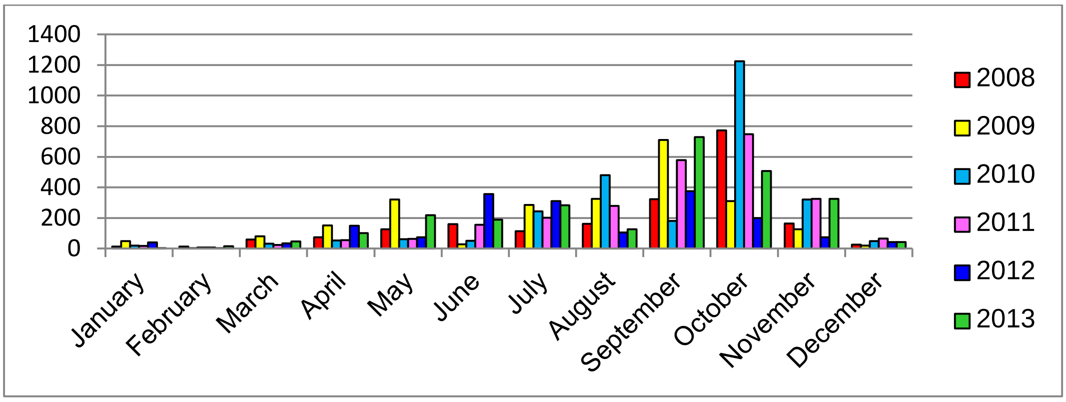
There is a distinct wet and rainy season within the project area (*Table 7.2).*

During rainy season, rainfall makes up 75% to 85% of total yearly evaporation. Additionally, tropical typhoons usually generate large-scale heavy rain and it may lead to serious flooding. The highest evaporation making account of 25% to 30% of total rainfall of rainy season, is reached in October.

Dry season has low rainfall making up 20% to 25% of total yearly evaporation. The lowest rainfall occurs in January. Dry season is strongly influenced by north-east monsoon, drizzle and chilly weather.

Table 7.2 ***Monthly evaporation***

Unit: milimetre



Source: Khe Sanh meteorological station, Quang Tri Hydro meteorological center

Temperature

Table 7.3 shows that ambient air temperature is relatively low in the winter (December to May), and high in the summer (June to November). It reaches the peak in June when the influence of south-west monsoon increases. The highest temperature recorded during five years (2008 to 2013) is 27.5°C in June, 2010. Annual lowest temperature occurs in January and February in a range from 15 to 19°C. The lowest temperature recorded during five years (2008 to 2013) is 13.4°C, occurring in February, 2008. It is noted that diurnal temperature variation in this area is considerably high, at approximately 7-10°C.

Table 7.3 ***Monthly Average temperature***

Unit: Degrees Celcius

Month	2008	2009	2010	2011	2012	2013
Average yearly temperature	22.1	23.0	23.6	21.7	23.1	23.0
January	17.7	16.3	19.3	15.0	17.4	17.9
February	13.4	22.1	22.3	17.9	18.5	21.4
March	20.4	22.8	22.6	16.7	21.2	23.5
April	24.6	23.9	24.9	22.6	25.0	24.6
May	24.6	24.8	27.3	25.9	26.2	26.5
June	25.5	26.2	27.5	26.1	25.6	25.8
July	25.7	25.4	26.7	25.7	24.9	25.3
August	25.2	25.2	24.8	25.1	25.1	25.3
September	24.6	24.9	25.2	24.1	24.8	24.5
October	23.8	23.5	22.5	22.6	23.8	22.8
November	20.9	20.8	20.7	21.7	23.5	21.5
December	18.2	19.8	19.3	16.8	21.0	16.4

Source: Khe Sanh meteorological station, Quang Tri Hydro meteorological center

Wind

Within study area, there are two main windy seasons in the year. The southwest monsoon occurs during summer between the months of May and

October and causes high humidity and heavy rain. The northeast monsoon occurs during winter between the months of November and April.

Average monthly wind speeds for the project area, based on the projects feasibility study is presented at *Table 7.4*.

Table 7.4 Wind speed at project area

Month	Wind speed at 60m high	Wind speed at 50m high
January	6.41	6.35
February	5.06	5
March	5.3	5.2
April	6.13	6.04
May	4.7	4.68
June	11.26	11.29
July	9.85	9.93
August	8.5	8.2
September	7.15	6.93
October	5.55	5.3
November	7.41	7.12
December	6.63	6.55
Annual average	**6.93**	**6.88**

Source: Feasibility Study of Project

7.2 *AIR QUALITY*

A baseline of air quality and noise was collected over a single day in 2015 to support the regulatory EIA. Three samples were taken in project area for analysing five parameters of ambient air, based on *QCVN 05:2013/BTNMT – National Technical Regulation on Ambient Air quality,* and *QCVN 26:2010/BTNMT – National Technical Regulation on Noise*. These are presented at *Table 7.5.*

The results show that at the sampling time, all the analysed parameters fell below thresholds' values, and ambient air at project area is generally in good condition.

Table 7.5 Ambient Air and Noise Results

No	Parameter	Unit	Sample KK1	Sample KK2	Sample KK3	QCVN 05:2013/BTNMT	QCVN 26:2010/BTMNT
1	Temperature	^oC	32.8	34.1	34.5	-	-
2	Humidity	%	68	66	65	-	-
3	Wind speed	m/s	1.8	3.2	3.4	-	-
4	TSP	µg/m3	201	142	150	300	-
5	Noise	dbA	66.7	63.1	62.2		70
6	SO_2	µg/m3	27	22	26	50	-
7	NO_2	µg/m3	28	24	22	200	-
8	CO	µg/m3	2,331	1,566	2,056	30,000	-

Source: Quang Tri Environmental Monitoring and Technical Center

7.3 NOISE

A key element in assessing environmental noise impacts is an understanding of the existing ambient and background noise levels in the vicinity of the closest and/or potentially most affected receptors situated within the potential area of influence of a project.

A noise screening study is provided at *Annex B* and provides a detailed analysis of baseline noise conditions

7.3.1 *Potentially Sensitive Receptors*

The potentially sensitive noise receptors where noise compliance has been assessed are tabulated in Table 7.6 below. These locations were provided for use in the assessment and include two dwellings, a healthcare centre, two commercial properties (village offices), a school and a kindergarten.

Table 7.6 Potentially Sensitive Noise Receptor Locations

Noise ID	Description	GPS Co-ordinates (X and Y)	
R1	Residential (Dwelling) Receptor	689858	1848969
R2	Residential (Dwelling) Receptor	688592	1849071
R3	Health Care Centre (Other) Receptor	687744	1849091
R4	HL People's Committee (Commercial) Receptor	688911	1848427
R5	HL High School (School) Receptor	687668	1849047
R6	Kindergarten (School) Receptor	687512	1848858
R7	HL Operation House (Commercial) Receptor	689198	1848252

Guidance Note

These locations do not represent all receptors located in the vicinity of the HL1 (or HL2) project but have been provided for the purposes of this noise assessment; they are considered to be representative of locations that will experience the highest impacts associated with the ongoing operation of both HL1 and HL2 projects.

Furthermore, where additional receptors are identified (beyond those presented in Figure 7.1 and Table 7.6) the predicted noise levels at the nearest assessed receptor (R1 to R7) provides an indication of potential wind farm emissions and impacts that could be experienced at other receptors not identified in this assessment.

7.3.2 *Existing Noise Levels*

Existing ambient and background noise levels were not measured via a detailed baseline monitoring campaign for this assessment but an understanding of the existing acoustics environment is summarised below.

Given the topography surrounding the HL1 project (steep forested hillsides occurring on each side) and the relatively remote village area in and around the footprint of HL1 and HL2, it would be expected that existing ambient and background noise levels would be low and representative of a generally rural environment.

However, given the community infrastructure and local roads in the area, and the potential for small commercial or agricultural activities to occur, existing ambient and background noise levels above that representative of a rural environment may be experienced. This evaluation and understanding of the existing noise environment excludes emissions from the now operational HL2 wind farm.

Noise sampling occurred between 6 AM and 9 PM on Thursday, 13 August 2015. Noise samples were recorded at three locations described as Air Sampling 1, Air Sampling 1, and Air Sampling 3 as identified in Figure 7.1 below. The recorded noise levels were:

- 66.7 dBA at "Air Sampling 1".
- 63.1 dBA at "Air Sampling 2".
- 62.2 dBA at "Air Sampling 3".

This information is presented here to provide a basic understand of existing noise levels but has not been adopted to inform this assessment as the measurement methodology is unknown, and therefore the quality of the data cannot be relied upon. It does however indicate that average or maximum noise levels up to approximately 65 dBA may be experienced by receptors within and near to the HL1 project.

Figure 7.1 *EIA Noise ("Air") Sampling Locations*

7.4 BIODIVERSITY

7.5 RELEVANT STANDARDS AND GUIDELINES

The relevant standards applicable to this project is the International Finance Corporation (IFC) Performance Standards (PS) (in particular, *IFC PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources*) The relevant applicable guidelines for this project are the *World Bank Group Environmental, Health, and Safety Guidelines for Wind Energy* (August 2015). The application of Critical Habitat criterion as outlined in IFC PS6 and associated Guidance Note is applicable to the species identified within this assessment that are likely occur at the Project site.

7.6 DESKTOP ASSESSMENT SUMMARY

An assessment of the biodiversity values was undertaken through a desktop assessment of the biodiversity values of the Project Area and Area of Interest. The desktop assessment focused on existing studies of the study area and on-line information.

The following existing studies were reviewed as part of the assessment:

- NGO webpages and databases including those belonging to the World Wildlife Fund (WWF); Alliance for Zero Extinction (AZE); BirdLife International; Wildlife Conservation Society (WCS) and International Union for the Conservation of Nature (IUCN);
- Integrated Biodiversity Assessment Tool (iBAT); and
- Species descriptions from the IUCN Red List of Threatened Species.

7.6.1 *Vietnam National Biodiversity Strategy to 2020, Vision to 2030*[1]

The main objectives of the Vietnam National Biodiversity Action Plan (NBSAP) are to: improve the quality and increase the area of protected ecosystems; to improve the quality and populations of endangered, rare and precious species; and to compile an inventory, to store, and to conserve native, endangered, rare and precious genetic resources to ensure that they are not impaired or eroded.

One key outcome from the Vietnam NBS is to improve the management of protected areas within the country and to preserve and protect endangered species. Vietnam has developed a comprehensive protected area network (under the Forestry Law 2007) as well as legislated for the protection of wildlife (under the Wildlife and Aquatic Law (2007).

[1] Data retrieved from: https://www.cbd.int/doc/world/vn/vn-nbsap-v3-en.pdf on 8 March 2017

There have been changes in the extent of protected areas with Vietnam, in terms of number and extent of area covered. Between 1990 and 2006, forest coverage, including natural forest and plantation forest, had risen to 38.2%, representing an increase of more 10% over this period. A system of 128 protected areas has been established and developed in all ecoregions, covering an area of 2.5 million hectares (equal to about 7.6% of the national territory). In addition, a system of 45 interior protected wetlands was approved late in 2008. Plans for another system consisting of 15 marine protected areas have been designed and submitted for Government approval. In addition to the national protected areas system, 2 Natural World Heritage Sites, 4 ASEAN Natural Heritage Parks, 2 Ramsar Wetlands and 6 Biosphere Reserves have been internationally recognized. In situ conservation takes many different forms, ranging from species and population conservation to landscape, ecosystem and ecoregion conservation. Vietnam also accessioned the *Convention on International Trade in Endangered Species of WiId Fauna and Flora* in 1994.

Quang Tri - Quang Nam Biodiversity Conservation Initiative

The Quang Tri - Quang Nam Biodiversity Conservation Initiative (BCI) proposed developing six biodiversity corridors with a total area of 130,000 hectares, including a system within the Vu Gia River's upstream area, Thu Bon River, Quang Nam and Phong Dien Nature Reserve, a part of A Luoi, upstream of Ta Trach River, Thua Thien-Hue, North Huong Hoa Nature Reserve, Dak Rong Nature Reserve and Northern Huong Hoa. The corridor system is currently being further developed by the project named the Greater Mekong Sub-region Biodiversity Conservation Corridors Projects (Vietnam component) - Phase 2 (2011-2019).

7.6.2 Global EcoRegions

WWF defines an ecoregion as a "*large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions*[1].

The boundaries of an ecoregion are not fixed and sharp, but rather encompass an area within which important ecological and evolutionary processes most strongly interact.

The Global Ecoregions are the results of regional analyses of biodiversity across the continents and oceans of the world, completed in collaboration with hundreds of regional experts worldwide and by conducting extensive literature reviews. These ecoregions were chosen from outstanding examples of each terrestrial, freshwater, and marine major habitat type. EcoRegions are based on the following parameters: species richness; endemism; higher

[1] Retrieved from http://wwf.panda.org/about_our_earth/ecoregions/about/what_is_an_ecoregion/ 16 January 2017

taxonomic uniqueness (e.g., unique genera or families, relict species or communities, primitive lineages); extraordinary ecological or evolutionary phenomena (e.g., extraordinary adaptive radiations, intact large vertebrate assemblages, presence of migrations of large vertebrates); and global rarity of the major habitat type.

The EcoRegion relevant to the Project Area and Area of Interest is described below.

Northern Vietnam Lowland Rain Forests (IM0141)

The Northern Vietnam Lowland Rain Forests [IM0141] ecoregion[1] extends from the freshwater swamp forests of the Red River Valley south along the north-central coast of Vietnam to the region south of Tam Ky. Geological formations are varied, but there are extensive limestone substrates.

The high rainfall and short dry season characterizing the coastal habitats of this ecoregion produce conditions that once supported diverse wet evergreen forests. Such forest habitats have largely been cleared and exist only in isolated patches today. This ecoregion is best preserved in Cuc Phuong and Pu Mat National Parks. At Cuc Phuong, 1,800 vascular plant species have been described for a small area with limited topographic diversity. Overall, the flora of these wet evergreen forests shows a stronger affinity to that of northern Vietnam and southern China than to that of southern Vietnam. Although the Dipterocarpaceae is an ecologically significant element of the lower-elevation wet evergreen forests, the species richness in this family is lower than that of similar habitats in the southern Annamite Range.

Primary wet evergreen forest consists of a dense, three-tiered canopy reaching 25-35 m and occasionally 45 m height in undisturbed sites, with large emergent trees extending above this level to give a rough upper surface to the canopy. The upper canopy is dominated by a species of Hopea, *Castanopsis hystrix*, and *Madhuca pasquieri*. The fan palm *Livistona saribus* is a common subcanopy species in small gaps and reaches 20 m in height. Wet evergreen forest stands disturbed by logging show a characteristic presence of Knema erratica, a fast-growing colonizer, and an increased dominance of Livistona saribus in the upper canopy.

Most of this ecoregion's biodiversity has been lost because of the extensive habitat loss. Nevertheless, it still harbors several mammals and birds of conservation significance, including the Owston's banded civet (*Hemigalus owstoni*), white-cheeked gibbon (*Hylobates leucogenys*), red-shanked douc langur (*Pygathrix nemaeus*), and Francois's leaf monkey (*Semnopithecus francoisi*). The ecoregion overlaps with a Level II TCU. There are more than 300 bird species in this ecoregion, including one endemic species. The Annamese Lowlands (143) EBA overlaps with this ecoregion.

[1] Retrieved from: https://www.worldwildlife.org/ecoregions/im01416 March 2017

More than 90 percent of the natural habitat in this ecoregion has been converted, and the remaining habitat is scattered as small fragments. The nine protected areas in the ecoregion cover less than 900 km^2 (4 percent) of the ecoregion. And many of these small protected areas (average size 99 km^2) are degraded.

7.6.3 *Candidate Species of Conservation Significance*

The following species of conservation significance exist within the Northern Vietnam Lowland Rain Forests EcoRegion[1]. Endemic Species are listed in *Table 7.7.* Species classified as Critically Endangered, Data Deficient, Endangered or Vulnerable on the IUCN Red List are shown in *Table 7.8.*

Table 7.7 ***Endemic Species with the Northern Vietnam Lowland Rain Forests EcoRegion***

S/N	Scientific Name	Class Name	Common Name	Red List Category
1.	*Leiolepis guentherpetersi*	Reptilia	Leiolepis guentherpetersi	N/A
2.	*Annan merlini*	Aves	Annam Partridge	N/A
3.	*Paracoelops megalotis*	Mammalia	Vietnam Leaf-nosed Bat	DD

Notes:

CR : Critically Endangered; EN : Endangered; VU : Vulnerable; NT: Near Threatened; DD : Data Deficient; NA : Not Assessed; LC: Least Concern

Table 7.8 ***Critically Endangered, Endangered Species within the Northern Vietnam Lowland Rain Forests EcoRegion***

S/N	Scientific Name	Class Name	Common Name	Red List Category
1.	*Gyps bengalensis*	Aves	White-rumped Vulture	CR
2.	*Gyps indicus*	Aves	Long-billed Vulture	CR
3.	*Sarcogyps calvus*	Aves	Red-headed Vulture	CR
4.	*Tringa guttifer*	Aves	Nordmann's Greenshank	EN
5.	*Lophura edwardsi*	Aves	Edwards' Pheasant	EN
6.	*Platalea minor*	Aves	Black-faced Spoonbill	EN
7.	*Pseudoryx nghetinhensis*	Mammalia	--	CR
8.	*Nomascus leucogenys*	Mammalia	White-cheeked Gibbon	CR
9.	*Trachypithecus delacouri*	Mammalia	--	CR
10.	*Manis javanica*	Mammalia	Malayan Pangolin	EN
11.	*Manis pentadactyla*	Mammalia	Chinese Pangolin	EN
12.	*Elephas maximus*	Mammalia	Asiatic Elephant	EN
13.	*Nomascus siki*	Mammalia	--	EN
14.	*Prionailurus viverrinus*	Mammalia	Fishing Cat	EN
15.	*Cuon alpinus*	Mammalia	Dhole	EN
16.	*Pygathrix nemaeus*	Mammalia	Douc Langur	EN
17.	*Trachypithecus francoisi*	Mammalia	François's Leaf Monkey	EN
18.	*Trachypithecus phayrei*	Mammalia	Phayre's Leaf Monkey	EN
19.	*Bos javanicus*	Mammalia	Banteng	EN

[1] Data Retrieved from: http://www.worldwildlife.org/ecoregions/im0136 16 January 2017

S/N	Scientific Name	Class Name	Common Name	Red List Category
20.	*Trachypithecus germaini*	Mammalia	--	EN
21.	*Trachypithecus hatinhensis*	Mammalia	--	EN
22.	*Panthera tigris*	Mammalia	Tiger	EN
23.	*Mauremys mutica*	Reptilia	--	EN

Notes:

CR : Critically Endangered; EN : Endangered; VU : Vulnerable; NT: Near Threatened; DD : Data Deficient; NA : Not Assessed; LC: Least Concern

7.6.4 *Key Biodiversity Areas and Protected Areas*

Key Biodiversity Areas (KBA) are places of international importance for the conservation of biodiversity through protected areas and other governance mechanisms[1]. KBAs are typically sites where there is a regular occurrence of significant numbers of one or more globally threatened species, restricted-range species and/or congregatory species. KBAs include Important Bird Areas (IBA), Alliance for Zero Extinction (AZE), Important Plant Areas (IPA) and Important Sites for Freshwater Biodiversity.

Under the provisions of IFC PS6, a Protected Area and Internationally Recognized area require specific requirements if development proceeds within the boundary (see requirements under KBAs outlined above). Consultation with protected area managers and the community will be required.

The locations of KBAs and Protected Areas within 25km of the Project Area are shown in *Figure 7.2.*

The KBAs relevant to the Project Area and Area of Interest are described in below.

Annamese Lowlands Endemic Bird Area

The Annamese lowlands cover the lowlands and foothills of north-central Vietnam (in southern Ninh Binh, Thanh Hoa, Nghe Anh, Ha Tinh, Quang Binh, Quang Tri and Thu Thien Hue provinces) and part of adjacent central Laos.
All the coastal plain forest in this EBA has already been cleared, and the only suitable habitat remaining for the lowland species is in small valleys and on the lower slopes of the hills. Seven of the restricted-range bird species are classified as threatened, including all five of those which are confined to this EBA. The Endemic Bird Area species triggers are shown in *Table 7.9* below.

Table 7.9 The Endemic Bird Area Spcies Triggers

S/N	Species	IUCN Category
1.	*Lophura imperialis*	NR
2.	*Lophura hatinhensis*	NR
3.	*Lophura edwardsi*	NR

[1] Retrieved from: http://www.biodiversitya-z.org/content/key-biodiversity-areas-kba 16 January 2017

S/N	Species	IUCN Category
4.	*Arborophila merlini*	NR
5.	Crested Argus *(Rheinardia ocellata)*	NT
6.	Sooty Babbler *(Stachyris herberti)*	LC
7.	Grey-faced Tit-babbler *(Mixornis kelleyi)*	LC
8.	*Rimator danjoui*	NR
9.	White-cheeked Laughingthrush *(Garrulax vassali)*	LC

Notes:

CR : Critically Endangered; EN : Endangered; VU : Vulnerable; NT: Near Threatened; DD : Data Deficient; NA : Not Assessed; LC: Least Concern

Phong Dien Nature Reserve and Important Bird Area

This IBA comprises Phong Dien Nature Reserve situated in the Annamese lowlands. The topography of the IBA is dominated by a ridge of low mountains, extending south-east from the Annamite Mountains. Throughout most of the IBA, the forest has been extensively degraded, fragmented and reduced in extent through a combination of logging, shifting cultivation, wartime spraying of defoliants, napalm and forest fires. However, the forest within the IBA forms part of one of the largest remaining areas of lowland evergreen forest in the Annamese lowlands.

The avifauna of Phong Dien IBA is characteristic of the Annamese Lowlands Endemic Bird Area (EBA), and the IBA supports six of the nine species that define this EBA. The species of greatest conservation importance at Phong Dien is Edwards's Pheasant *Lophura edwardsi*. Until its rediscovery in 1996, this species was believed to be extinct in the wild. Edwards's Pheasant has a very restricted range in central Vietnam but reports from hunters suggest that this species is still relatively common in the IBA. Detailed information is lacking on the status of other restricted-range species found at the IBA, such as Annam Partridge *Arborophila merlini* and Short-tailed Scimitar Babbler *Jabouilleia danjoui*, although a field survey in 1998 confirmed that Crested Argus *Rheinardia ocellata* is still common.

A summary of the Phong Diwn Nature Resrve IBA is shown in *Table 7.10* below.

Table 7.10 ***Summary of the Phong Dien Important Bird Area***

Phong Dien Important Bird Area (IBA)[1]	
Location:	16° 27' North, 107° 12' East
IBA Criteria met:	A1, A2 (2003)
Area:	41,548 ha
Year of assessment:	2008
Threat score (pressure):	Medium
Condition score (state):	Near favourable
Action score (response):	Medium
Distance to Project Area:	<25km South East

[1] Retrieved from: BirdLife International (2017) Important Bird Areas factsheet: Phong Dien. Downloaded from http://datazone.birdlife.org/site/factsheet/phong-dien-iba-vietnam

Bac Huong Hoa Nature Reserve

Bac Huong Hoa Nature Reserve[1] encompasses an area of lowland and mid-montane evergreen forest in central Vietnam, adjacent to the international border with Laos. The original vegetation cover of Nature Reserve is evergreen forest. Below 600 m the land supports tropical lowland evergreen forest and above 600 m the forest is classified as subtropical mid-montane evergreen forest. Almost 85% of the nature reserve still retains natural forest cover, of various degrees of quality. The project area is adjacent to an area of forest that is contiguous with the Nature Reserve. The habitat for these species therefore likely extends to forested areas surrounding the Project area.

Surveys in 2008 recorded a number of species of conservation concern within the nature reserve. A total of 47 mammal species (not including bats) have been recorded of which 21 species are considered globally threatened, Near Threatened or Data Deficient. Of the 207 species of birds that have been recorded in the Nature Reserve, one species is considered threatened at a global level and nine species are considered Near Threatened at a global level.

The data obtained for the Nature Reserve is from 2008 and is the most recent data available for the area. This information has been used in the Critical Habitat assessment, however these species may not be present currently within the Nature Reserve. Additional surveys would be recommended to confirm presence.

A summary of the species of conservation concern (listed as CR or EN on the IUCN Red list or Vietnam Red Book) is outlined in *Table 7.11* below.

Table 7.11 Species of Conservation Concern in Bac Huong Hoa Nature Reserve (2008)

S/N	Group	Common Name	Scientific Name	VRDB	IUCN
1.	Plants	-	*Aquilaria crassna*	EN	CR
2.	Plants	-	*Cinnamomum balansae*	VU	EN
3.	Plants	-	*Cinnamomum parthenoxylon*	CR	DD
4.	Plants	-	*Dipterocarpus grandiflorus*	VU	EN
5.	Plants	-	*Dipterocarpus hasseltii*		EN
6.	Plants	-	*Dipterocarpus kerrii*		EN
7.	Plants	-	*Erythrophleum fordii*		EN
8.	Plants	-	*Anoectochilus cetaceus*	EN	
9.	Plants	-	*Dendrobium amabile*	EN	
10.	Plants	-	*Asarum balansae*	EN	
11.	Plants	-	*Madhuca pasquieri*	EN	
12.	Mammals	Red-shanked Douc Langur	*Pygathrix nemaeus*	EN	EN
13.	Mammals	Hatinh Langur	*Trachypithecus hatinhensis*	EN	EN
14.	Mammals	Northern White-cheeked	*Nomascus leucogenis*	EN	CR
15.	Mammals	Gibbon			
16.	Mammals	Annamite Striped Rabbit	*Nesolagus timminsi*	EN	DD

[1] Retrieved from: BirdLife International Vietnam Program (2008) The Biodiversity of Bac Huong Hoa Nature Reserve, Quang Tri Province, Vietnam. Downloaded from https://lethoaituanfpd.files.wordpress.com/2012/02/bhhbiodiv.pdf

S/N	Group	Common Name	Scientific Name	VRDB	IUCN
17.	Mammals	Sunda Pangolin	*Manis javanica*	CR	NT
18.	Mammals	Clouded Leopard	*Neofelis nebulosa*	EN	VU
19.	Mammals	Leopard	*Panthera pardus*	CR	
20.	Mammals	Binturong	*Arctictis binturong*	EN	
21.	Mammals	Dhole	*Cuon alpinus*	EN	EN
22.	Mammals	Large-antlered Muntjac	Muntiacus vuquangensis	VU	CR
23.	Mammals	Sun Bear	*Helarctos malayanus*	EN	DD
24.	Mammals	Asian Black Bear	*Ursus thibetanus*	EN	VU
25.	Mammals	Saola	*Pseudoryx nghetinhensis*	EN	CR
26.	Mammals	Chinese Serow	*Capricornis sumatraensis*	EN	EN
27.	Birds	Edwards's Pheasant	*Lophura edwardsi*	EN	EN
28.	Herp.	Water monitor	*Varanus salvator*	EN	
29.	Herp.	Burmese Python	*Python molurus*	CR	NT
30.	Herp.	Common Rat Snake	*Pytas mucosus*	EN	
31.	Herp.	Banded Krait	*Bungarus fasciatus*	EN	
32.	Herp.	Indochinese Cobra	*Naja naja*	EN	
33.	Herp.	King Cobra	*Ophiophagus hannah*	CR	
34.	Herp.	Indochinese Box Turtle	*Cuora galbinifrons*	EN	CR
35.	Herp.	Chinese three-striped Box Turtle	*Cuora trifasciata*	CR	CR
36.	Herp.	Keeled Box Turtle	*Pyxhidea mohotti*		EN
37.	Herp.	Four-eyed Turtle	*Sacalia quadriocellata*		EN

Notes:

CR : Critically Endangered; EN : Endangered; VU : Vulnerable; NT: Near Threatened; DD : Data Deficient; NA : Not Assessed; LC: Least Concern

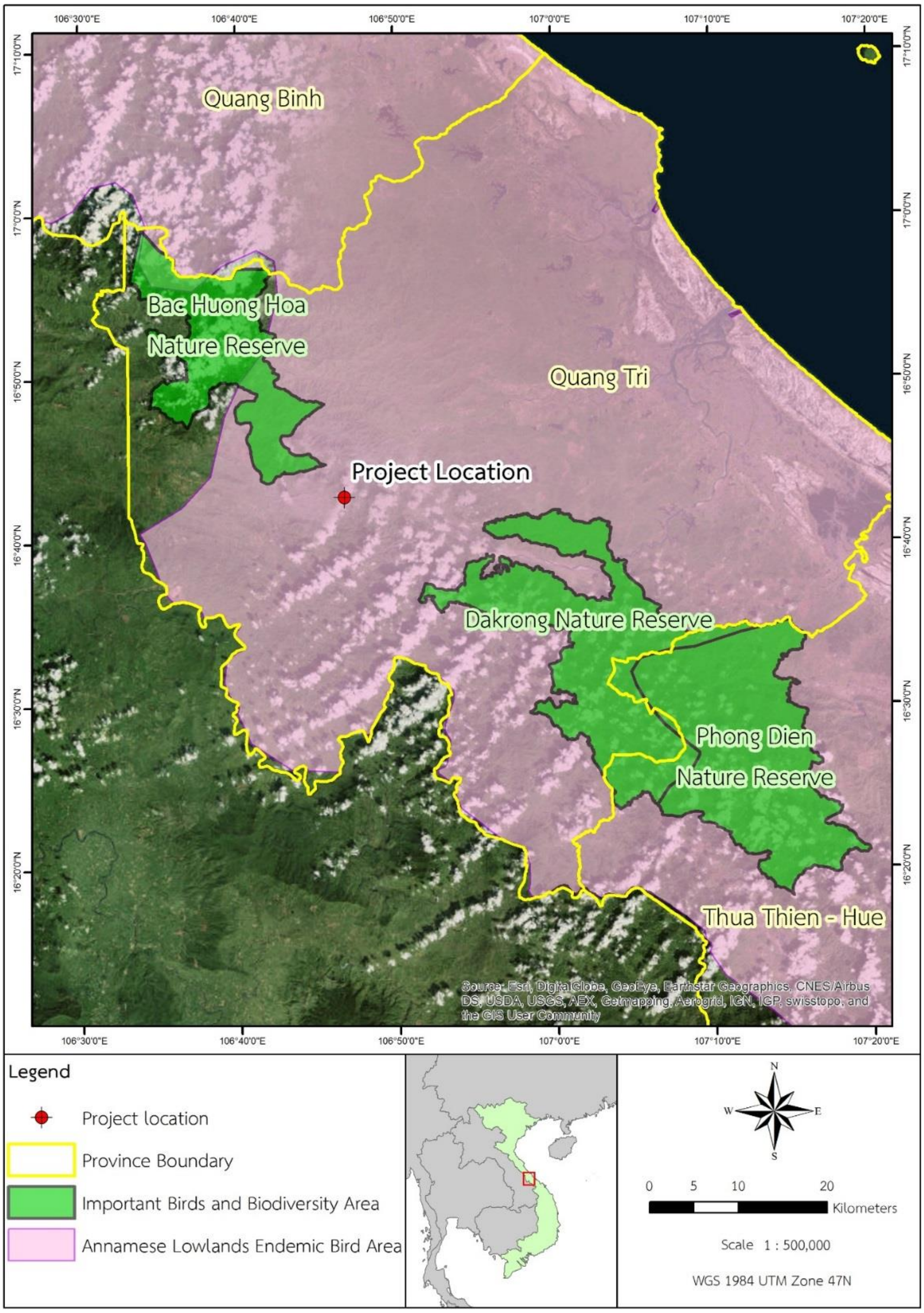
Herp. : Herpetofauna

A summary of the features of the Bac Huong Hoa Nature Reserve is contained in *Table 7.12.*

Table 7.12 Summary of the Bac Huong Hoa Nature Reserve

Bac Huong Hoa Nature Reserve	
Location:	16043'22'' to 16059'55'' N and 106033'00'' to 106047'03''E.
IBA Criteria met:	-
Area:	23,486ha
Year of assessment:	2012
Threat score (pressure):	Not reported
Condition score (state):	Not reported
Action score (response):	Not reported
Distance to Project Area:	<5km North

Figure 7.2 Key Biodiversity Areas and Protected Areas within 25km of the Project Area



7.6.5 *Invasive Species*

Invasive species are non-native species to a particular ecosystem and whose introduction and spread causes, or are likely to cause, socio-cultural, economic or environmental harm or harm to human health. These species become naturalized in their introduced range, and often reproduce in large numbers spread over a large area. This can result in competition and damage to native species[10].

Invasive species have the capacity to exacerbate their role in ecosystem degradation through combination threats by habitat change, climate change, over-exploitation of ecosystem resources and pollution. These further enhance their threat to biodiversity and the human condition[11].

According to the Global Invasive Species Database (GISD)[12] and WWF, a total of 119 species have been identified as invasive species in Vietnam.

7.6.6 *Summary of Bird and Volant Mammal (Bat) Screening Assessment*

ERM has conducted a screening assessment against to determine whether there are potential bird and volant mammal (bat) species that may be at risk due to the project, in particular direct impacts due to strike of turbine blades to birds and bats (including barotrauma); as well as indirect impacts to these species due to habitat loss (See *Annex C*).

Specifically, ERM has undertaken the assessment to identify:

- Are any of the species likely to be Critical Habitat candidate species as identified under IFC PS 6.
- What species may be at risk due to potential strike (and barotrauma in relation to bats) due to the rotation of turbine blades during the operation of the windfarm?

The results of the assessment identified 215 species of birds and 42 bat species that may be at risk of flying through the Rotor Swept Zone (RSZ) of the project. These species are listed in *Annex C*.

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10 Food and Agriculture Organisation of the United Nations (2016) Invasive Species: Impacts on Forests and Forestry. Retrieved from http://www.fao.org/forestry/aliens/en/

11 Emerton L and Howard G (2008) A Toolkit for the Economic Analysis of Invasive Species. Global Invasive Species Programme, Nairobi. Retrieved from http://www.issg.org/pdf/publications/GISP/Guidelines_Toolkits_BestPractice/Emerton&Howard_2008_EN.pdf

12 Global Invasive Species Database (2016). Retrieved from http://www.iucngisd.org/gisd/

The data from the screening assessment has identified that:

- Seven (7) bird species and 4 bat species may trigger Critical Habitat under Criterion 1, Tier 1 or 2 (Critically Endangered or Endangered species);
- Ninety eight (98) bird species and 19 bat species may trigger Critical Habitat under Criterion 3, Tier 2 (migratory species); and
- One hundred and nine (109) bird species and 27 bat species are not considered as Critical Habitat triggers but may pose a risk of flight within the RSZ.

The Critical Habitat candidate species identified in the screening assessment for Criterion 1, 2 and 3 are further assessed below.

7.7 CRITICAL HABITAT SCREENING ASSESSMENT

The objectives for the project require than assessment is made of the presence or absence of terrestrial and aquatic biodiversity values, including their location, status and condition. The assessment is to include an evaluation of Critical Habitat values, as defined by *IFC PS6 paragraph 16*. Critical habitats are defined by IFC PS6 as:

"Areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered11 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."

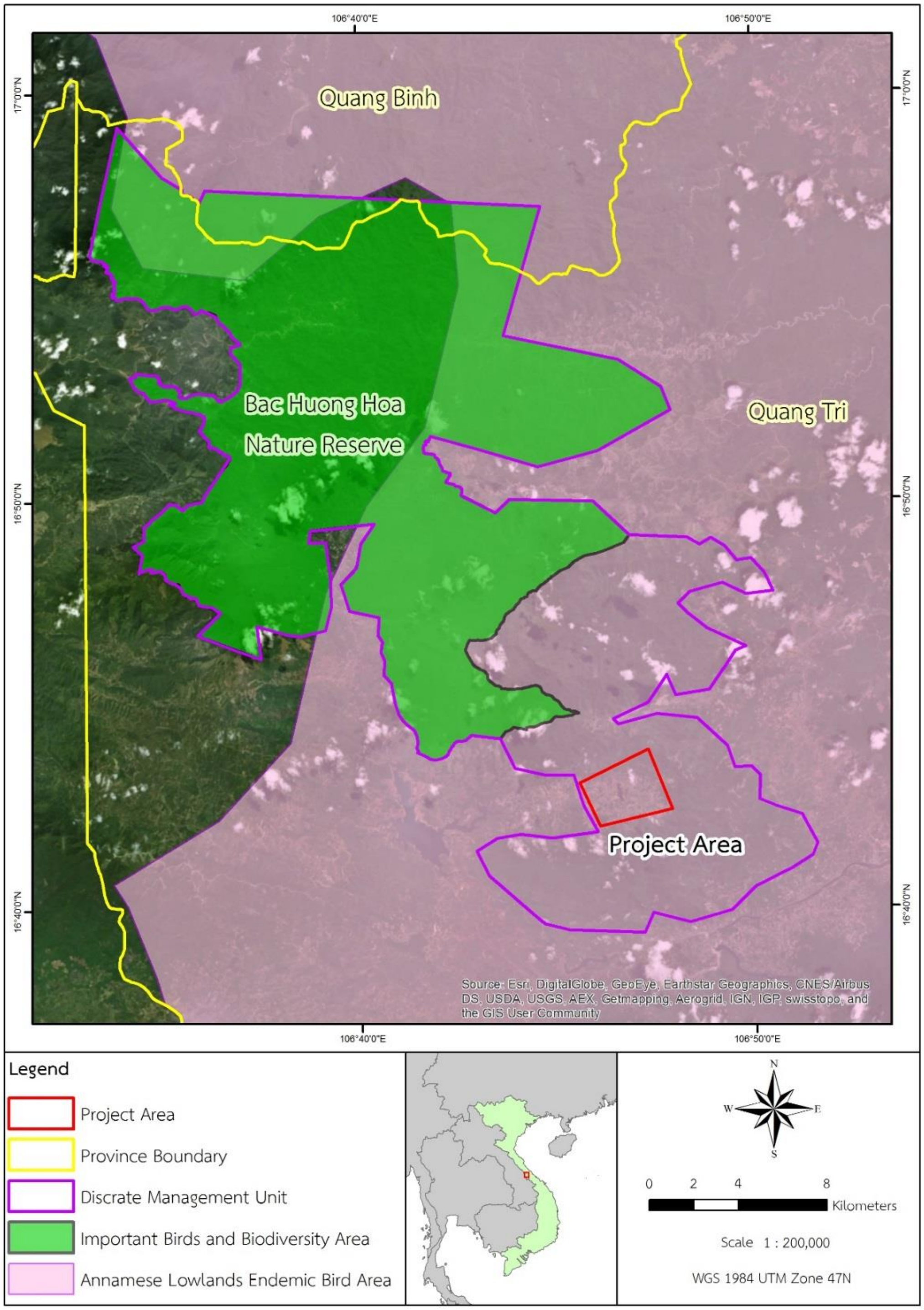
7.7.1 Discrete Management Unit

As part of the process in undertaking the Critical Habitat assessment it is a requirement that the spatial boundaries relevant to the assessment are clearly determined and defined (IFC, 2012). IFC PS6 recommends defining a Discrete Management Unit (DMU) which delineates the area of habitat to be considered for the assessment within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas (IFC, 2012). A DMU may or may not have an actual management boundary (e.g. legally protected areas, World Heritage sites, KBAs, IBAs, community reserves) but could also be defined by some other sensible ecologically defined boundary (IFC, 2012).

The DMU for the Project Area includes contiguous forest areas adjacent to the project area and includes the Bac Huong Hoa Nature Reserve which is located 5km north of the Project area. A review of photographs taken at the site and satellite imagery indicates that the forest area surrounding the Project area is

degraded but is contiguous with the Nature Reserve. This forested area is located to the south, east and north of the project area. A newly constructed road transverses the DMU directly to the east of the project area. The Project area itself appears to be sparsely vegetated. As defined by PS6, it is considered that the area of forest is a defined as the DMU is a distinct ecological boundary for the species likely to be present within the vicinity of the Project area.
The DMU chosen for this assessment is outlined in *Figure 7.3*.

Figure 7.3   Discrete Management Unit



7.7.2 *Critical Habitat Triggers*

Critical Habitat may not be limited to pristine or highly biodiverse areas but rather may include both modified habitat and natural habitats across the broader landscape that supports the biodiversity values that trigger the Critical Habitat criterion. Critical Habitats can therefore be a subset of both modified habitat and natural habitat.

Assessment for Critical Habitat is undertaken as a screening process against the criteria defined within IFC PS 6 Guidance Note. This involved GIS analysis and desk based data collection including a review of previous biodiversity studies. Critical Habitat criteria are defined in PS6 Guidance Note 6 (GN6), Paragraphs GN69 to 97. *Table 7.13* provides detail of the qualifying requirements for Critical Habitat criteria 1 to 3 (i.e. thresholds), while details of the likely qualifying interests for Criterion 4 and 5 will be defined based on research and expert opinion.

It should be noted that ERM has undertaken an assessment of the potential for Critical Habitat values to occur within the Project Area as well as the DMU. The species assessed include the Critical Habitat candidate species identified within the Bac Huong Hoa Nature Reserve (*Table 7.14)* and species identified during the bird and volant bat screening assessment.

Table 7.13 Criteria Habitat Criteria (IFC PS6 Guidance Note 2012)

Criteria	Tier 1[(1)]	Tier 2[(1)]
Criterion 1: Critically Endangered (CR) / Endangered (EN) species:	a) Habitat required to sustain ≥ 10 % of the global population of a CR or EN species /sub /species and where there known regular occurrences of the species and where habitat could be considered a discrete management unit for the species. b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.	c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally- important concentrations of Red-listed EN species where that habitat could be considered as a discrete management unit for the species/subspecies. d) Habitat of significant importance to CR/EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species. e) As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.
Criterion 2: Habitat of significant	a) Habitat known to sustain ≥ 95 % of the global population of an	b) Habitat known to sustain ≥ 1 % but < 95 % of the global population of an endemic or restricted-range species where

Criteria	Tier 1(1)	Tier 2(1)
importance to endemic and/or restricted-range species;	endemic or restricted-range species where that habitat could be considered a discrete management unit for that species.	that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment.
Criterion 3: Habitat supporting globally significant concentrations of migratory species and/or congregatory species;	(a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 % of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species.	(b) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 % but < 95 % of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment. (c) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. (d) For species with large but clumped distributions, a provisional threshold is set at ≥ 5 % of the global population for both terrestrial and marine species. (e) Source sites that contribute ≥ 1 % of the global population of recruits.
Criterion 4: Highly threatened and/or unique ecosystems; and/or	Criterion 4 has no tiered system although recent publication (Keith et al, 2013) may introduce this. This criterion must include one of the following a) The ecosystem is at risk of significantly decreasing in area or quality; b) Has a small spatial extent; and /or c) Contains unique assemblages of species including assemblages or concentrations of biome-restricted species. Highly threatened or unique ecosystems are defined by a combination of factors which may include long-term trend, rarity, ecological condition, and threat.	
Criterion 5: Areas associated with key evolutionary processes	The criterion is defined by: a) the physical features of a landscape that might be associated with particular evolutionary processes; and/or b) Sub-populations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history. The latter includes evolutionarily significant units and evolutionarily distinct and globally endangered species.	

Note: (1) *No Tier system is in place for Criterion 4 and Criterion 5.*

With regard to Criterion 2, it should be noted that an endemic and restricted range species is defined by the IFC as one which possesses an extent of occurrence of 50,000 km^2 (C. Savy pers. comms). Plant species may qualify as endemic if has ≥95% of its global range inside the country or region of analysis. The five criteria are 'triggers' in that if an area of habitat meets any one of the criteria, it will be considered Critical Habitat irrespective of failing to meet any other criterion[13]. Therefore, Critical Habitat can be determined through a single criterion or where a habitat holds biodiversity meeting all five criteria. This approach is generally more cautious but is used more widely in conservation[14]. Critical Habitat criteria therefore have two distinctive characteristics. First, components of biodiversity are essentially assigned to only two levels of conservation significance, those that trigger Critical Habitat and those that do not (Tier considerations being secondary to this primary Critical Habitat determination). Second, each criterion is applied separately and not in combination, meaning that the assessment is not cumulative.

Critical Habitat Candidate Species (Criteria 1-2)

For Criterion 1 to 3, this exercise considers if habitats from which candidate species are found in could qualify as Critical Habitat under IFC PS6. Threatened species refer to species evaluated as CR or EN on IUCN status or have been conferred national protection status, are endemic or restricted range species, and are migratory or congregatory species (ADB, 2012).

ERM has identified seven (7) birds and four (4) bats from the bird and volant mammal screening assessment and an additional 36 species of terrestrial fauna identified to occur within the Bac Huong Hoa Nature Reserve, which is within the DMU of the Project area. It should be noted that the data used in the terrestrial Critical Habitat assessment for the Nature Reserve is from 2008 and may not represent the species currently present within the DMU.

The evaluations were carried out in consideration of the threats facing these identified species and their habitat requirements for Criterion 1 and 2. The Critical Habitat candidates and assessment against thresholds are summarized in *Table 7.14* and *Table 7.15*.

[13] The Biodiversity Consultancy (TBC) (2013) Getting through PS6: Critical Habitat and its requirements. Case Studies from Guinea and Mongolia. Whitmore, T.C. (1984) Tropical Rain Forests of the Far East. Oxford University Press. Second Edition.
[14] McDonald-Madden, E. Gordon, A. Wintle, B. Walker, S. Grantham, H. Carvalho, S. Bottrill, M. Joseph, L. Ponce, R. Stewart, R. & Possingham, H. P. (2009). "True" Conservation Progress. Science 323: 43-44.

Table 7.14 Critical Habitat Screening Assessment – Bird and Volant Mammal Species

S/N	Scientific Name	Common Name	Potential Critical Habitat	Species information	CH Rationale
Birds					
1.	*Cutia legalleni*	Vietnamese Cutia	CH2	The species occurs as two races within a small range in south-east Asia. *C. hoae* occurs on the Kon Tum Plateau in the eastern part of south Laos and central Annam in Vietnam, whilst *C. legalleni* is confined to the Da Lat Plateau in South Annam, Vietnam. The extent of occurrence is 98,300 km².	The species does not meet the restricted range for Criterion 2 of <50,000km².
2.	*Emberiza aureola*	Yellow-breasted Bunting	CH1	The species is migratory and winters in a relatively small region in South and South-East Asia, which includes eastern Nepal, north-eastern India, Bangladesh, Myanmar, southern China, Cambodia, Laos, Vietnam and Thailand. The wintering habitat consists of cultivated areas, rice fields and grasslands, preferring scrubby dry-water rice fields for foraging and reed beds for roosting.	The species is potentially critical habitat for Criterion 1, Tier 1 or 2 depending on presence within the Project Area.
3.	*Garrulax vassali*	White-cheeked Laughingthrush	CH2	The species is distributed in Southern Laos and Southern Vietnam and Southern Cambodia. It has an extent of occurrence of 119,000km².	The species does not meet the restricted range for Criterion 2 of <50,000km².
4.	*Gyps tenuirostris*	Slender-billed Vulture	CH1	Unlikely to be present at the Project site as current extent of occurrence is limited to Cambodia and Myanmar in SE Asia.	Not assessed as unlikely to be present.
5.	*Pycnonotus hualon*	Bare-faced Bulbul	CH2	Unlikely to be present at the Project site as current extent of occurrence is limited to Phou Hinpoun and Hin Namno National Protected Areas in Lao PDR.	Not assessed as unlikely to be present.
6.	*Sarcogyps calvus*	Red-headed Vulture	CH1	The population close to the project area is in Cambodia and is restricted to the northern and eastern plains; with a minimum of only 47 individuals in 2010. Vagrants may sometimes stray into Vietnam.	The species is highly unlikely to visit the project area given the distance from the extant population in Cambodia to the Project area. Critical Habitat for Criterion 1 Tiers 1 and 2 would not be triggered.

S/N	Scientific Name	Common Name	Potential Critical Habitat	Species information	CH Rationale
7.	*Stachyris herberti*	Sooty Babbler	CH2	The distribution of the species indicates that it is found in the Central area of Laos and the Annam range in Central Vietnam. The extent of occurrence for the species is 23,700 km^2.	The species is potentially critical habitat for Criterion 2, Tier 1 or 2. Restricted range species that may inhabit the project area, being potentially <50,000km^2.
Bats					
1.	*Hipposideros scutinares*	Shieldnosed Leafnosed Bat	CH2	This species is currently known from a geographically restricted area, on the border between central Lao PDR and the Cha Noi Cave, Phong Nha-Kẻ Bàng National Park in Vietnam. It is likely to have a population size of less than 10,000 individuals.	The current known population of the species in Vietnam is approximately 200km North of the project area. It is unlikely to be present at the Project area.
2.	*Murina beelzebub*	Beelzebub's Tubenosed Bat	CH2	The species is known from the Bac Huong Hoa Nature Reserve in Central Vietnam. It has a restricted range although this has not been defined.	The species is potentially critical habitat for Criterion 2, Tier 1 or 2. Restricted range species that may inhabit the project area, being potentially <50,000km^2.
4.	*Myotis annamiticus*	Annamite Myotis	CH2	This species is documented only from , Quang Binh province, Minh Hoa district, 35 km south Minh Hoa (Qui Dat), Yen Hop valley near Yen Hop; but probably this bat inhabits similar valleys in middle elevation in other parts of Central Viet Nam.	The species is considered as potentially critical habitat for Criterion 2, Tier 1 or 2. Restricted range species that may inhabit the project area. Although the extent of occurrence is unknown, it is likely to be less than 50,000km^2.

Table 7.15 Critical Habitat Screening Assessment – Bac Huong Hoa Nature Reserve (within Project DMU)

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
1.	Plants	*Aquilaria crassna*	Eagle Wood	EN	CR	CH1	The species is a medium-sized evergreen tree growing to a height of 15-20m and a diameter at breast height of 40-50cm. The species is found throughout SE Asia and has become rare due to exploitation for their resinous and fragrant heartwood. The species has been recorded only in Ha Tinh, Tay Nguyen and Phu Quoc in Vietnam.	Potential Critical Habitat for Criterion 1, Tier 2c, being habitat that supports the regular occurrence of a single individual of a CR species.
2.	Plants	*Cinnamomum balansae*	-	VU	EN	CH1	The species is an evergreen tree that can grow up to 45 metres tall. The species is distributed throughout Indo-China, especially Vietnam. The tree is harvested from the wild for its high quality essential oil and timber. Very little habitat remains. The species suffers poor regeneration. Known from H Ty and Ninh Bnh in northern Viet Nam.	The distribution of the species is unclear. It is uncertain whether the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b). The species does appear to be widespread throughout its range so it is unlikely. It is also uncertain as to whether the population is Nationally significant in Vietnam (Criterion 1, Tier 2e). Further assessment is required.
3.	Plants	*Cinnamomum parthenoxylon*	-	CR	DD	CH1	This species is a tall evergreen tree that can eventually grow up to 45 metres. The tree is commonly harvested from the wild as a source of essential oils and flavourings. The species has a wide distribution including: southern China, Indian	Potential Critical Habitat for Criterion 1, Tier 2c, being habitat that supports the regular occurrence of a single individual of a CR species.

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
							subcontinent, Myanmar, Thailand, Cambodia, Laos, Vietnam, Malaysia and Indonesia. In Vietnam, although the species occurs commonly in areas of evergreen rainforest in the north, exploitation of the roots for their commercial essence has caused severe population declines.	
4.	Plants	*Dipterocarpus grandiflorus*	-	VU	EN	CH1	The species is a medium sized to large resinous, evergreen tree growing up to 43 metres tall. The species has a large distribution: Southeast Asia - Myanmar, Thailand, Cambodia, Laos, Vietnam, Malaysia, Indonesia and the Philippines.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
5.	Plants	*Dipterocarpus hasseltii*	-	-	EN	CH1	The species is a tree growing up to 45 metres tall. The species has a large distribution: Vietnam, Thailand, Malaysia, Indonesia, Philippines. Commercially used as a timber source and its primary threat is over harvesting.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
6.	Plants	*Dipterocarpus kerrii*	-	-	EN	CH1	The species is a tree growing up to 45 metres tall. The species has a large distribution: Myanmar, Vietnam, Thailand, Malaysia, Indonesia, Philippines. Commercially used as a	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
							timber source and its primary threat is over harvesting.	unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
7.	Plants	*Erythrophleum fordii*	-	-	EN	CH1	The species is a tree usually growing around 10 metres tall. The distribution of the species is limited to southern China and Vietnam. The tree is intensively logged from the wild and has been reduced to single trees in China. The extent of the remaining population in Vietnam is unknown.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
8.	Plants	*Anoectochilus cetaceus*	-	EN	-	CH1	Listed as native to Java in Indonesia. Potentially misidentified species.	Not assessed
9.	Plants	*Dendrobium amabile*	-	EN	-	CH1	This orchid species is found in Southern China and Vietnam. It is found at elevations above 1200m asl. No further information about the species is readily available.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution of the species is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
10.	Plants	*Asarum balansae*	-	EN	-	CH1	No information available	Further assessment required
11.	Plants	*Madhuca pasquieri*	-	EN	VU	CH1	The species has a wide distribution: South-west Guangdong, southern Guangxi, Malipo and Pingbian in Yunnan and northern provinces of Viet Nam. Populations have been heavily exploited throughout the range.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
								Nationally significant in Vietnam (Criterion 1, Tier 2e).
12.	Mammals	*Pygathrix nemaeus*	Red-shanked Douc Langur	EN	EN	CH1	This species range occurs in central Laos and northern central Vietnam. The species occurs in undisturbed primary and secondary evergreen, semi-evergreen broadleaf forests and limestone forests. There are at least 5 known localities in Vietnam where this species has been found. Main threats to this species are hunting, the international pet trade and habitat loss from conversion to agriculture and plantations.	If the species is present within the DMU, it is likely that the habitat supports a regionally important concentration of the species and hence would constitute critical habitat (Criterion 1, Tier 2e).
13.	Mammals	*Trachypithecus hatinhensis*	Hatinh Langur	EN	EN	CH1; CH2	This species appears to be restricted to limestone areas in parts of Vietnam and Laos. The species is typically found in forested habitats associated with karst/limestone environments. There is no reliable population estimate for this species. Main threats to this species are hunting for the wildlife trade, bushmeat and traditional medicine. The species occupies a range of 19,000 km^2.	Potential Critical Habitat for restricted range species (Criterion 2, Tier 1 or 2). The species meets the restricted range for Criterion 2 of <50,000km^2.
14.	Mammals	*Nomascus leucogenys*	Northern White-cheeked Gibbon	CR	CR	CH1	This species is found in tall primary and heavily degraded evergreen and semi-evergreen forest. In north eastern Viet Nam and northern Lao PDR. In Viet Nam, it occurs west and south of the Black River; it has been extirpated from several areas from	Potential Critical Habitat for Criterion 1, Tier 2c, Habitat that supports the regular occurrence of a single individual of a CR species. The species meets the restricted range for Criterion 2 of <50,000km^2.

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
							which it was previously recorded and is now only known from a few localities in the north-west and north-central parts. In Viet Nam, the forest habitat for this species is particularly fragmented. The species has suffered from deforestation through agricultural encroachment into mountainous areas and fuel-wood and timber extraction.	
15.	Mammals	*Nesolagus timminsi*	Annamite Striped Rabbit	EN	DD	CH1	The species occurs in the northern Annamites, almost certainly in the central Annamites in Vietnam and Lao PDR. This species occurs in wet evergreen forests that experience little or no dry season and generally occur on the seaward facing slopes of the Annamite mountains. Records suggest that it is still well distributed in suitable habitats however is becoming rare across some parts of its range. Threats include hunting, poaching and habitat destruction.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
16.	Mammals	*Manis javanica*	Sunda Pangolin	CR	NT	CH1	The species is rare in central and southern Vietnam. The species exhibits habitat plasticity and can be found in primary and secondary forests, plantations, gardens and near human settlements. Main threats to this species are overexploitation for the international wildlife trade. There	Potential Critical Habitat for Criterion 1, Tier 2c, being habitat that supports the regular occurrence of a single individual of a CR species.

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
							is a very large hunting pressure in Vietnam on this species.	
17.	Mammals	*Neofelis nebulosa*	Clouded Leopard	EN	VU	CH1	The species is found from the Himalayan foothills in Nepal through mainland Southeast Asia into China. The species is most strongly associated with primary tropical forest which is rapidly disappearing across its range.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
18.	Mammals	*Panthera pardus delacouri*	Leopard	CR		CH1	The species is distributed in Southeast Asia, where small populations remain only in Myanmar, Thailand, Malaysia, Cambodia, and southern China. It has been recorded as extinct in Vietnam.	Not assessed as considered extinct in Vietnam.
19.	Mammals	*Arctictis binturong*	Binturong	EN	VU	CH1	The species is widespread in South and South-east Asia occurring from eastern Nepal, Bangladesh, north-east India and southern China through mainland and island South-east Asia, south-east to Java.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
20.	Mammals	*Cuon alpinus*	Dhole	EN	EN	CH1	There are few recent confirmed records of Dholes in Vietnam. The last confirmed records were in Pu Mat National Park in 1998-99 and Yok Don National Park in 2003. It is believed that the Dhole is likely	Not assessed as considered extinct in Vietnam.

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
							extirpated from Vietnam although individuals may occasionally enter from Cambodia or Lao.	
21.	Mammals	*Muntiacus vuquangensis*	Large-antlered Muntjac	VU	CR	CH1	The species occurs in Cambodia, Laos and Vietnam. Evidence for its presence comes mostly from the Annamite Mountain range. The species does not generally live above 900 m asl. The species faces substantial population losses from very high hunting pressure. Key threats are hunting for bushmeat and antlers, habitat loss and degradation.	Potential Critical Habitat for Criterion 1, Tier 2c, Habitat that supports the regular occurrence of a single individual of a CR species.
22.	Mammals	*Helarctos malayanus*	Sun Bear	EN	DD	CH1	The species occurs patchily through their range (across much of Southeast Asia, from Borneo and Sumatra north to at least Yunnan Province, China). Sun Bears are a forest-dependent species, favouring interior mature and/or primary forest. Threats include habitat destruction and poaching for use of bear parts in medicine.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
23.	Mammals	*Ursus thibetanus*	Asian Black Bear	EN	VU	CH1	The species distribution includes Assam in India, Laos, Myanmar (Burma) Nepal, Thailand (north of the Kra Isthmus) and central Vietnam. The species prefers mountain and hill forested areas of range up to around 3,000 metres. Threats include habitat destruction and poaching for use of bear parts in medicine.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
24.	Mammals	*Pseudoryx nghetinhensis*	Saola	EN	CR	CH1; CH2	This species is suspected to occur in less than 10, potentially non-contiguous forest blocks within Laos and Vietnam, with a restricted range of 10,000 km². The total Saola population is believed to be less than 750. The species is highly associated with wet evergreen forest (little to no dry season). This habitat type occupies a restricted geographic range mainly on the eastern Vietnamese slopes of the Annamite Mountains.	Potential Critical Habitat for Criterion 1, Tier 2c, Habitat that supports the regular occurrence of a single individual of a CR species. Potential Critical Habitat for restricted range species (Criterion 2, Tier 1 or 2). The species meets the restricted range for Criterion 2 of <50,000km².
25.	Mammals	*Capricornis milneedwardsii maritimus*	Chinese Serow	EN	EN	CH1	The species is native to Cambodia, Laos, Myanmar, Thailand and Viet Nam. Populations in the northern highlands of Vietnam are likely to be heavily depleted in number and fragmented, but are likely more numerous along the Annamite mountains. The species occurs in rugged limestone mountains and cliffs. In Vietnam, it is usually found above 1500m in steep montane scrub, evergreen hill forests, and grassland slopes.	If the species is present within the DMU, it is likely that the habitat supports a regionally important concentration of the species and hence would constitute critical habitat (Criterion 1, Tier 2e).
26.	Birds	*Lophura edwardsi*	Edwards's Pheasant	EN	EN	CH1; CH2	The species occurs over 18,000 km² and has been recorded from 6 to 10 locations in central Vietnam. Populations appear very small, fragmented and are suspected to be declining. It inhabits damp mountain	Potential Critical Habitat for restricted range species (Criterion 2, Tier 1 or 2). The species meets the restricted range for Criterion 2 of <50,000km².

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
							forests up to an estimated 600 m, favouring thick underbrush and lianas. The population is only estimated at 50 - 249 mature individuals.	
27.	Herp	*Varanus salvator*	Water monitor	EN	LC	CH1	This species has a wide distribution, can be found in various habitats, and adapts to habitats disturbed by humans. It is also abundant in parts of its range, despite large levels of harvesting. Populations in Vietnam have suffered from over exploitation.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
28.	Herp	*Python molurus*	Burmese Python	CR	NT	CH1	The species is widely distributed species found throughout Southeast Asia, with evidence of extensive and widespread population declines. This species has declined across its native range through harvesting for the skin, traditional medicine and pet trade.	Potential Critical Habitat for Criterion 1, Tier 2c, Habitat that supports the regular occurrence of a single individual of a CR species.
29.	Herp	*Pytas mucosus*	Common Rat Snake	EN	LC	CH1	The species is common in parts of South and Southeast Asia and is widely distributed.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
30.	Herp	*Bungarus fasciatus*	Banded Krait	EN	LC	CH1	The species occurs from India north of 17^{o} latitude across southern China to Vietnam, and southward to	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
							Sundaland. The species is traded for medicinal purposes in Vietnam, including consumption in snake wine.	(Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
31.	Herp	*Naja naja*	Indochinese Cobra	EN	LC	CH1	The species is found in Southeast Asia, including Thailand, Cambodia, Vietnam, and Laos. It is targeted in Vietnam for medicine.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is also widespread so it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).
32.	Herp	*Ophiophagus hannah*	King Cobra	CR	VU	CH1	This species has a wide distribution range, however, it is not common in any area in which it occurs. This species is found in a variety of habitats, primarily in pristine forests, but it can also be found in degraded forest, mangrove swamps and even agricultural areas	Potential Critical Habitat for Criterion 1, Tier 2c, being habitat that supports the regular occurrence of a single individual of a CR species.
33.	Herp	*Cuora galbinifrons*	Indochinese Box Turtle	EN	CR	CH1	The species occurs in Hainan and Guangxi in PR China, in north eastern Lao PDR, and in northern Viet Nam at least as far south as Nghe An province. The species has been subject to intensive exploitation primarily for consumption and secondarily for the pet and aquaculture trades.	Potential Critical Habitat for Criterion 1, Tier 2c, being habitat that supports the regular occurrence of a single individual of a CR species.

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Potential Critical Habitat	Species information	CH Rationale
34.	Herp	*Cuora trifasciata*	Chinese three-striped Box Turtle	CR	CR	CH1	The species occurs in China; Lao PDR and Viet Nam. The species has been subject to intensive exploitation primarily for consumption and secondarily for the pet and aquaculture trades.	Potential Critical Habitat for Criterion 1, Tier 2c, being habitat that supports the regular occurrence of a single individual of a CR species.
35.	Herp	*Pyxhidea mohotti*	Keeled Box Turtle		EN	CH1	No information available	Further assessment required
36.	Herp	*Sacalia quadriocellata*	Four-eyed Turtle		EN	CH1	There are modest to small populations in Lao and Viet Nam, where it is not under great threat, but the main population in China is certainly Endangered. The species has been subject to intensive exploitation primarily for consumption and secondarily for the pet and aquaculture trades.	It is unlikely that the population within the DMU would constitute 1 of 10 DMUs for the species (Criterion 1, Tier 1b) given its large distribution. Distribution in Vietnam is unknown however it is unlikely that the population is Nationally significant in Vietnam (Criterion 1, Tier 2e).

Notes:

CR : Critically Endangered; EN : Endangered; VU : Vulnerable; NT: Near Threatened; DD : Data Deficient; NA : Not Assessed; LC: Least Concern

Herp. : Herpetofauna

Critical Habitat Candidate Species (Criteria 3)

ERM has not completed the assessment for critical habitat for migratory birds at this stage. The ERM screening assessment identified 98 species of migratory birds that may trigger Critical Habitat.

It is considered that habitat present within the DMU is unlikely to support >95% (Tier 1) or ≥ 1 % but < 95 % (Tier 2) of the global population of migratory species (Criterion 3) given the small extent of the Project area. Critical Habitat is unlikely to be triggered by migratory species. Further assessment will be undertaken once surveys for bird species have been completed (scheduled for March and August 2018).

Threatened and/or Unique Ecosystems (Criterion 4)

Highly threatened and unique ecosystems as defined by the IFC are those that are a) under significant threat; b) small in size; and/or c) have unique species assemblages. An assessment of the presence of habitats within the Project DMU which meet these criteria and relevant discussions are provided below.

Ecosystems at Risk of Significantly Decreasing In Area or Quality

The FAO had reported Vietnam as possessing 14.3 million ha of natural forests in 1943 (43% of the total land area). From 1980 to 1990, the report observed that Vietnam had lost an average of 100,000 ha of forests per year[15]. Forest quality had also decreased, with a rapid increase in areas of poor and regenerating forest. Tree cover loss has continued to progress steadily since 2001, approaching 1,775,945 ha lost in 2015[16]. This trend has seen a reversal since 1995 with the implementation of forest rehabilitation and plantation programs. In 2015, World Bank data shows that percentage of forested area in Vietnam is approximately 48%. However there is no indication if these forests are plantations or regenerated natural stands of habitat.

In order to inform if the evergreen forest ecosystem type at the Project DMU qualifies as Critical Habitat under Criterion 4, its risk status was defined based on guidelines surrounding the development of an Ecosystems Red List under

[15] Vietnam Forestry Outlook Study (2009) Forest Science Institute of Vietnam. Asia Pacfic Forestry Sector Outlook Study II. Working Paper Series. Working Paper no. APFSOS II/WP/2009/09. Retrieved from http://www.fao.org/docrep/014/am254e/am254e00.pdf

[16] Global Forest Watch (2016) Vietnam Country Data. Retrieved from http://www.globalforestwatch.org/country/VNM

the IUCN [17,18]. The assessment was undertaken in the context of the DMU and relies largely on Global Forest Watch data.

Based on the information above, habitats in the DMU are not decreasingly rapidly in area. However it must be noted that any decline in tree cover is likely to be localised and occurring in unprotected areas around human settlement. The rapid biodiversity survey had observed that majority of vegetation around the project area was in a highly degraded state, with several converted to plantation forests/agricultural use, and logged.

Hence, forest ecosystems at the DMU do not qualify as Critical Habitat under Criterion 4.

Ecosystems with a Small Spatial Extent

The key ecosystems within the Project DMU comprise the lowland evergreen forest and montane forest ecosystems. These ecosystems are likely to be the most intact within Bach Ma National Park, which in turn can be used to represent the smallest minimum extent of evergreen forest ecosystems within the Project DMU. These ecosystems are likely to be found throughout the Northern Vietnam Lowland Rainforest ecoregion and the Northern Annamites Rainforest ecoregion.

The Northern Vietnam Lowland Rainforest ecoregion comprises nine (9) Protected Areas covering 90,000 ha, approximately 4% of the 2,250,000 ha of the ecoregion. The Northern Annamites Rainforest ecoregion 4,700,000 ha also contains 9 Protected Areas covering 1,260,000 ha (26%) of the ecoregion. The total size of protected lowland evergreen and montane evergreen forests stands at 1,350,000 ha.

These ecosystems are not considered to have a small spatial extent and hence it habitats in the Project DMU are unlikely to trigger Critical Habitat under this Criterion.

Ecosystems Containing Unique Assemblages of Species Including Assemblages or Concentrations of Biome-Restricted Species

Based on expert opinion and review of available data there is no evidence to support the DMU as having unique assemblage of species. Insufficient evidence currently exists to evaluate the Project area as containing a unique assemblage of species or biome restricted species. The species present are representative of the species that are normally associated with this habitat type

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[17] IUCN (2016) An introduction to the IUCN Red List of Ecosystems: The categories and criteria for assessing risks to ecosystems. Gland, Switzerland: IUCN. Vi + 14 pp.

[18] Bland LC, Keith DA, Miller RM, Murray NJ and Rodriguez JP (ed) (2016) Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria. Version 1.0 Gland, Switzerland: IUCN. Ix + 94 pp.

in SE Asia. Therefore, the ecosystems within the DMU are not evaluated as Critical Habitat under this Criterion.

Criterion 5) Key Evolutionary Process

Criterion 5 recognises the attributes of a region that can influence evolutionary processes and give rise to regional configuration of species and ecological properties. Examples can include isolated areas where populations are phylogenetically distinct, areas of high endemism, environment gradients or ecotones and biological corridors.

Based on expert opinion, the biodiversity values are widely spread and do not exhibit characteristics that represent phylogenetically distinct species or gradients.

8.1 NATURAL HABITAT AND MODIFIED HABITAT ASSESSMENT

IFC PS6 requires that an assessment be made of the extent of modified and/or natural habitat (as per *IFC PS 6 paragraphs 11* and *13*) within the Project area.

To identify and map Natural and Modified Habitats, ERM has used the IFC PS6 Guidance Note to define the habitat types within the Project Area and Area of Interest. For the purposes of this study the definitions provided by the IFC (2012a) are used as outlined below.

"Modified habitats are areas that may contain a 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 components."

"Natural habitats are 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 functions and species composition."

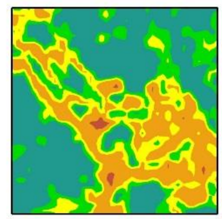
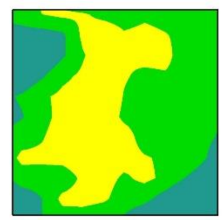
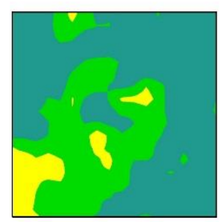
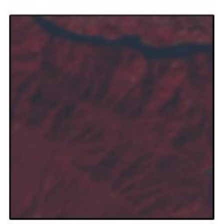
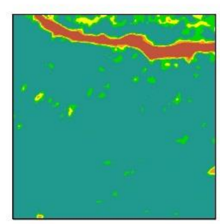
8.1.1 Vegetation Classification

Remote sensing was undertaken of the project area to determine the area of Natural Habitat and Modified Habitat. The assessment determined vegetation density based on the Normalised Differential Vegetation Index (NDVI) of November 2017 LandSat 8 data for the Project area and DMU. A portion of the DMU was not available as the north western portion was covered with cloud.

A supervised classification of the imagery was undertaken to identify areas of high, medium and low density. Based on this classification, the areas of high, medium and low vegetation class was able to be derived. Shadows were corrected based on the adjacent vegetation cover. *Table 7.16* outlines the characteristics of the satellite imagery in relation to the remote sensing assessment for each vegetation class. The results of the assessment are shown in Figure 7.4 for the Project Area and DMU and *Figure 7.5* for the Project Area.

Field verification of the Project area in December 2017 indicated that the project area consists mainly of Modified Habitats. The project site consists of agricultural land, bare ground and infrastructure.

Table 7.16 Classification Assessment of Vegetation Types

Vegetation Class	Satellite Image	Infrared Image	Classified Image
Non Vegetation			
Low Density Vegetation			
Medium Density Vegetation			
High Density Vegetation			

8.1.2 *Natural Habitat and Modified Habitat Classification*

Based on the classification of vegetation density and distribution, the density of vegetation was used to classify whether the site was considered to be "natural" or modified".

High density vegetation is considered to be likely primary or secondary forest. The vegetation class exhibits a diversity of canopy sizes and has a NDVI that corresponds to dense growing vegetation. High density vegetation is therefore likely to be Natural habitat.

Medium density vegetation is considered to be regrowth forest, agriculture (such as plantations) or scrub vegetation. The vegetation class type exhibits a less dense NDVI and corresponds to smaller canopy sizes. Medium density vegetation is therefore likely to be Modified habitat.

Low density vegetation is considered to be cleared land, rice paddies, agricultural fields, urban areas or roads. The vegetation class type represents a low NDVI and corresponds to bare ground. Low density vegetation is considered to be Modified Habitat.

Table 7.17 outlines the area of Natural Habitat and Modified Habitat within the Footprint, Project area and DMU.

Table 7.17 Area of Natural Habitat and Modified Habitat within the Project Area and DMU

Habitat Type	**Footprint**	**Footprint %**	**Project Area**	**Project Area %**	**DMU**	**DMU %**
Natural Habitat	0.5	1.1%	416.9	29.4%	43,506.8	88.5%
Modified Habitat	43.1	98.9%	1001.4	70.6%	5649.5	11.5%
Total	43.6	100%	1418.3	100%	49,156.3	100%

Figure 7.4 Results of NDVI Assessment of Project Area and DMU

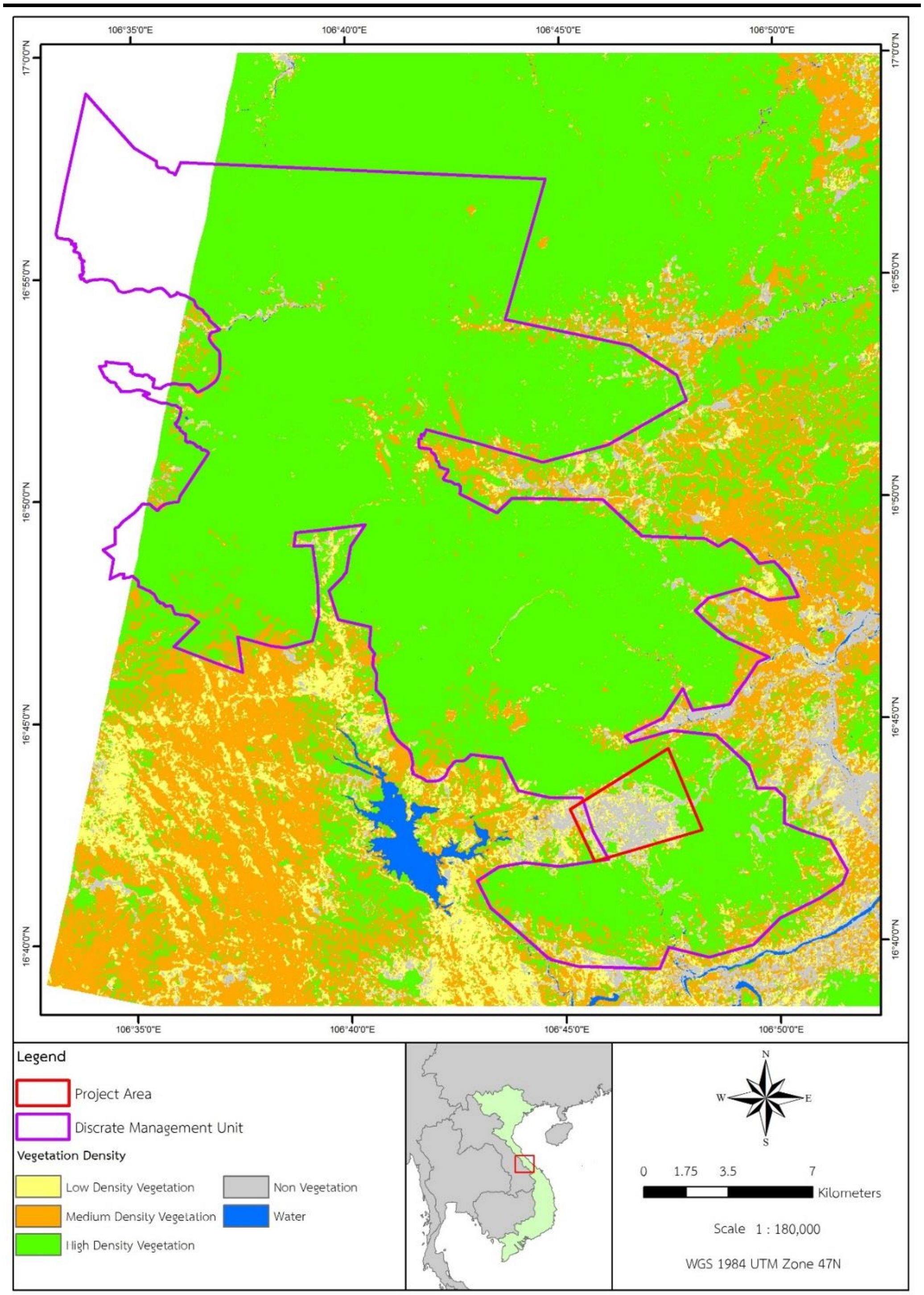
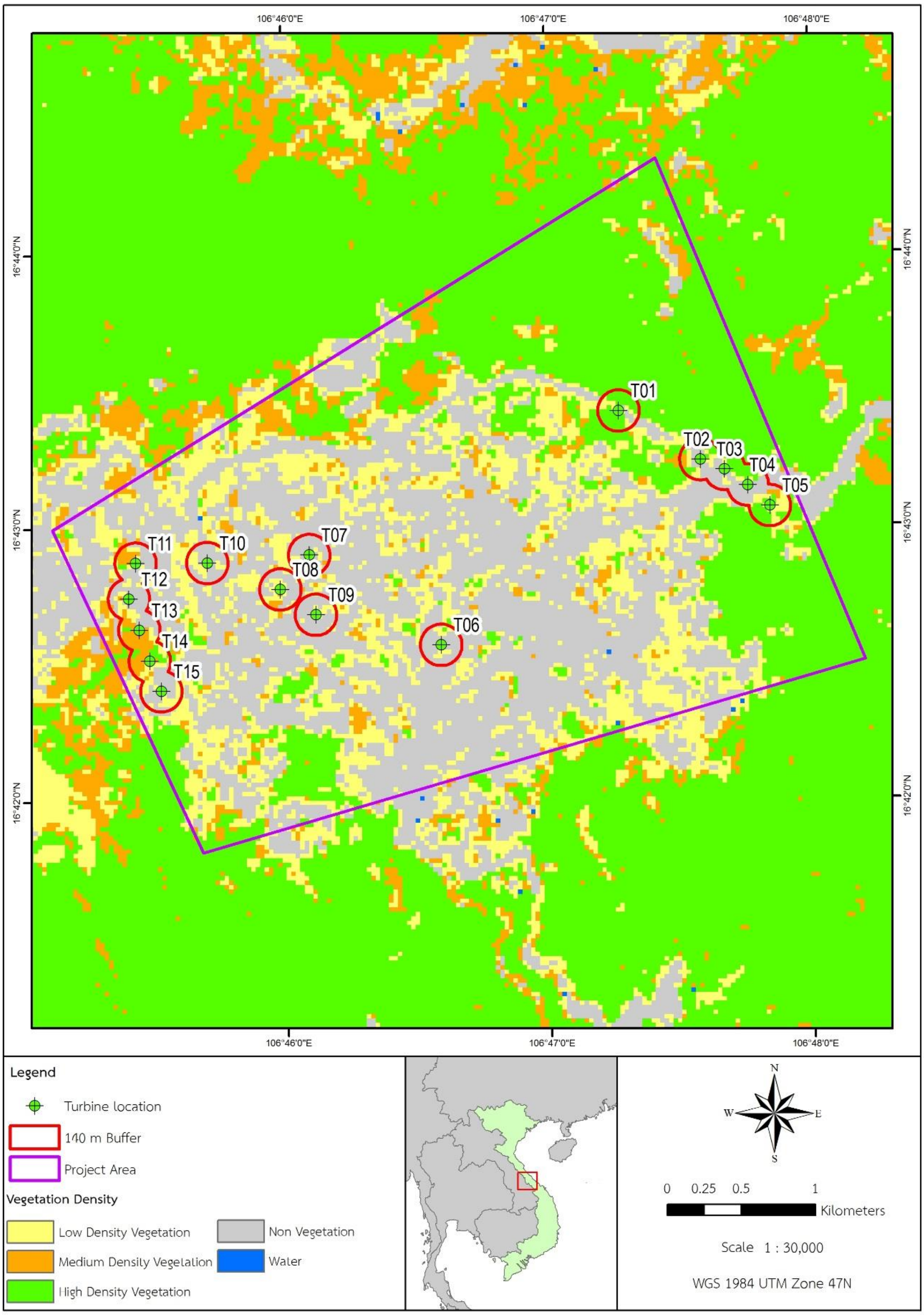


Figure 7.5 Results of NDVI Assessment for Project Area



8.2 *HYDROLOGY AND DRAINAGE*

The project area consists of a system of numerous small streams. No major creeks or river systems are located within the Project Area. This system provides water to Khe Nghi river and finally joins the Ba Long river which are 2km downstream from the confluence of Dakrong river and Rao Quan river. Water from Khe Nghi is mainly used for agriculture such as wet rice cultivation.

The Dakrong river and Rao Quan river are the two main freshwater sources in Huong Linh and Dakrong district. Dakrong river rises at Truong Son mountain at the south of Dakrong district, has 85km length, and Rao Quan river has its source at Rao Quan lake and flows in a northwest – southwest direction. Both rivers show steep gradient or slope characteristics, which are considered as suitable for hydropower.

8.3 *GROUNDWATER*

One surface sample named NM was taken on 13 August, 2015 for the local EIA at a well belonging to household of Mr. Ho Pa Buan, Cooc village, Huong Linh commune. This sample was analysed for 11 parameters in accordance with*QCVN 09:2008/BTNMT- National technical regulation on ground water quality*. As shown in the below table, none of analysed parameters exceed the thresholds.

Table 7.18 Analysis results for groundwater

No	Parameter	Unit	Result of Sample NM	QCVN 09:2008/BTNMT
1	pH	mg/l	6.23	5.5-8.5
2	Total hardness	mg$CaCO_3$/l	38.8	500
3	TS	mg/l	139	1,500
4	N-NH_4^+	mg/l	Not detected	0.1
5	N-NO_3^-	mg/l	1.40	15
6	SO_4^-	mg/l	21.5	400
7	Fe	mg/l	0.04	5
8	Ecoli	MPN/100ml	Not detected	-
11	Coliform	MPN/100ml	Not detected	2

8.4 *SURFACE WATER*

One surface sample was taken on 13 August, 2015 at a location upstream of the Khe Nghi river, approximately 1,5 km of the project area. This sample was analysed for 11 parameters according to *QCVN 08:2008/BTNMT- National technical regulation on surface water quality*. As shown in the laboratory results at Table 7.19, all the parameters meet the criteria for irrigation drainage purpose, and water sampled also meets the standards for domestic purpose. The water body is generally clean and has no evidence pollution at the time of sampling.

Table 7.19 Analysis results for surface water

No	Parameter	Unit	Result of Sample NM	A1 (*)	A2(*)	B1(*)	B2(*)
1	pH	mg/l	6.57	6-8.5	6-8.5	5.5-9	5.5-9
2	DO	mg/l	6.03	>=6	>=5	>=4	>=2
3	TSS	mg/l	8.6	20	30	50	100
4	BOD_5	mg/l	2.5	4	6	15	25
5	COD	mg/l	5.3	10	15	30	50
6	Cl^-	mg/l	5.65	250	400	600	-
7	$N\text{-}NH_4^+$	mg/l	Not detected	0.1	0.2	0.5	1
8	$N\text{-}NO_3^-$	mg/l	0.09	2	5	10	15
9	$P\text{-}PO_4^-$	mg/l	0.05	0.1	0.2	0.3	0.5
10	Fe	mg/l	0.86	0.5	1	1.5	2
11	Coliform	MPN/100ml	93	2,500	5,00	7,500	10,000

(*) Reference values stated in *QCVN 08:2008/BTNMT- National technical regulation on surface water quality,* for various using purposes: A1-able to use for domestic purpose, A2-treatment needed before using for domestic purpose, B1- able to use for irrigation drainage purpose, B2-low quality, waterway transport purpose only.

9 SOCIO- ECONOMIC BASELINE

9.1 INTRODUCTION

The following sections present the description of social conditions within the Project area. Some of the information presented in this study has been obtained from the social baseline survey and field observations by the ESIA team in the Project affected communities of Cooc village, Miet village and Hoong village, Huong Linh commune, Huong Hoa district, during the social survey and engagement conducted on 24-26th January 2018. The findings presented in this chapter will be used as a baseline to assess the potential impacts of the Project on social aspects and also identify and propose appropriate management and mitigation measures.

9.2 OBJECTIVES

The objectives of the socio-economic survey are to:

- Gain an understanding of the baseline socio-economic conditions of the Project area;
- Obtain perceptions and concerns of affected communities regarding the project development;
- Provide a basis for social impact assessment for the ESIA; and
- Develop a detailed Stakeholder Engagement chapter, as provided within this ESIA documentation, taking into account the concerns and suggestions of local people collected in the socio-economic survey.

9.3 SCOPE OF BASELINE STUDY

Within the scope of the baseline for the ESIA report, it was proposed and agreed with the Project before the survey that the engagement plan should focus on the directly affected villages only (i.e. Cooc village, Miet village and Hoong village). Local authority engagement, Key Informant Interviews, Focus Group Discussion and Household Interviews were selected as the engagement tools for collection of baseline data and information for informing this chapter. Data presented in this chapter includes:

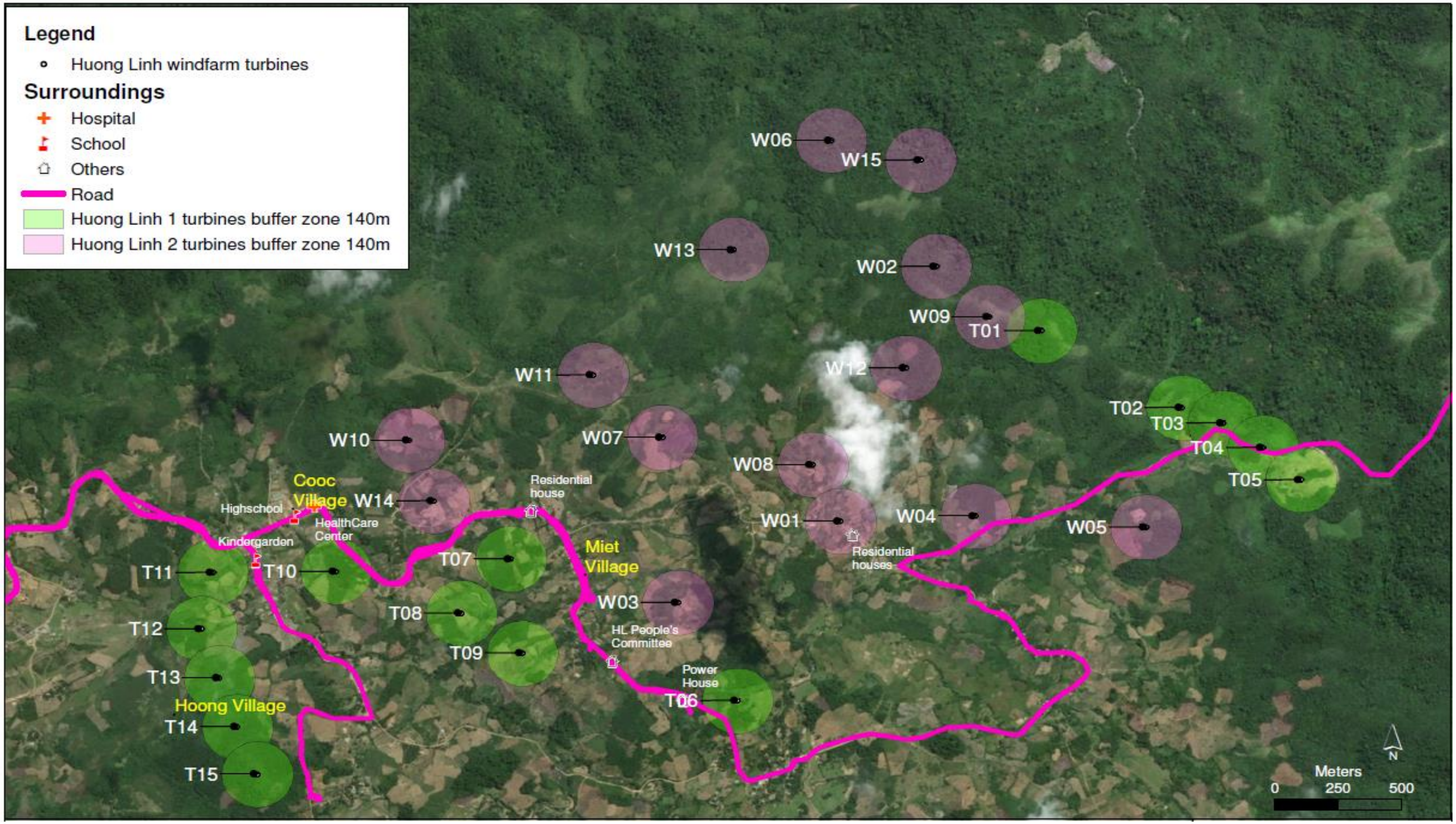
- demographic conditions;
- economics and livelihoods;
- community health;
- social and cultural institutional arrangements; and

- community perceptions.

Figure 9.1 below shows the general village positions and the Project facility locations. Approach and methodology for data collection is discussed in the following section.

Secondary data were gathered from the project and government's (provincial, district and commune) reports and documents, brochures, related published statistical data, and relevant governmental decisions and planning. Analysis of newspaper articles and research reports was also conducted.

Figure 9.1 The surveyed location



Source: ERM, 2018

9.4 *METHODOLOGY AND APPROACH*

9.4.1 ***Data Collection***

The socio-economic baseline work has been conducted in such a manner that ensures data can be gathered at both regional and local levels, which is sufficiently detailed to detect significant changes in the initially assessed baseline levels, and the perceptions of stakeholders towards the Project attained. The methodology is discussed in terms of (A) Consultation with local authorities and secondary socio-economic data collection; and (B) Primary socio-economic baseline data collection.

A. Consultation with local authorities and secondary socio-economic data collection

A consultation with local authority was conducted with the Chairman of People's Committee of Huong Linh commune on 25th January 2018, see the Annex D(1) of the meeting minutes. Through this consultation ERM collected the current information on the socio-economic conditions of the area (i.e. through published socio-economic reports in 2016 and 2017), conditions of public infrastructure and key concerns/perceptions of the local authority about the Project development. In addition, the authority shared their experience regarding community development and Huong Linh 2 Wind Power Project and provided suggestions to the Project.

Secondary socio-economic data was also conducted for Huong Hoa district and Quang Tri province. At the provincial level, information about Quang Tri province was collected from secondary data from the internet, governmental documents and provincial statistical sources. In addition, the People Committee of Huong Hoa District and People Committee of Huong Linh commune provided hard copies of socio-economic reports of 2017 at the district and commune levels.

B. Primary Socio-Economic Baseline Data Collection

During the site visit from the 24th to 26th January 2018, ERM and sub-contractors conducted a total of 24 household interviews in the three directly affected villages, including 10 households in the Cooc Village, 10 households in the Miet Village and four households in Hoong Village. It is noted that the interviewed households of each village included both the directly affected households (i.e. households having land acquired by the Project) and randomly chosen households in the villages and most of the surveyed households (91.6% or 22 out of 24 households) were Van Kieu Indigenous People.

Furthermore, three Key Informant Interviews (KIIs) with village heads and one Focus Group Discussions (FGD) with affected Van Kieu Indigenous People in Cooc, Miet and Hoong villages. The surveyed area is illustrated in *Figure 9.1*

It is noted that the purpose of this consultation focused on understanding the current socio-economic conditions and concerns/problems of the affected people, especially those are economically displaced by the land acquisition of the Huong Linh 1 Wind Power Project.

<u>Key Informant Interviews (KIIs) with Village Heads</u>

The KIIs were conducted with three village heads that are knowledgeable about the current conditions of the communities to obtain the socio-economic data of the commune and villages. (See *Annex D* for the Templates for KIIs). The interviews were organized in the form of semi-structured interviews with open questions and discussion. The interviews were held individually and qualitative information on perceptions and concerns about the Project activities, especially the positive and negative impacts were collected. The feedbacks of the interviewees will also be considered for the social impact assessment of the Project.

Table 9.1 Attendant List of the KII

No	Full Name of the Attendants	Position/Job	Organisation
Cooc Village (24th Jan 2018)			
1	Ho Van Truong	Village Head	Cooc Village
Miet Village (25th Jan 2018)			
2	Le Xuan Son	Village Head	Miet Village
Hoong Village (26th Jan 2018)			
3	Ho Xuan Van	*Village Head*	*Hoong Village*

Figure 9.2 KII with the Head of Miet Village

Note: This is just a representative photo; photos of KIIs are provided in ***Annex E-Photo log***

<u>Focus group discussions</u>

ERM completed one FGD of the affected Van Kieu Indigenous People (Van Kieu ethic group) at Hoong village. The FGD covered a diversity of participants including elder, youth, male and female representatives. Moreover, the participants all belong to the Van Kieu Indigenous People. Through conducting the FGD, ERM has obtained an understanding of the current socio-economic conditions of the Van Kieu People, their livelihoods, custom, culture and their dependence on the natural resources as well as their accessibility to public services and opinions or concerns about the project.

The FGD questions is provided in *Annex F* while the list of interviewers in the socal baseline survey is provided at *Annex G.*

Figure 9.3 A Focus Group Discussion with Vulnerable Groups at Hoong Village

Household interviews

The questionnaire of the household interview was designed to collect the following data and information:

- Family status and demographics;
- Vulnerable status (i.e. who by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage, or social status that may be more adversely affected by the Project development);
- Livelihoods and employment (i.e. their livelihoods/employment before and after the land acquisition);
- Household income and expenditure.
- Housing and land (i.e. land use and land tenure)
- Education background (i.e. education level of members in the surveyed households);
- Health status and health care practice;
- Access to and availability to public facilities (i.e. electricity, water supply, etc.);
- Awareness on the development of the Project and its engagement activities; and

- Concerns on/recognition of impacts of other projects surrounding their area.

The interviewed members were adults and one of senior persons of the household (i.e. husband/wife/oldest brother/sister).

The number of households of each village involved in the interview is provided in *Table 9.2*. The final Household questionnaire as agreed and approved by the Project and the list of the interviewed households are provided in *Annex H* and *Annex G*, respectively.

Table 9.2 Number of Households Involved in the Interview of ERM

Cooc Village	Miet Village	Hoong Village	Total
10	10	4	24

9.4.2 Data Analysis

The data collected via the paper-based questionnaires were coded and entered into Microsoft Excel worksheets for analyses. Before the analysis process, however, multiple cleaning processes were conducted to further identify potential errors. Some of the answers were cross-checked to make sure the data was consistent. The final databases for the surveys then were analysed for the different frequency and percentage tables.

9.4.3 Field Observation

Field observations were carried out during the ERM survey, at the village and commune level covering the following aspects:

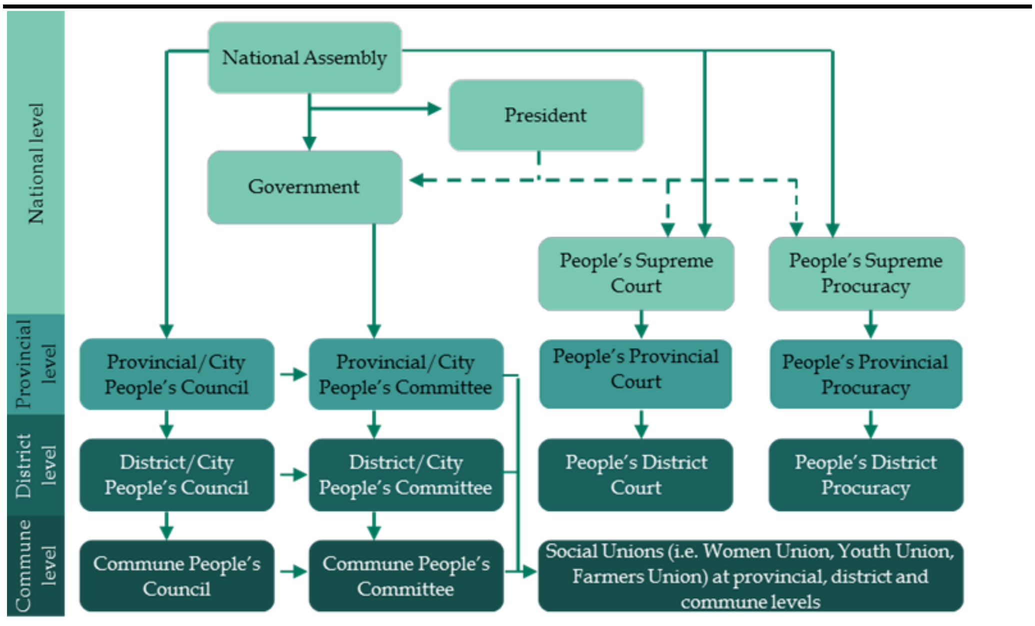
- Health facilities;
- Education facilities;
- Religion facilities;
- Community security system;
- Commune and Village government facilities;
- Public transportation services and infrastructures;
- Community daily activities; and
- Community use of natural resources and livelihood.

9.5 SOCIO-ECONOMIC BASELINE AT REGIONAL LEVEL

9.5.1 Overview of Administrative System of Vietnam

The state system of governance of Vietnam has four levels: national, provincial, district and commune as illustrated in *Figure 9.4*.

Figure 9.4 *The State System of Vietnam*



Within the scope of this ESIA, the organization of the institutional governance from provincial/city level to commune level will also be taken into account. These consist of:

- The People's Council at provincial, district and commune levels; a body of state power at the local level, representing the rights of the people and is elected by the local people; and
- The People's Committee at provincial, district and commune levels; the executive body of the People's Councils and State administrative agencies at the local level. The People's Committee at the provincial/city and district level includes departments for different fields such as agriculture and rural development, natural resources and environment, and transport etc.

The number of staff for each part may vary from commune to commune depending on the size and area of the commune.

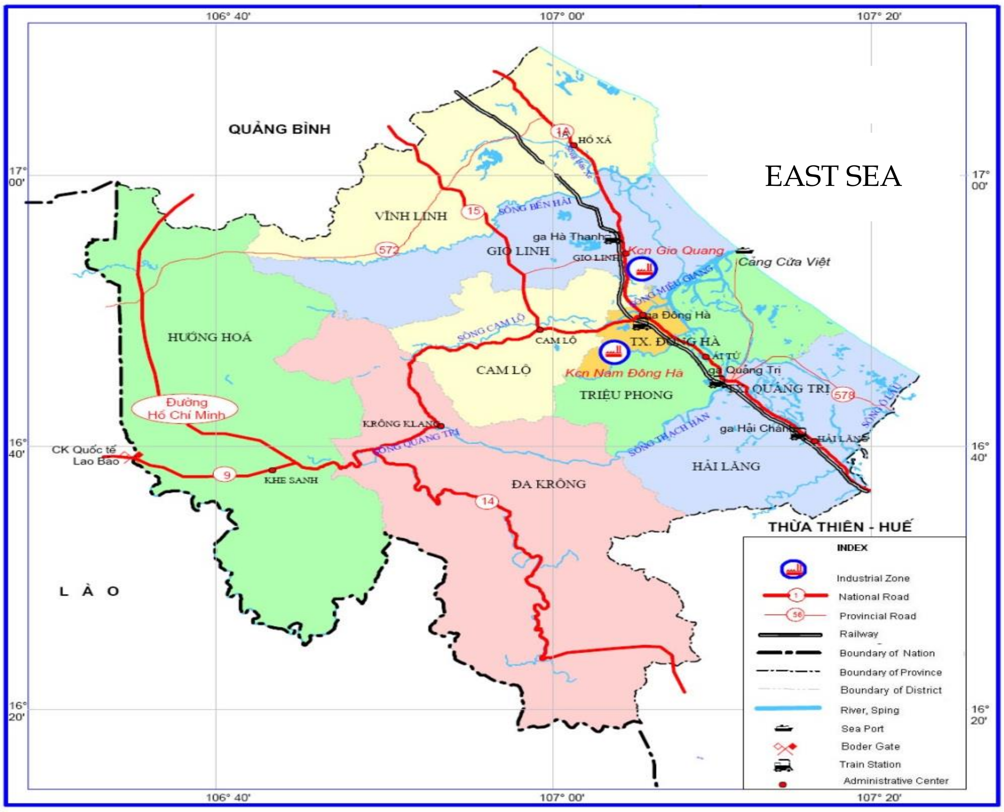
9.5.2 *Quang Tri Province*

Quang Tri, a coastal province of the Central Vietnam, is surrounded by:

- Le Thuy district, Quang Binh province to the North;
- Phong Dien and A Luoi districts, Thua Thien Hue province to the South;
- Savanakhet and Salavan, Laos to the West; and
- East Sea to the East.

The topography of Quang Tri province includes varied landscapes including mountains, hills, lowland, sand-dunes, coastal regions and islands. Quang Tri province has an area of 4.737 km^2, 10 administrative units including Dong Ha City, Quang Tri Town, and 08 districts of Vinh Linh, Gio Linh, Trieu Phong, Cam Lo, Hai Lang, Dakrong, Huong Hoa and Con Co island district. Dong Ha city is the political, economic, and cultural center of the province.

Figure 9.5 ***Map of Quang Tri Province***

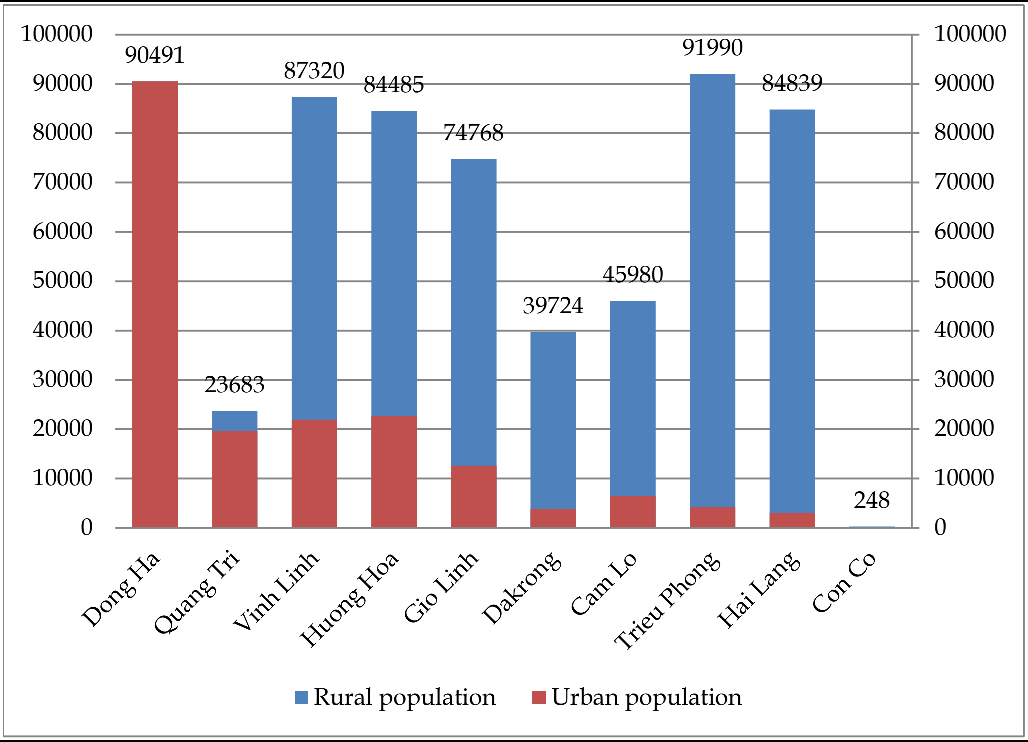


Source: Retrieved www.investinvietnam.vn, Feb 2018

Regarding land use data in 2014 (i.e. according to the Quang Tri Statistical Office 2017), agricultural land area is 387,286 ha, accounting for 81.75% of the total area of natural land. Unused land of the province is 46,096 ha, accounting for 9.73% (8.2% is unused mountainous land and 1.44% is unused flat land).

According to Quang Tri Statistical Office (2017), the whole province has a population of 623,528 people and population density of 132 persons/km^2. The highest population density is in Dong Ha (1,238 persons/km^2), 32 persons/km^2 in Dakrong (lowest) and 72 persons/km^2 in Huong Hoa (second lowest)). The female proportion accounts for 50.92% of the total population, and rural residents are 438,664 people, accounting for 70.35%. More than 95% of the district's population live in rural areas whereas in Huong Hoa district, 83.1% of the population are rural residents (see *Figure 9.6*). The natural increase rate of the population is 11.1‰ (i.e. 14.41‰ for urban areas and 10.76‰ for rural areas) and the total fertility rate is 2.81 (i.e. 2.78 for urban areas and 2.82 for rural areas).

Figure 9.6 Provincial population by district and by residence



Source: ERM created the figure based on Quang Tri Statistical Office, 2017

It is estimated in the Quang Tri Province's 2017 Socio-Economic Development Report by Quang Tri Province People's Committee dated 20th November 2017, that the province's gross regional domestic product (GRDP) in 2017 (at constant 2010 prices) reached 17,585.27 billion VND, making a growth of 7% compared with year 2016 (16,408.046 billion VND). The key sectors are agriculture, forestry and fishery increased by 2.5% (3,584.15 billion VND), industry and construction by 11% (4,314.32 billion VND), and services by 8% (8,825.74 billion VND). The province's GRDP per capita rose from 1,567 USD (33,993 thousand VND) in 2015 to 1,660 USD (36,395 thousand VND) in 2016 (Quang Tri Statistical Office 2017) and up to 38,000 thousand VND in 2017 (Provincial Socio-economic Development Report 2017), which is below the GDP per capital of the whole country (2,214.4 USD in 2016)[1].

Quang Tri has three main ethnic groups: Kinh, Van Kieu, and Pa Co. The proportion of ethnic minorities accounts for about 9% of the total population. Each ethnic group has a long history and rich and unique cultural traditions, especially folk culture. Ethnic minorities such as Van Kieu and Pa Co live mainly in mountainous districts located to the west of the province, including Huong Hoa and Dakrong districts.

Quang Tri with disadvantaged communities

According to Decision 582/QĐ-TTg dated 28/4/2017 by the Prime Minister, the province has 213 villages categorized "with special difficulties" (see Table 9.3).

[1] worldbank.org

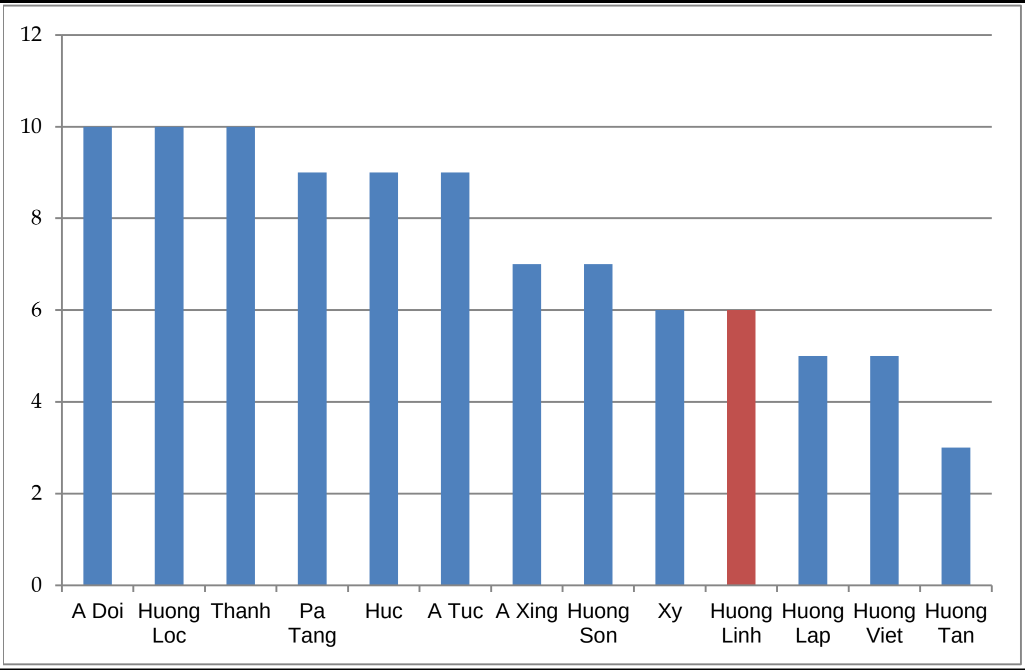
Table 9.3 Number of villages "with special difficulties" in Quang Tri[1]

Locations	Number of communes	Number of villages categorized "with special difficulties"
Zone I	6	-
Zone II	15	29
Zone III	26	184
Total	47	213

Source: Decision 582/QĐ-TTg dated 28/4/2017 by the Prime Minister

In Huong Hoa district, there are 13 communes categorized as zone III commune (see ***Figure 9.7***), as zone II communes, and only one commune categorized as zone I commune. Huong Linh commune is categorized as a Zone III commune "with special difficulties" which is the most vulnerable communes in terms of socio-economic development (see further *Section 9.6* for the discussion on the socio-economic conditions of the commune).

Figure 9.7 Number of villages with special difficulties in Huong Hoa District by commune



[1] *Communes of ethnic minority and mountainous areas are defined in 03 zones. Zone III communes are the most vulnerable communes in terms of socio-economic development; Zone II communes has difficult but temporarily stable socio-economic conditions; Zone I communes are the remaining. Zone III communes have at least four out of five criteria as follows: (i) Number of extremely difficult villages is 35% and above (compulsory criteria); (ii) The rate of poor and near poor households is 45% and above; in which the rate of poor households is 20% and above; (iii) Satisfying at least three out of five following conditions: Communal or inter-commune roads are not concreted; At least one village is not connected to the national electricity grid; Lack of primary classrooms or village classrooms as regulated by the Ministry of Education and Training; Communal health station does not satisfy requirements of the Ministry of Health; Communal culture house does not satisfy requirements of the Ministry of Culture, Sports, and Tourism;(iv) Having at least two out of three following conditions: From 30% of households do not access clean water; The rate of untrained laborer is over 60%; Over 50% of specialized cadres and communal civil servants do not satisfy qualification requirements as regulated; and (v) Having at least two out of three following conditions: 20% of households lack production areas as regulated; Lack of qualified agriculture, forestry, fishery extension officer; Below 10% of households work in the non-agriculture field.*

Source: Decision 582/QĐ-TTg dated 28/4/2017 by the Prime Minister

9.5.3 *Huong Hoa District*

Located to the west of the province, Huong Hoa district is one of two mountainous, border districts of Quang Tri province. The district borders:

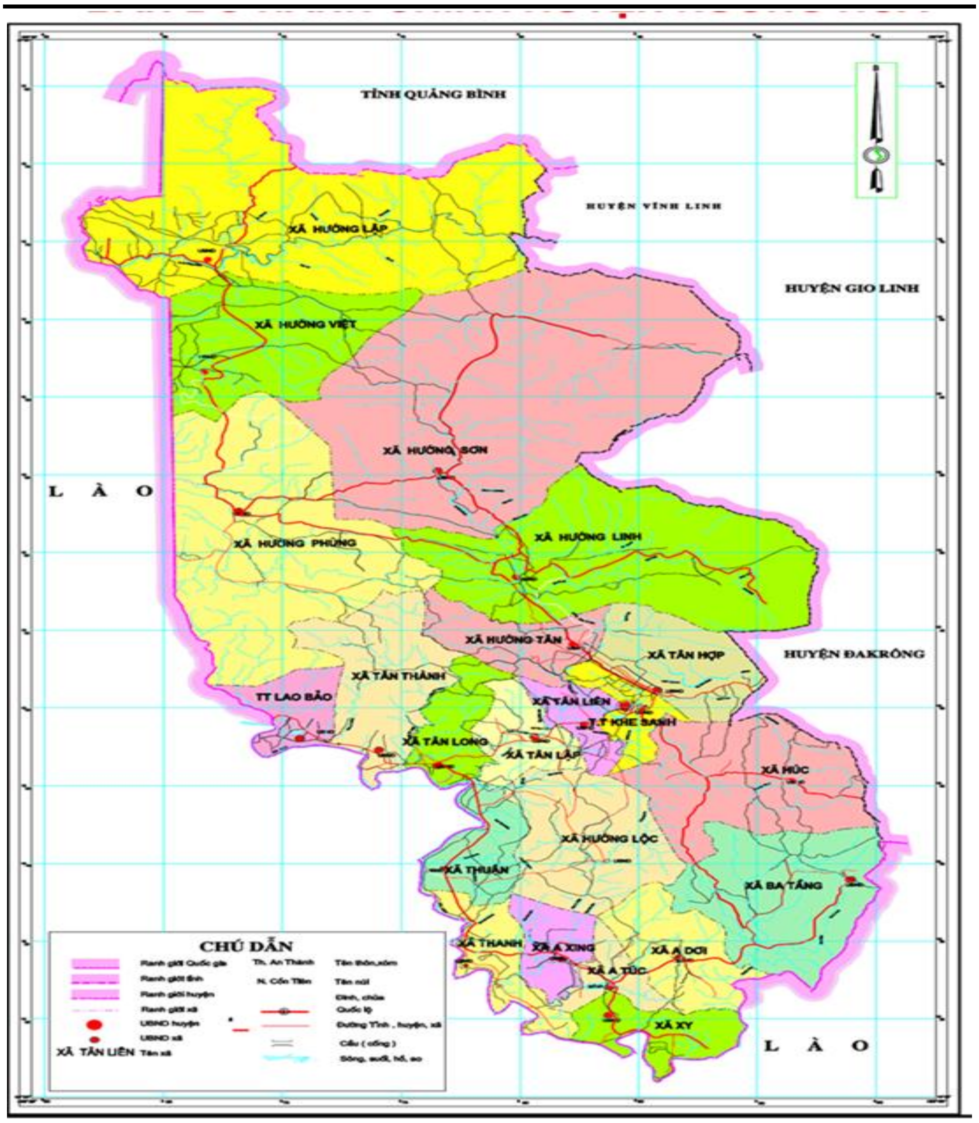
- Laos PDR to the South and West (bordered with 156 km of three districts of Laos PDR);
- Quang Binh province to the North; and
- Do Linh, Vinh Linh and Dakrong Districts to the East.

It comprises of 22 administrative units, including 20 communes (i.e. 13 communes with special difficulties, 11 communes bordering Laos PDR) and 02 towns (Khe Sanh and Lao Bao), as illustrated in *Figure 9.8*. According to Huong Hoa District Statistical Office (2017), the natural area of the district is 1152.36 km^2. The population by the end of 2016 was 84,485 people. Two main ethnic minority groups in Huong Hoa district are Pa Ko and Van Kieu.

The topography of the district is quite diversified. Mountains and rivers and streams originating from high mountains are interwoven, forming a disjointed terrain.

There are two main types of land including sandy soil and basaltic soil that are favourable for the development of agriculture and forestry. Forest and mineral resources are rich and potential for long-term exploitation. Abundant water resources from the rivers of Se Pang Hieng, Se Pon, Rao Quan and pond systems, hundreds of streams, small springs, and underground water meet local people's needs of domestic use and production. Especially, the construction of Quang Tri Hydropower - Irrigation Project on the Rao Quan River with the investment value of over 2,000 billion VND has completed and been connected to the national electricity grid with a capacity of 64MW. In addition, the Rao Quan downstream hydropower project and La La hydropower project are under construction, which is expected to facilitate the development of electricity grid in the district in particular and in the province in general, and provide water for agriculture production of local people in the district.

Figure 9.8 Map of Huong Hoa District



Source: huonghoa.quangtri.gov.vn

With favourable geographical location and natural conditions and potentials from the border and the Lao Bao special commercial-economic zone that is a focal trading point located on the Trans-Asia route and the Central Vietnam, Huong Hoa has been one of the localities with a significant position in the province's economic development strategy.

9.6 SOCIO-ECONOMIC BASELINE AT DISTRICT AND COMMUNE LEVEL (HUONG LINH COMMUNE, HUONG HOA DISTRICT)

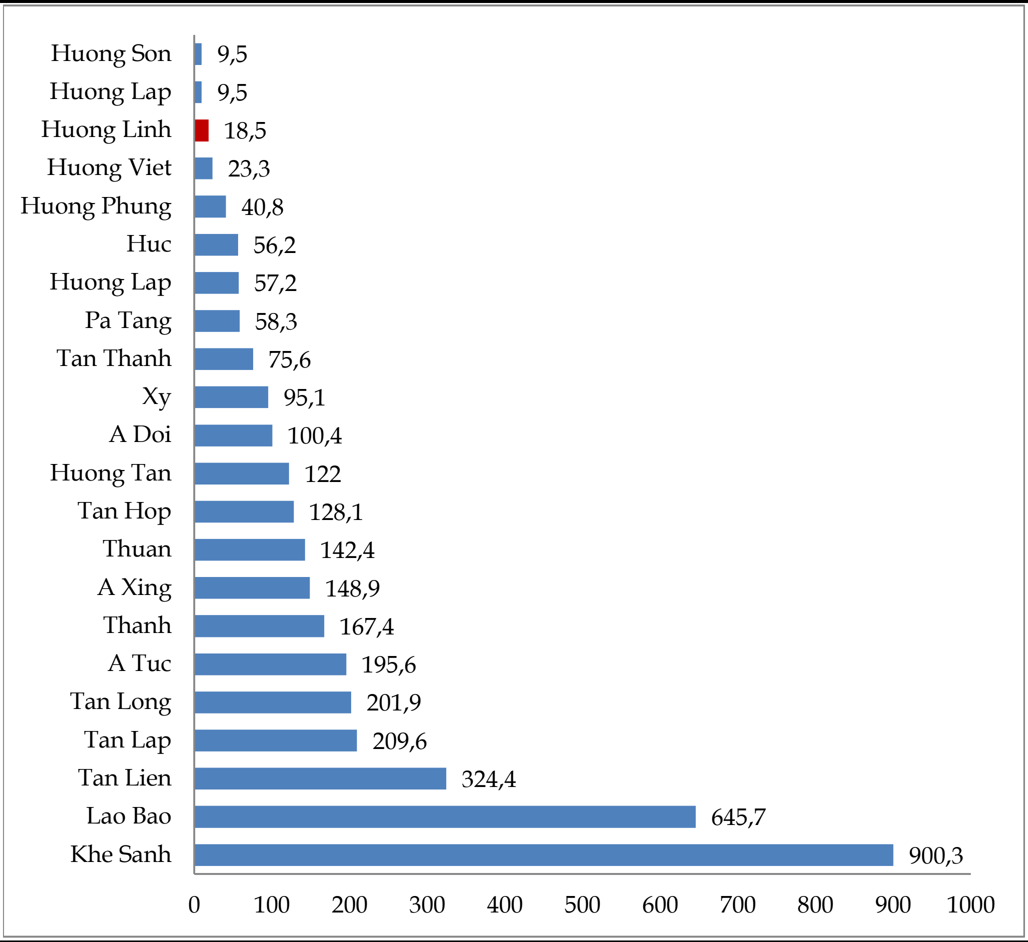
9.6.1 *Demographic Profiles*

Population

According to Huong Hoa District Statistical Office (2017), the total population of the district is 84,485, of which 73.2% (61,810) reside in rural areas. The population density of the district is 73 persons/km^2, much lower than the provincial average rate (132 persons/km^2). Similar to Huong Lap and Huong

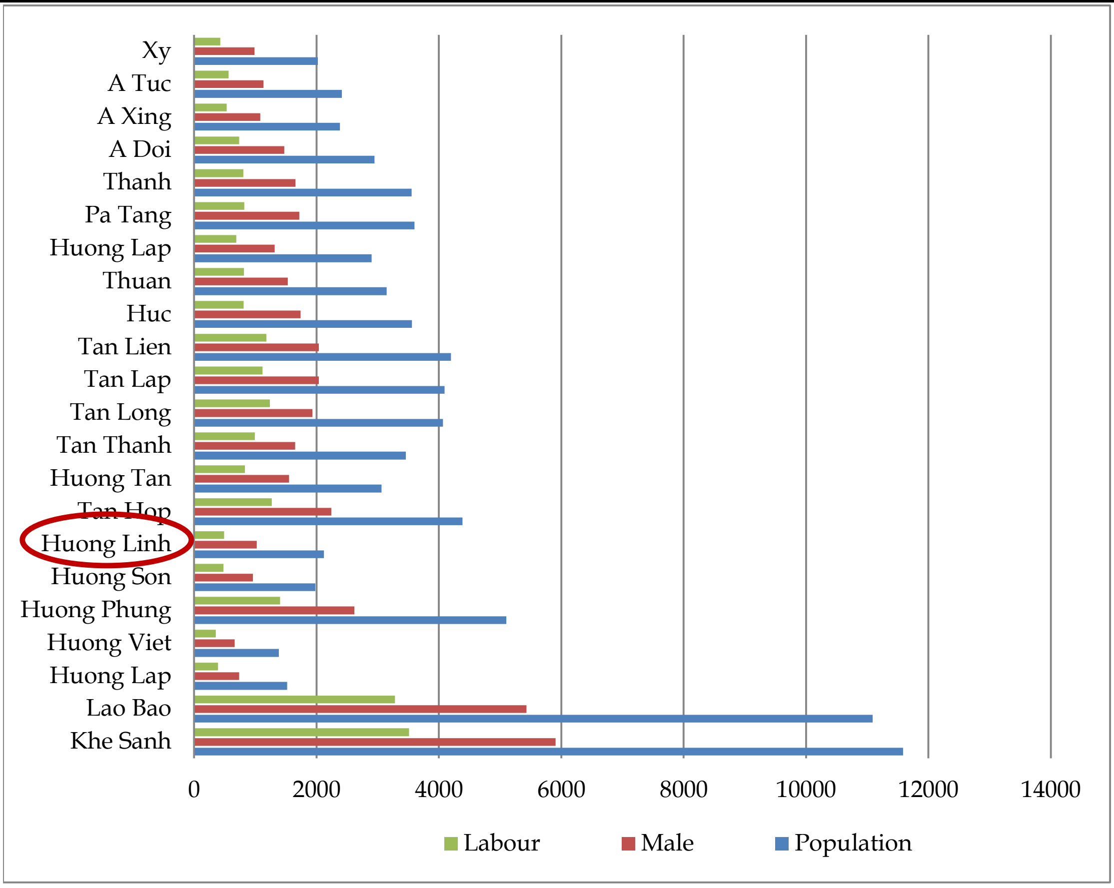
Son commune, Huong Linh commune has the lowest population density with 18.5, persons/km² (see Figure 9.9). The total population of Huong Linh commune is 2,123 people of which, 52% are females and 23% are of working age (i.e. people aged from 18 – 60 years old) (see Figure 9.10).

Figure 9.9 Population density by commune



Source: ERM based on Huong Hoa Statistical Office, 2017

Figure 9.10 Population by gender and labour age by commune



Source: ERM based on Huong Hoa Statistical Office, 2017

It is recognised that on average, the family size of the household in Huong Hoa district and Huong Linh commune is approximately 4-5 persons/households. Depending on the ethnic group, the family size will be different and it is indicated in Table 9.4.

Table 9.4 Household size of Huong Hoa District and Huong Linh Commune by ethnic group

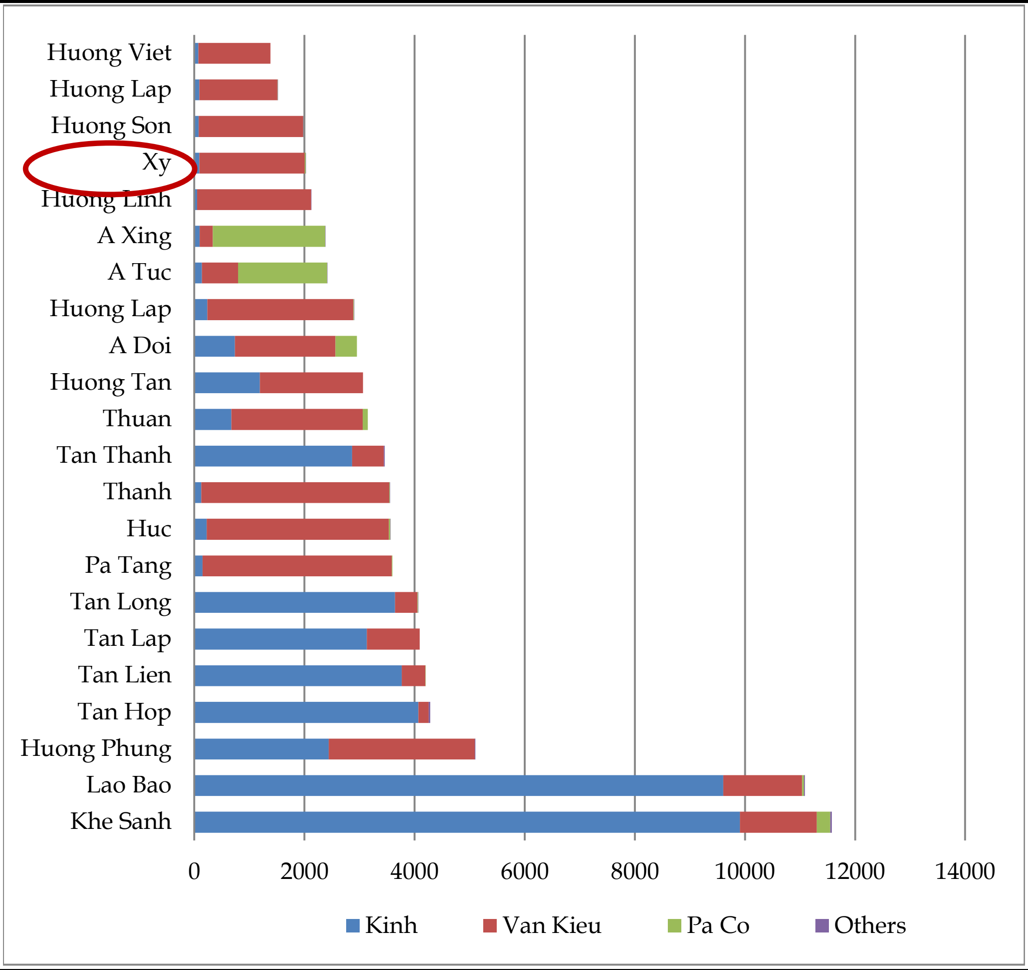
Areas	Kinh	Van Kieu	Pa Co	Others	Whole population
Huong Hoa District	3.89	4.79	4.80	5.08	4.28
Huong Linh Commune	6.50	4.52	0.00	4.00	4.55

Source: ERM created, based on Huong Hoa Statistical Office, 2017

Ethnic Communities

The district consists of three main ethnic groups: Kinh, Pa Co and Van Kieu. While the Kinh represents the largest proportion in communes of more than 4,000 in population, as reported by *Huong Hoa Statistical Office 2017*. Kinh people are an ethnic group originating from present-day northern Vietnam. They are the majority ethnic group of Vietnam, comprising 86.2% of the population at the 2009 census, and are officially known as Kinh to distinguish from other ethnic groups in Vietnam. It is interesting to note that the Van Kieu ethnic minority resides in all communes of the district. As discussed further at ***Section 0***, the Van Kieu are a recognised Indigenous Peoples. They make of more than 95% of the population in the communes of Huong Linh (97.4%), as prescribed in Figure 9.11.

Figure 9.11 Population in ethnic groups by commune



Source: ERM created, based on Huong Hoa Statistical Office, 2017

Van Kieu (Bru-Van Kieu) People

Van Kieu are one of three indigenous ethnic minorities residing in the mountainous areas of Quang Tri and Thua Thien Hue provinces. The other two indigenous minorities are the Co Tu and Ta Oi people[1]. According to the 2009 Vietnam Population and Housing Census, the Van Kieu in Viet Nam has a population of 74,506 people, residing in 39 out of 63 provinces. The Van Kieu people reside largely in Quang Tri Province, 55,079 people, accounting for 74% of the total population of Van Kieu in Vietnam.

In the past, the Van Kieu people had settled in the Central Laos. Later, due to historical changes, they had to migrate to other places, including to northwest

[1] https://www.thuathienhue.gov.vn/vi-vn/Thong-tin-du-dia-chi/tid/Dan-cu/newsid/6DABF5AE-88A1-4947-8179-AD8FAED258CC/cid/547476B3-0EF9-495D-BB0A-45FFFC7CEDF2

to Thailand, some to the east to settle down in the West of Quang Tri province where they set up their villages around the mountain called Vien Kieu, which popularly pronounced as Van Kieu. As such they are called Van Kieu or Bru-Van Kieu.

Figure 9.12 Van Kieu People

Source: Socio-economic survey conducted by ERM, 2018

As introduced in the Thua Thien Hue portal website (retrieved from *thuathienhue.gov.vn* in 2018), the traditional society of the Van Kieu people was established cohesively into *vil* (village). Each *vil* may consist of many *Mu* (collection of households that have the same bloodline of the father side), who have the same ancestor. Relationships among families in the same *Mu*, and *vil* are very close and attached. They often help each other and share the same responsibilities.

The village patriarch is the hereditary leader of Van Kieu community, maintaining the most powerful role in community unity, traditional functions, community property use and dispute settlement. He is "the court", as metaphorically expressed by an interviewee, particularly in boundary identification of newly reclaimed land between villagers. Even though the village leader, frequently younger and over fixed term elections, apparently has a more pro-active role in modern administrative system related to the village issues and resources (Bayrak 2015), the village patriarch is respectful and trusted for his ethnic-concerned advice and decisions. In Huong Linh commune, despite the fact that Cooc and Hoong are two villages with two separate village heads, they have the same village patriarch because they have the same ancestor and share one temple of ancestor. The 95-year-old village patriarch of Hoong village told the tale of Hoong-Cooc establishment, recognizing their one ancestor migrated from Laos approximately ten generations ago (see Figure 9.13). Meanwhile, residents from Miet village, also mainly Van Kieu Indigenous People, were resettled in the village in 2006 as a result of the Rao Quan Hydropower project and have modernized housing and to some extent lifestyle.

Figure 9.13 The 95-year-old village patriarch of Hoong and Cooc village

Source: Socio-economic survey conducted by ERM, 2018

Van Kieu's house construction

Field observation reaffirms that Van Kieu people prefer residing in villages relatively isolated on the hills or in the middle of the mountains. In the village's structure, the village house should be centered by resident's houses. Even in the resettlement areas, houses are built on top/ middle of the mountain following stilt house types (see *Figure 9.14).*

Figure 9.14 Van Kieu people's houses often built in the top/middle of the mountain

Source: Socio-economic survey conducted by ERM, 2018

Van Kieu's ceremonies and festivals

Van Kieu people mainly live on farming with two paddy crops in a "good weather" year. They worship the God of rice (*dang sro*) and organize ceremonies on the occasions of new crop, seed sowing, threshing, or post harvesting. The new rice ceremony is the biggest event of all. Every three years the villages have a "major" village worshipping ceremony, illustrated in Figure 9.15.

Figure 9.15 Preparing a new rice ceremony

Source: Dang Duc – Tran Thanh (dantri.com.vn)

Traditional sickness treatment

Medical blowing is a Van Kieu's traditional treatment of sickness of such as red eyes, snake bites, abdominal pain, headache, boils, dysentery, broken bones, and bleeding wound and is based on the belief that people get sickness when their soul leaves their body. Hoang Cam and Nguyen Truong Giang (2013) describe this process: When having sickness, they must ask a fortune teller to diagnose the sickness cause and then invite a master of ritual to host the soul calling ceremony. In the soul calling ceremony, the master carries out a "blowing" ritual to blow out sickness and then call soul. S/he puts a red candle with flame into his mouth and blow the flame to the back or the pain area of the sick people. When blowing, s/he rubs on the pain area by using a secret kind of leaves (see Figure 9.16).

Figure 9.16 Sickness treatment by blowing rituals

Source: Hoang Cam and Nguyen Truong Giang, 2013

During the consultation with villagers, there were many stories told to affirm the mysterious effects of blowing methods although many villagers acknowledged the importance of modern healthcare and the role of the commune health station. "Blowing" as argued by Hoang Cam and Nguyen Truong Giang (2013) can be viewed as a valued combination of local spiritual elements and indigenous knowledge on medical herbs and treatment, within specific natural, cultural, and social context of the ethnic minority group.

Clarification of Indigenous People Status

Based on the above review ethnographic literature, and consultations an Indigenous Peoples evaluation based on IFC PS 7 is provided in the table below. This provides a review against the criteria against which Indigenous Peoples can be defined.

PS7 Considerations	ERM evaluation
Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;	Van Kieu people have their own language, scripts and unique culture although they have integrated well to the larger Kinh community. Van Kieu ethnic group has particular ethnic features and their identity is normally recognised by other ethnic groups.
Collective attachment to geographically distinct habitats or ancestral territories in the project	Van Kieu ethnic group is one of three indigenous ethnic minorities residing in the mountainous areas of Quang Tri and Thua Thien Hue provinces. In the past, the Bru people had settled in the Central Laos. Later, due to historical changes, they had to migrate to other places,

area and to the natural resources in these habitats and territories;	including some to the east to settle down in the West of Quang Tri province where they set up their villages around the mountain called Vien Kieu, which popularly pronounced as Van Kieu. According to the patriarch of Hoong and Cooc villages, the Van Kieu people have inhabited and attached to the mountainous area of Quang Tri province for approximately 10 generations.
Customary cultural, economic, social, or political institutions that are separate from those of the mainstream society or culture; or	Van Kieu people have distinct cultural practices such as community organization, including the patriarch system, house style, ceremony and festival, belief (Sacred Forest) and blowing rituals as described in sections above.
A distinct language or dialect, often different from the official language or languages of the country or region in which they reside.	Van Kieu people have their own language and scripts which is different from the official language of Vietnam. Though they are also proficient in official language, they often interact with each other in their language.
Is there a national definition of indigenous people (outlined in local / national legislation)? Has the country ratified international treaty or instruments with obligations towards Indigenous Peoples?	Yes, Vietnam has defined the term 'ethnic minorities' and has bestowed constitutional rights to protect their interest. It has created Institutions such as Council on Ethnic Minorities to advise the National Assembly on Ethnic Minority Issues. Vietnam had voted in favour of the UN Declaration on Rights of Indigenous Peoples but is yet to ratify the ILO Convention 169.
Overal conclusion	Van Kieu people are recognized as 'ethnic minorities' and their traditional habitats the mountainous areas of Quang Tri province are recognized by Vietnam government as well as other ethnic groups. They also have distinct cultural identity and their livelihood is mostly dependent on upland agriculture which is affected by Huong Linh 1 Wind Power Project. Hence, Van Kieu in this specific context may be considered as Indigenous Peoples.

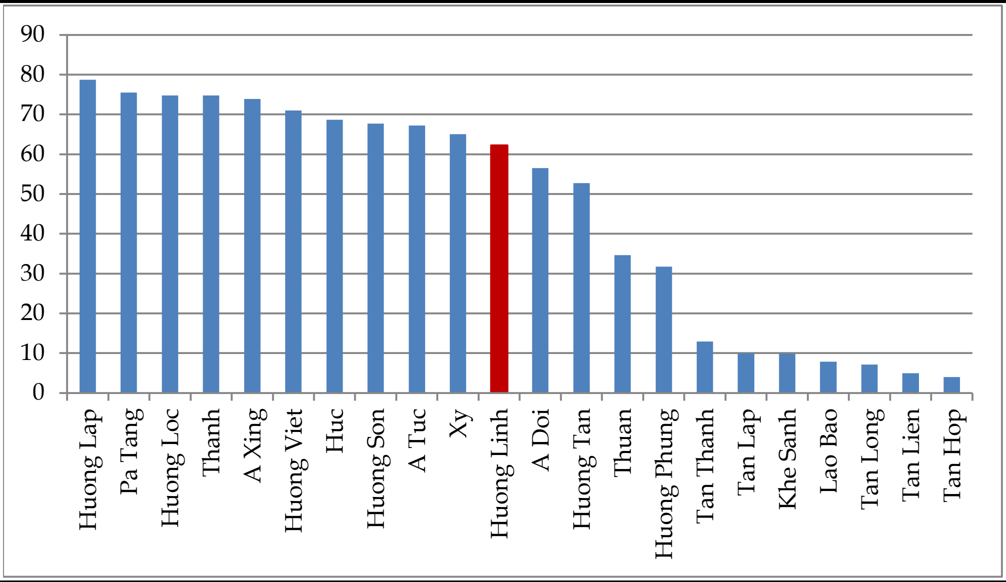
The Project is reported to have direct impact on approximately 15 households of Van Kieu people living in the Project area. If any other adverse impact on these households is identified, the mitigation measures should be tailored to their specific circumstances so that their ethnic identity and cultural rights are appropriately protected. The participation and engagement process carried out as required under IFC PS1 should identify them as a distinct stakeholder group and engage with them in a culturally appropriate manner.

Poor households

Based on the data by Huong Hoa District Statistical Office (2017), 31% of district's households is categorized as poor. This percentage is more than 70 in Huong Lap, Pa Tang, Huong Loc, Thanh, A Xing and Huong Viet. The number of poor and near poor households of the whole commune, as stated in Huong Linh Commune's 2017 Socio-Economic Development Report, continued to decrease by the end of the year 2017:

- 264 poor households, 53.66% of the whole commune; and
- 61 near poor households, 12.4% of the whole commune.

Figure 9.17 Percentage of poor households by commune



Source: ERM based on Huong Hoa Statistical Office, 2017

Religion

The main religions in Quang Tri province and Huong Hoa district are Buddhism, Catholicism and Protestantism. Before 1975, Catholicism was booming in the province with more than 100 churches and 20,000 Catholics, many of whom migrated to the South (Hoang Duc Thang 2014). La Vang is the site of the Minor Basilica of Our Lady of La Vang (Đuc Me La Vang). Quang Tri province is also a land of Buddhism, with 205 pagodas and temples and among highest numbers of monks and nuns of the country. As a religious minority, Protestants in Quang Tri province has two main centers in Gio Linh, Trieu Phong districts and Khe Sanh town, Huong Hoa district, making an increasing religious population of Van Kieu and other ethnic minorities.

Figure 9.18 Establishment of Ka Tang Village Protestant Congregation under Khe Sanh Church

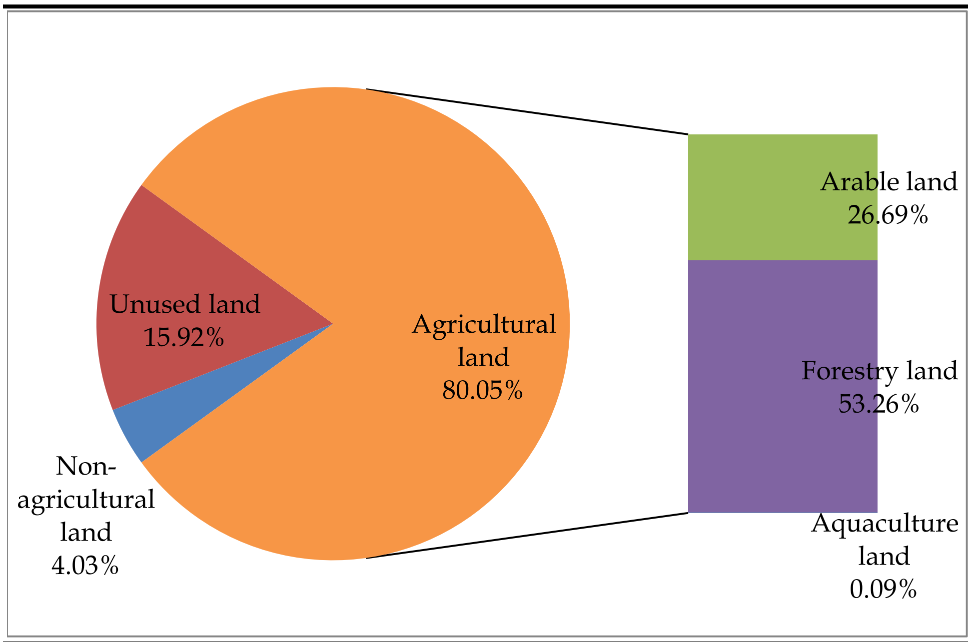
Huong Linh Commune's 2017 Socio-Economic Development Report indicated that: the whole commune has 03 certified practice sites of Protestantism. They included 01 minister and 03 site heads. There was 01 cadre of Pa Kong village Women's Union following Protestantism, 01 pupil sent to be nourished in Son Ca Monastery in Hue City and 02 students sent to study in Da Nang. During the summer time from 22 to 24 June 2017, 39 pupils from the commune graded 1 to 6 participated in Bible courses at Tan Lien church. One religious practice site had its signboard installed with proper size and aesthetics.

9.6.2 *Land use*

Within 115,236 ha of land of the district, as reported by Huong Hoa District Statistical Office (2017), the arable land accounts for 26.69%, including 952 ha of rice cultivation (0.83%). Forestry land has the highest proportion (53.26%), comprising 16,136 ha of production forest land (14%), 22,645 ha of specific use forest land (19.65%), and 22,588 ha of protection forest land (19.60%). Only a very modest land area (0.1%) of the district are developed for aquaculture. More than 15% of the district land are unused, which is mainly hilly and mountainous land; and 4% of non-agriculture land including residential land and land for development of infrastructure, industry, public offices, etc. (see Figure 9.19).

Land use in Huong Linh Commune appears to be similar, with perhaps a higher proportion of forest land.

Figure 9.19 Current status of land use of Huong Hoa District



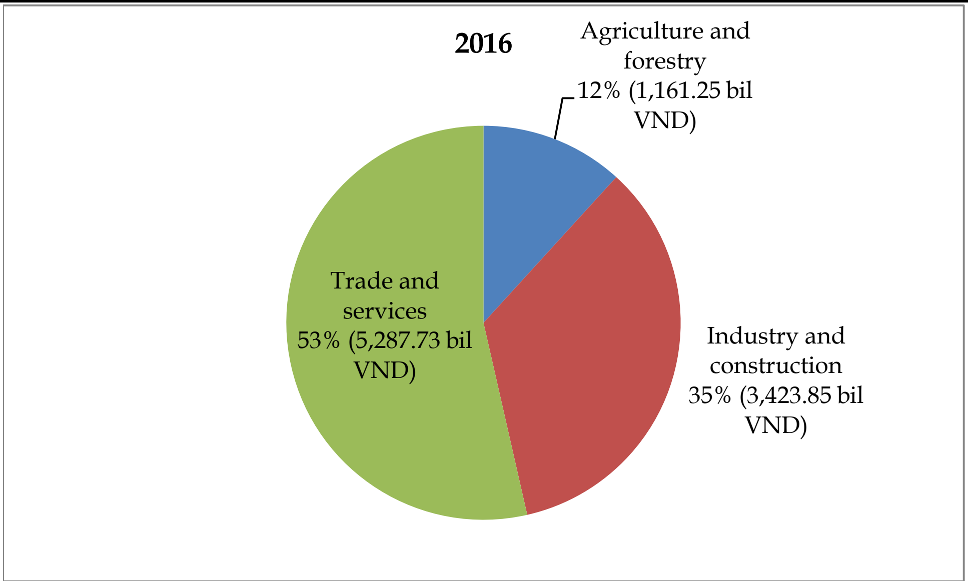
Source: ERM based on data from Huong Hoa Statistical Office, 2017

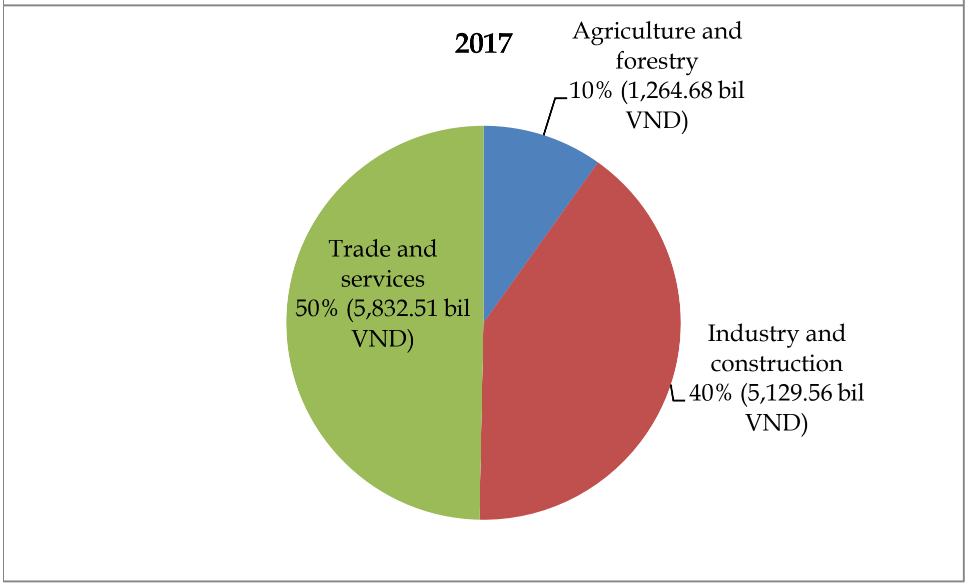
9.6.3 *Economy*

Economic structure

Based on Huong Hoa District's 2017 Socio-Economic Development Report, the economy of Huong Hoa is largely trade-service oriented concentrated in Khe Sanh and Lao Bao towns (see Figure 9.20). It has small industrial sector, but integrated with construction, making it increasing proportion in the district's economic structure. However, it is worth-noting that it has a significant agricultural base, especially in Zone III communes including Huong Linh. In our interview with the Chairman of Huong Linh Commune People's Committee, the contribution of agriculture to the commune's economy is estimated at 90% and the remaining proportion 10% is from the forest-related sector.

Figure 9.20 District's economic structure in 2016 and 2017





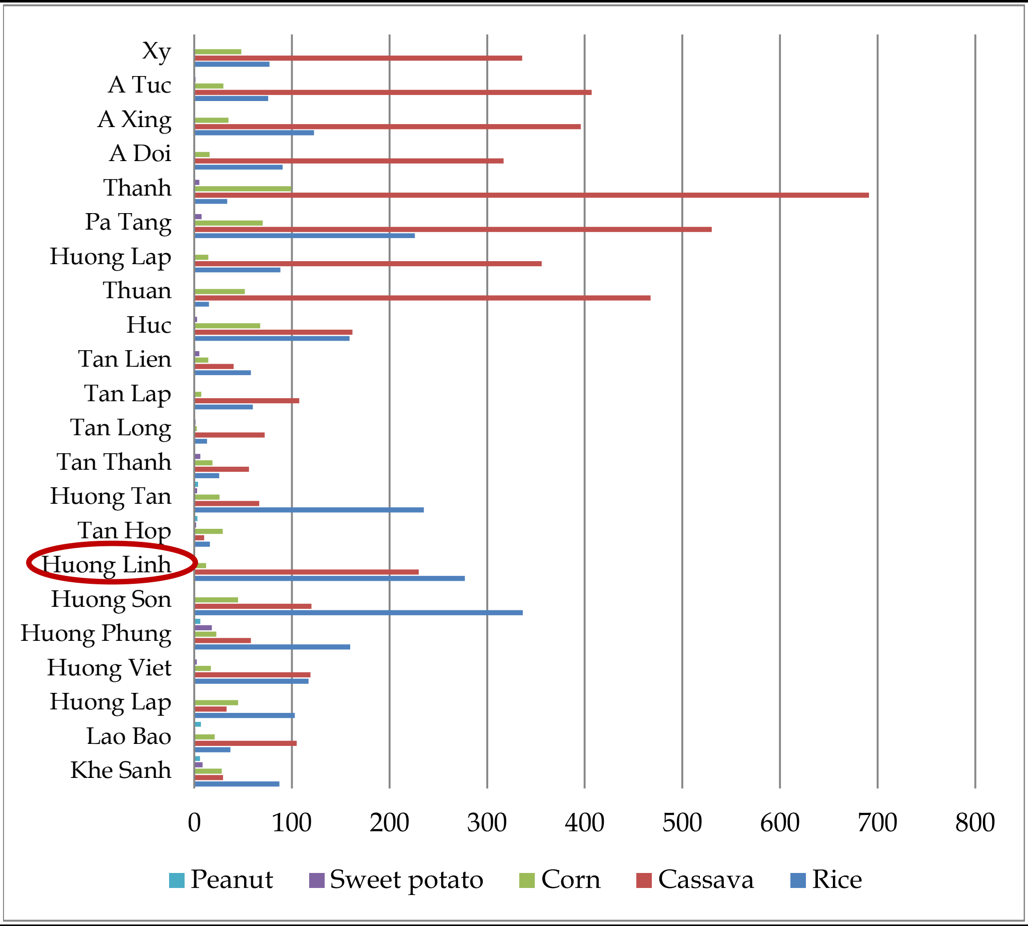
Source: ERM based on Huong Hoa Statistical Office, 2017

Cultivation

Table 9.22 indicates that main crops of the district include cassava, rice, corn, sweet potato and peanut, according to *Huong Hoa Statistic Office, 2017*. Cassava is widely developed in several communes, including Huong Linh (230 ha, 3,795 tons in 2016), with the average yield of 16.5 tons/ha. Huong

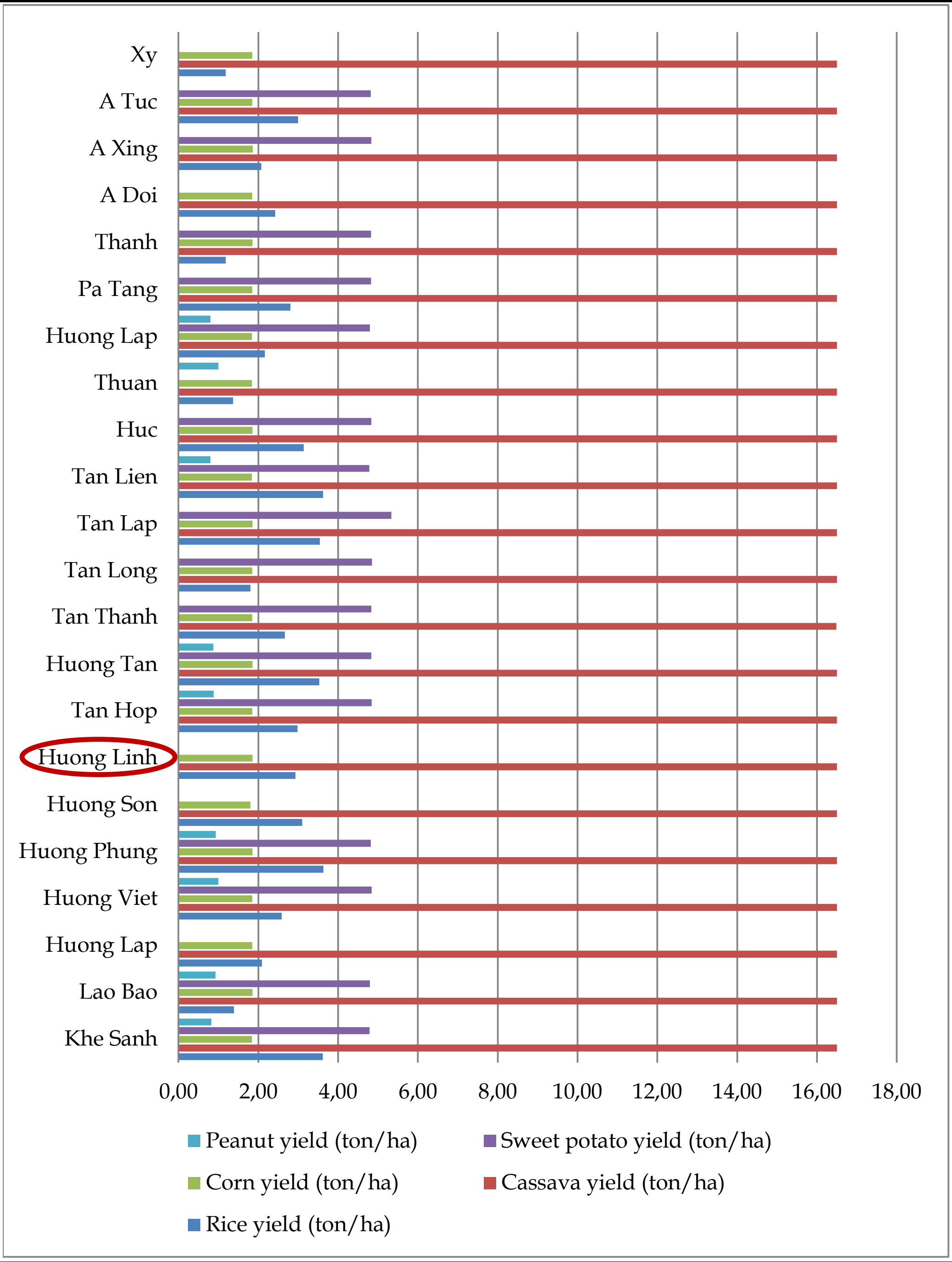
Linh (227 ha, 812.5 tons in 2016) is seen to be the "rice basket" of the district, with the average yield of 3 tons/ha. Apart from its two main crops of rice and cassava, according to the 2016 data, Huong Linh commune produced 22.3 tons of corn and 51.9 tons of vegetable.

Figure 9.21 Planted area of main crops (ha) by commune



Source: ERM based on Huong Hoa Statistical Office, 2017

Figure 9.22 Yield of main crops (ton/ha) by commune



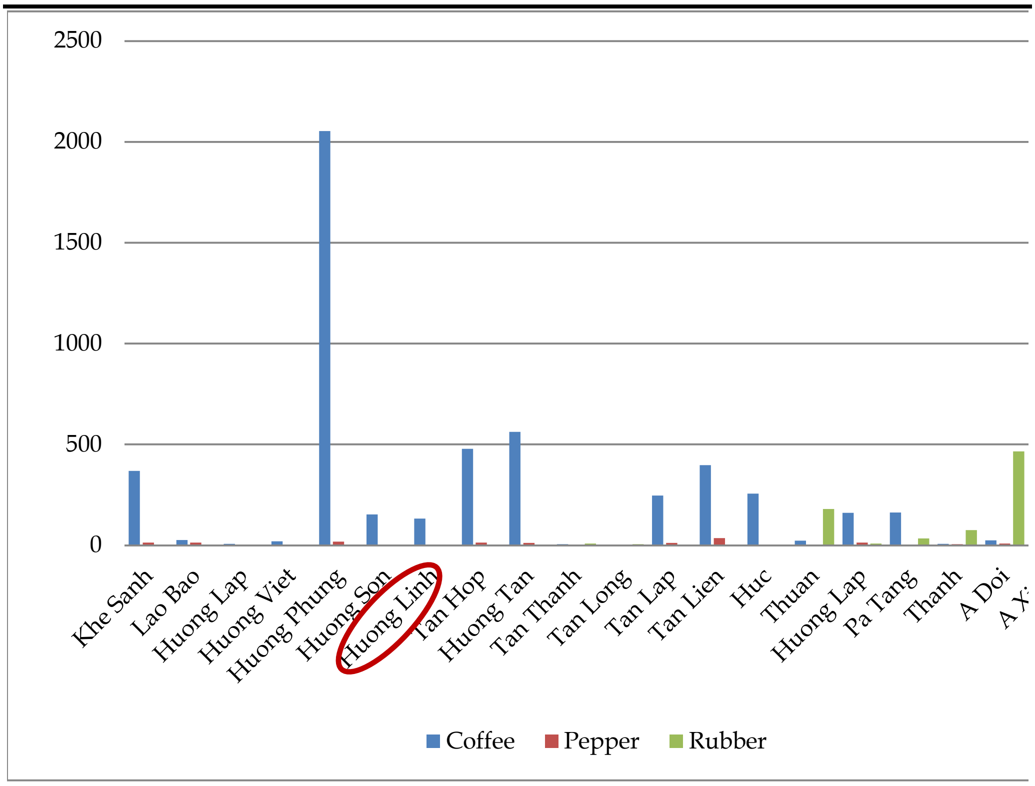
Source: ERM based on Huong Hoa Statistical Office, 2017

It is important to note that there is a slight decrease, as reported in *Huong Linh Commune's 2017 Socio-Economic Development Report*, in both rice and cassava productivity in Huong Linh commune in 2017:

- Total annual cultivation area: 404,55 ha
- Total annual paddy rice cultivation area: 190 ha
- Average rice productivity: 2,55 tons/ha
- Total cassava planting area: 214,55 ha
- Raw cassava productivity: 14,5 tons/ha

Figure 9.22 Yield of main crops (ton/ha) by commune demonstrates areas of main industrial crops of the district including coffee, pepper and rubber. The largest area of 200 ha in Huong Phung is used for coffee planting, equal to the total amount of coffee land of five next largest communes (Huong Tan, Tan Hop, Khe Sanh, Tan Lien, Tan Lap) or more than the total land for pepper of the district. The average yield of coffee of the district range from 1.1 to 1.3 ton/ha while that of pepper is 0.72 ton/ha. The main rubber plantation of the district is located in A Doi with 465 ha, the prominent source of rubber of the district (296 tons in 2016). Huong Linh has 132 ha of coffee (with yield of 1.1 tons/ha) and 0.5 ha of pepper (producing 0.4 ton in 2016).

Figure 9.23 Planted area (ha) of industrial crops by commune



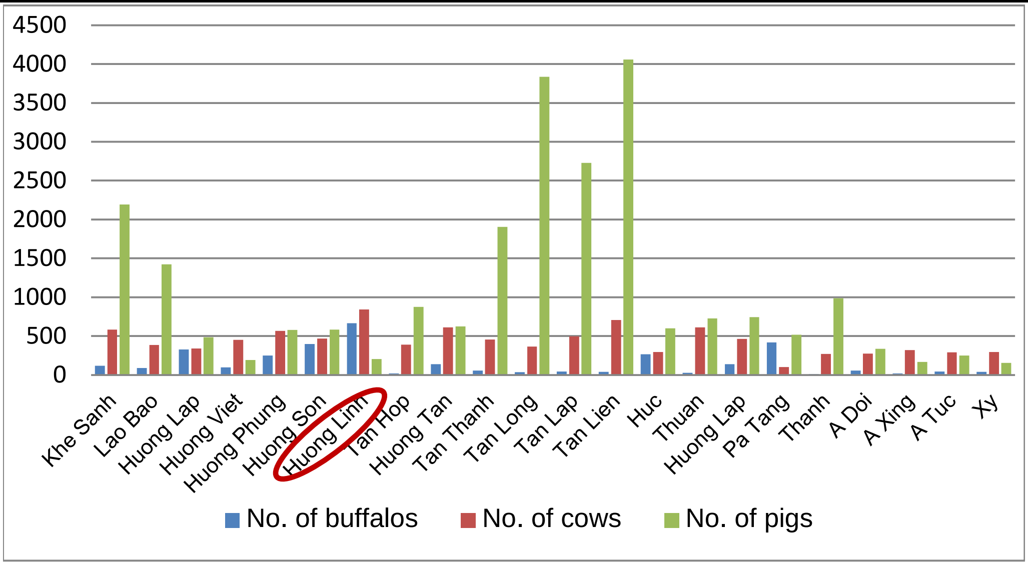
Source: ERM based on Huong Hoa Statistical Office, 2017

Animal husbandry

As illustrated in *Figure 9.24*, the district has a total of 25,558 pigs, 9,629 cows and 3,296 buffalos. It is interesting to note that pig farming is concentrated in Kinh-prominent communes, led by Tan Lien (4,057), Tan Long (3,836) and Tan Lap (2,728).

Huong Linh commune has the largest herds of buffalos (664) and cow (841) in the district. Huong Linh Commune's 2017 Socio-Economic Development Report indicated that the commune's cattle increased to 2,185 plus a total poultry flock of 4.500.

Figure 9.24 Number of cattle by commune

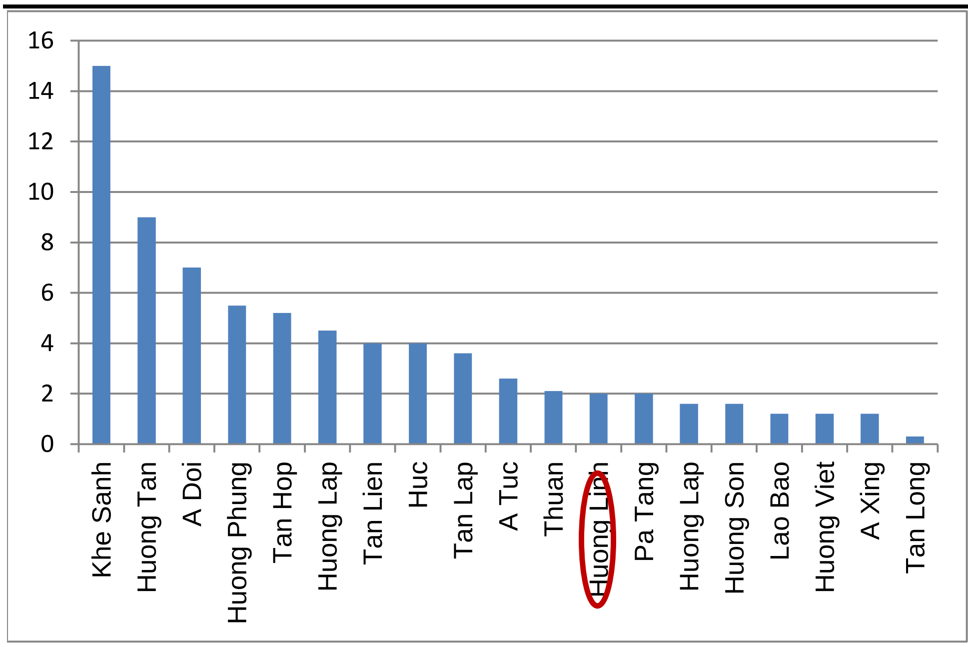


Source: ERM based on data from Huong Hoa Statistical Office, 2017

Aquaculture

Aquaculture as encouraged as an alternative livelihood for the mountainous communities is till developing. Aquaculture here is mainly characterised by household's small size freshwater fishponds. Khe Sanh pioneered with 15 ha of aquaculture. Most of Van Kieu prominent communes has less than 3 ha of aquaculture, including Huong Linh commune (2 ha) (Figure 9.25**)**.

Figure 9.25 Areas (ha) of aquaculture by commune



Source: ERM based on Huong Hoa Statistical Office, 2017

Forest planting

Noticeably, forest planting is another important source of income particularly for local communities in mountainous areas. In Quang Tri province, it is estimated that between 6,000 ha and 10,000 ha of planted forests, mainly *Acacia auriculiformis* can be exploited. Forest planting is promoted through forest land allocation programs by the State with the support from non-governmental initiatives. It should also be noted that forest planting has been through ecosystem service initiative such as Greater Mekong Sub-region Biodiversity Conservation Corridors Project - Vietnam component (BCC Project) in three provinces: Quang Tri, Quang Nam and Thua Thien Hue.

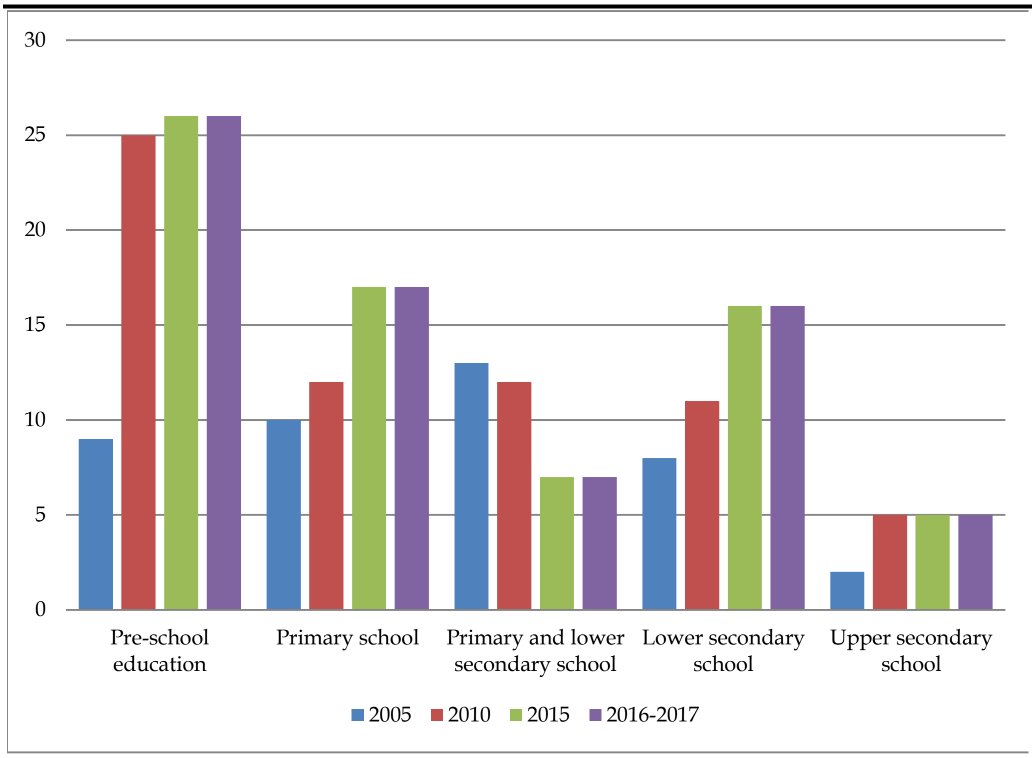
In 2017, as highlighted in Huong Linh Commune's 2017 Socio-Economic Development Report, the commune newly planted 79 ha of forest (24 ha by local people and 55 ha under the project). Under the commune's 2017 production development project, 120,950 acacia seedlings (279,969,500 VND) was provided to 50 poor households (2,419 seedlings/household).

9.6.4 Education

Figure 9.26 shows the number of school classes in Huong Hoa District. While the number of schools from kindergarten to primary and high-school maintains unchanged in the last few years, the number of classes within the school has increased as the number of students has been growing (see Figure 9.27).

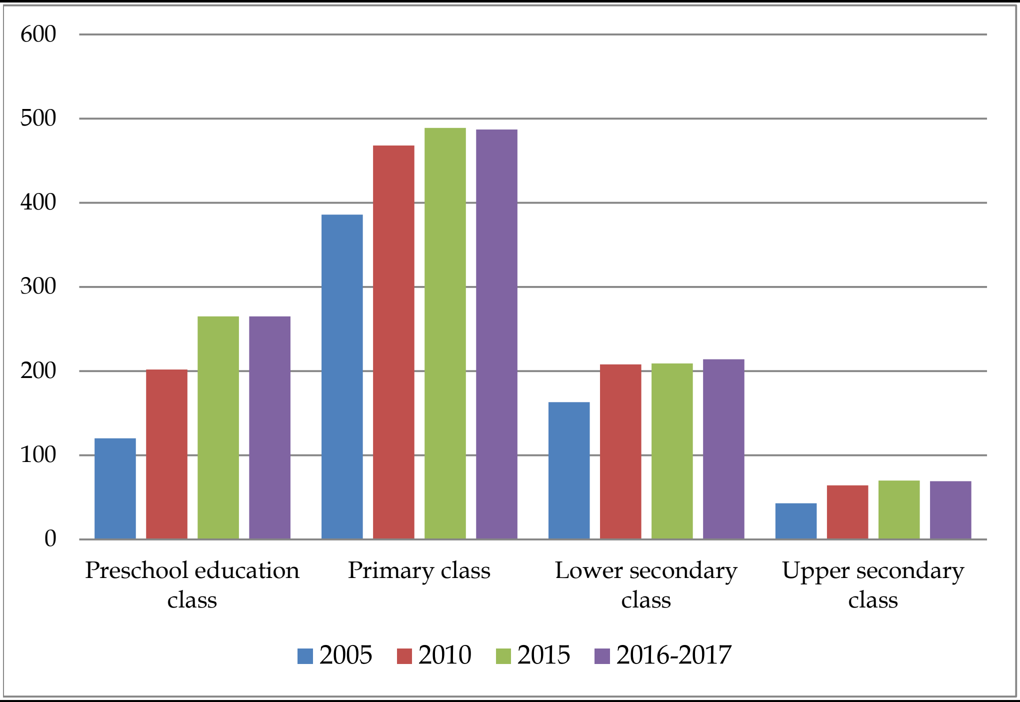
In reality, kindergarten/ primary school of one commune can comprise of several "satellite schools" established at the village level to reduce the distance from the remoted houses of local people to school to encourage pupils to go to schools (i.e. most of pupils walk to schools).

Figure 9.26 Number of schools of all levels in Huong Hoa Districts



Source: ERM, based on Huong Hoa Statistical Office, 2017

Figure 9.27 Number of classes of all levels in Huong Hoa District



Source: ERM, based on Huong Hoa Statistical Office, 2017

In the school year of 2016-2017, the district recorded 6,926 preschool education children, 10,137 primary school pupils, 6,758 lower secondary school pupils and 2,498 upper secondary school pupils.

Based on the Huong Linh Commune's 2017 Socio-Economic Development Report, in the school year of 2016-2017, Huong Linh Commune had 186 pre-school education children, in which 39 children were at the nursery level (enrolment ratio: 34%), 147 children at kindergarten level (enrolment ratio: 96.3%), and 53 aged 5 years (enrolment ratio: 100%). There were 334 primary pupils in 20 classes and 218 lower secondary school pupils in 7 classes. The graduation rate of primary and lower secondary education of the commune in the school year of 2016-2017 was 96.72% and 100% respectively.

9.6.5 *Health service*

Table 9.5 shows the improvement of the healthcare sector of the district, especially the commune-level medical services over the past decade. By 2015, all commune-level medical service units in the district have doctors and midwives. 99.48% of under-one-year children were fully vaccinated (data of 2016). However, the under-five malnutrition rate of the district was high, 24.8% (i.e. in terms of height for age, data of 2015) and 17.87 (i.e. in terms of weight for age, data of 2016).

Table 9.5 Number of health establishments, patient beds and health staff in Huong Hoa district

	2005	2010	2015	2016
Health establishments (establishment)				
• Hospital	1	1	1	1
• Maternity house	1	1	1	0
• Commune-level medical service units	22	22	23	22
• Other medical service units	0	1	8	9
Patient beds (bed)				
• Hospital	70	75	75	75
• Maternity house	3	3	2	0
• Commune-level medical service units	66	66	135	135
• Other medical service units	0	0	0	0
Medical staff (person)				
• Doctors	24	39	51	52
• Assistant physicians	58	60	25	34
• Nurses	36	51	53	53
• Midwives	40	40	38	37
Pharmaceutical staff				
• Pharmacists and higher	1	0	3	3
• Pharmacists of middle degree	2	17	17	17
• Assistant pharmacists	3	3	0	0

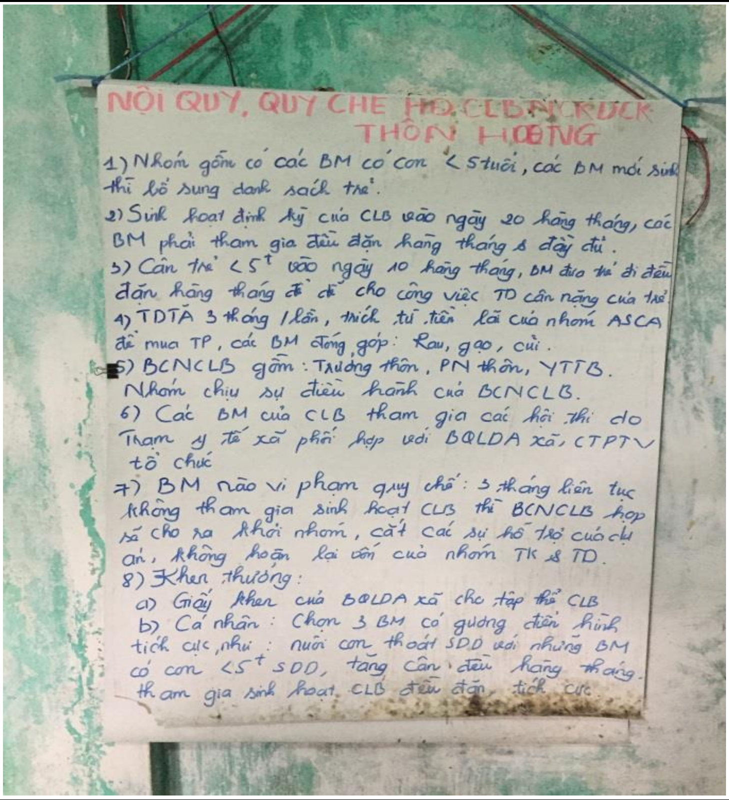
Source: ERM based on Huong Hoa Statistical Office, 2017

Referring to the Huong Linh Commune's 2017 Socio-Economic Development Report, the under-five malnutrition rate of the commune was much higher, 42.8% (i.e. in terms of height for age) and 29.87% (i.e. in terms of weight for age, data of 2016). 80.3% of children under one-year-old were fully vaccinated. In 2017, 50/54 infants were born at the commune health station (clinics) and the rest (4) were born at home. 17/40 mothers having a third child and more, accounting for 32% of total women having children. The rate of natural population growth was 1.04%/year (data of 2017).

In 2017, the commune health station (clinics) with 7 staff (one doctor, 2 assistant physicians, 2 nurses and 2 midwifes) received 1,505 cases for health checks and treatment including 1,478 patients with external treatment, 27 patients with internal treatment, and 11 referred patients. The station also organized 70 awareness raising initiatives for malaria prevention for local people.

Besides that, international efforts contributed to healthcare services in the district and Huong Linh commune. World Vision International developed Nutrition Clubs for years in villages in the communes to introduce localized meals and best practices to address childhood under nutrition (see Figure 9.28).

Figure 9.28 A regulation of a World Vision developed Nutrition Club at Hoong Village



Source: ERM, 2018

9.6.6 *Infrastructure and Public Facilities*

Road and Transport

The Project area is located 8 km to the northeast from the National Road 9 (the intersection area with the sealed road to Huong Linh commune). Within the Project area, there is a paved road connecting from the National Road 9 (west direction) to Huong Linh commune and a system of concrete roads and 6m wide inter-village road. In addition, there are some small tracks for local transportation. In general, the local transportation system has basically been completed to satisfy criteria of new rural development.

The traffic road system from Ho Chi Minh road (West direction) to the commune was sealed. Inter-village roads were concreted including Miet-Cooc inter-village concrete road, Hoong-Cooc inter-village road, and a road to the Hoong village production area. The commune coordinated with Huong Hoa Development Program to successfully build the irrigation system in Cooc village and other irrigation works in Xa Bai village.

It is reported in Huong Linh Commune's 2017 Socio-Economic Development Report that under the National Target Program for New Rural Development and Sustainable Poverty Reduction Support Program, Hoong and Cooc inter-village road phase 1 was completed via the new rural development fund and put into use. The commune is starting up the construction of the Hoong and Cooc inter-village road, package 2.

Electricity

The national power grid covers the whole commune and thus, all households are able to connect to electricity. However, based on the communication with village heads and interviewees during the survey, a few households (i.e. limited to 1-2 households per village) are not connected to electricity due to poor economic condition. However, the project area (where an 110kV transformer sub-station is planned to be installed) has a 22kV electricity transmission line going through. Upon the project start up, electricity source is connected with this electricity supply system.

Water supply

There is no clean water supply system available in the project area. Local people use water from wells (self-dwelling or supported by NGOs such as World Vision) and springs for their domestic activities.

Domestic Waste Management

A solid waste collection system is not available in Huong Linh commune. As such, solid waste has not been collected properly. It is processed by burning or discharging in the surrounding area. As noted during the formal interviews with Huong Linh commune PC and village heads, domestic wastes are generally collected and treated by each household by burning or disposal at a small spot within their adjacent land.

9.6.7 Cultural Practices and Heritage

Approximately 1km from the operation house of the Project, there is a sacred forest of Van Kieu People (Figure 9.29). Sacred forests or “ghost” forests are the holy cemetery of Van Kieu’s family lines. Like the stilt house of the living of Van Kieu Indigenous People, sacred forests are the home of the dead. Van Kieu people maintain a belief that sacred forests must be a quiet and “green” place for the dead (see Figure 9.29). Outsiders must obtain permission of the head of the family line in advance if they wish to enter this area.

Figure 9.29 A Sacred Forest in Cooc Village

Source: Socio-economic survey conducted by ERM, 2018

9.7 HOUSEHOLD INTERVIEW

9.7.1 Demographic Profiles of the Affected Households

Population

Total of 24 households in the impacted area were surveyed, including 10 from Cooc village, 10 from Miet village and 04 from Hoong village. It is noted that the surveyed households included both 10 directly affected households (i.e. having land acquired by Huong Linh 1 Wind Power Plant) and other 14 local households in the villages. According to the Project management, total land acquired is 8.4 Ha and mainly forestation and cropping land. The majority of the surveyed households (i.e. 22 out of 24 surveyed households or 91.6%) are Van Kieu Indigenous People. Given the total number of households of the 3 villages is 239, (as reported by the village heads), this surveyed households at 10% could to some extent provide a representative picture of the local population.

It should be noted that the people whose names are still recorded in the household registration book and are not living with the family are not counted in this survey statistics. For example, the females who have already got married and are currently living with their husband's family, or those who are working in other cities/provinces and did not contribute to the income or spending of the household. However, those who are students, living in the other areas and involves in the expenditure of the households, are counted.

Table 9.6 Population of the Surveyed Households by Gender and Age

Age	Gender				Total	
	Male		Female			
	Number	%	Number	%	Number	%

Below 18	27	42.2%	27	43.5%	54	42.9%
From 18 to 60	33	51.6%	32	51.6%	65	51.6%
Above 60	4	6.3%	3	4.8%	7	5.6%
Total	**64**	**100%**	**62**	**100%**	**126**	**100%**

Source: Socio-economic survey conducted by ERM, 2018

In total, there are 126 people are living in the 24 households with roughly equal gender proportion (i.e. 64 males versus 62 females). In which, 53 people are from Cooc village, 56 from Miet village and 17 from Hoong village. Amongst them, there are 10 households who have had their land acquired due to the Huong Linh 1 Wind Power Project.

According to *Table 9.6*, more than half of people in the surveyed sample are from 18-60 years old, which is within the working age, accounting for about 52% of the total sample. Noticeably, the number of people who are below 18 is remarkably high, with 54 people, accounting for nearly 43% of the total family members of the sample size. Only 7 people out of 126 people in the surveyed households are over 60-year-old (5.6%).

Table 9.7 and Figure 9.30 demonstrate the proportions of the vulnerable cases in the survey. Vulnerable households include ones with at least one of the following criteria:

- Women led/abandoned households;
- Households with their breadwinner is above the age of 60 (out of working
- age);
- Households with members who are differentially disabled either mentally or physically or injured war veterans;
- Orphans; and
- Poor households with small land holdings.

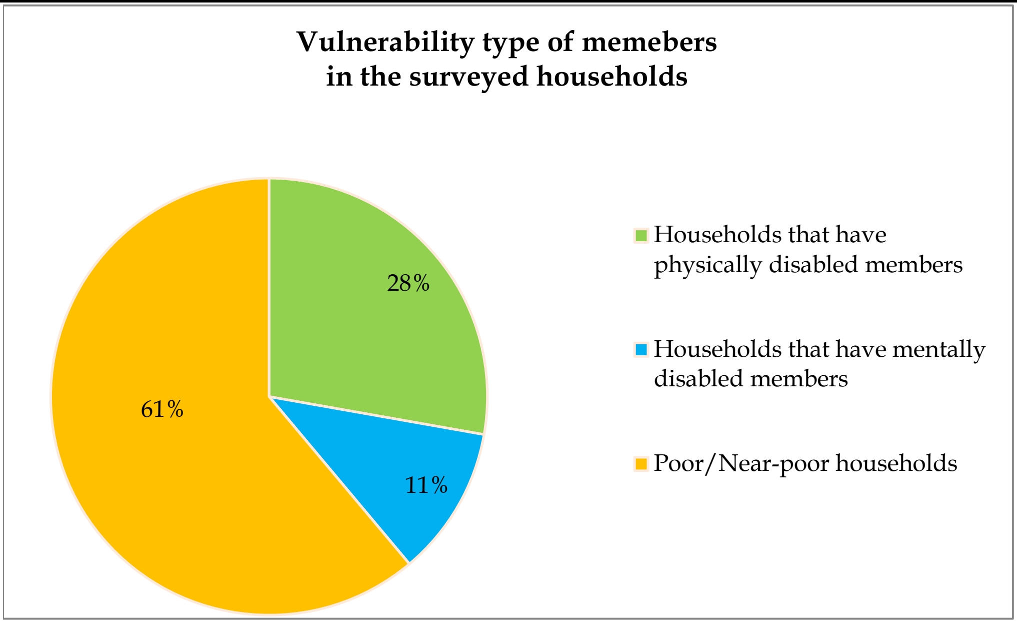
In total, 12 cases of vulnerability have been identified, accounting for 50% of the total surveyed households. The two main reasons why these households are listed as vulnerable households include (1) poor households (based on the granting of a 'poor certificate' to the households) and (2) having family member(s) with either a mental or physical disability. Of the 12 vulnerable households, 5 households exhibited these characteristics.

Table 9.7 Vulnerability of the Surveyed Households

Vulnerability	**Commune**						**TOTAL (N=24)**	
	Cooc (N=10)		**Miet (N=10)**		**Hoong (N=4)**			
	Number	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
Yes	6	60%	6	60%	0	0%	12	50%
No	4	40%	4	40%	4	100%	12	50%
Total	10	100%	10	100%	4	100%	100%	100%

Source: Socio-economic survey conducted by ERM, 2018

Figure 9.30 Types of Vulnerability



Source: Socio-economic survey conducted by ERM, 2018

Ethnicity

As shown in
Table ***9.8*** below, the surveyed households who are belonging to Van Kieu Indigenous People entail up to 91.6% while there is a very small percentage of Kinh group, with 8.4%. In fact, in the three villagers, it is estimated by the village heads that 99% of the population is Van Kieu. However, statistics reveal that there is an increasing trend of the number of Kinh households moving to the area, for instance there were seven more Kinh households immigrating to Cooc village in 2017.

Table 9.8 Ethnicity of the surveyed households

Ethnicity	Number	Percentage (%)
Van Kieu	22	91.6%
Kinh	2	8.4%
Total	24	100%

Source: Socio-economic survey conducted by ERM, 2018

Religion

Table 9.9 presents the religion of the surveyed households of the three villages. 19 out of the 24 surveyed households (i.e. 79.2% of the total sample) are notreligious. A noteworthy percentage of households who follow Protestantism is recognized, at 20.8% (i.e. 05 households).

As stated in the 2016 socio-economic report of Huong Linh commune, the communal People's Committee granted certificate for a group of Protestants in Miet village to gather for religious purposes. Accordingly, Protestantism seems to be the increasing religion tendency in the area.

Table 9.9 Religion of the surveyed households

Religion	Number	Percentage (%)
Non-religion	19	79.2%
Protestantism	5	20.8%
Total	24	100%

Source: Socio-economic survey conducted by ERM, 2018

Education

The survey found that the education level of the surveyed population is quite low (as

Table ***9.10****)*. The numbers of people whose education level either at primary or secondary are at 29% and 31%, respectively, making up a total high proportion of 60%.

The illiteracy rate in the surveyed population is nearly 12% (i.e. 15 out of 126 people). The number of people who have or are undertaking intermediate and university level education is limited (3.2% in total).

The students in the surveyed area are reportedly facing many difficulties. These include low income and other financial pressure, as well as long distance from the surveyed area to the high schools (i.e. 25 – 35 kilometres to the high schools in Khe Sanh town or Huong Phung commune), which perpetually hinder them from getting to higher education levels. A relatively high proportion of secondary students would cease their study after graduation and some would give up halfway even when they are pursuing high-school levels.

Table 9.10 Education Levels of People of the Surveyed 24 Households

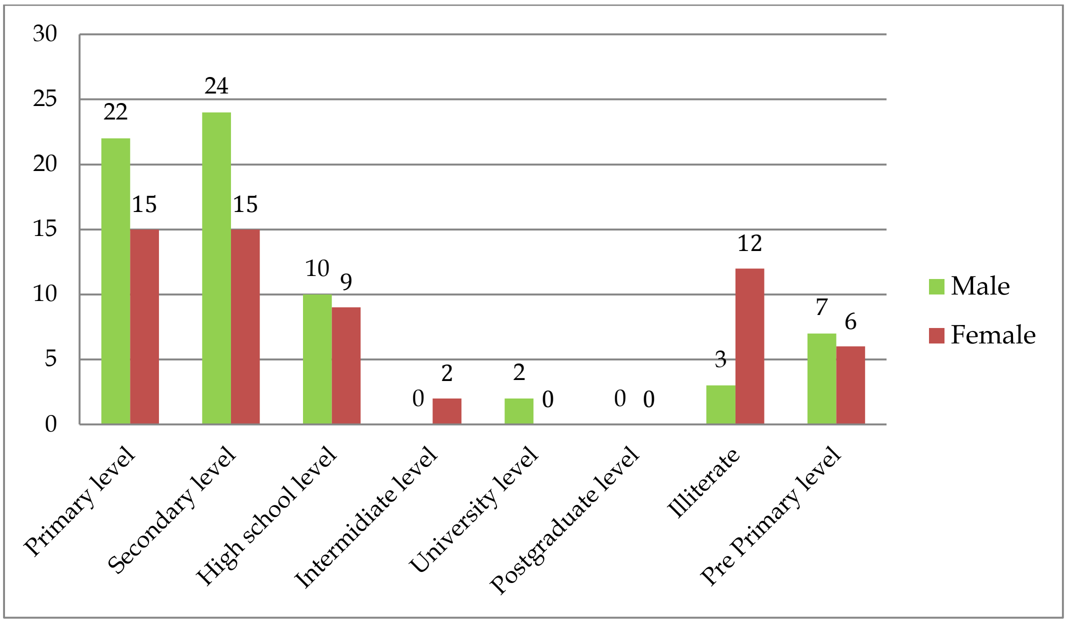
Educational attainment	Gender				Total	
	Male		Female			
	Number	%	Number	%	Number	%
Primary level	22	32.8%	15	25.4%	37	29.4%
Secondary level	23	34.3%	15	25.4%	38	30.2%
High school level	10	14.9%	9	15.3%	19	15.1%
Intermediate level	0	0.0%	2	3.4%	2	1.6%
University level	2	3.0%	0	0.0%	2	1.6%
Postgraduate level	0	0.0%	0	0.0%	0	0.0%
Illiterate	3	4.5%	12	20.3%	15	11.9%
Pre-school level	7	10.4%	6	10.2%	13	10.3%
Total	**67**	100%	**59**	100%	**126**	100%

Source: Socio-economic survey conducted by ERM, 2018.

Gender analysis, as shown in the Figure 9.31 below, for the surveyed sample demonstrates that males outnumber females from primary to high-school levels, with respectively ratios of 22/15, 23/15, and 10/9. However, it is noted that this might be due to the disproportion in male and female in young age. However, the distribution is equal between the two genders at tertiary levels, with a 2/2 ratio.

Notably, the number of females identified as illiterate is 4 times greater than the male counterparts (12 females versus 3 males).

Figure 9.31 Education Level of Male and Female from 7 Years Old in the 24 Surveyed Households



Source: Socio-economic survey conducted by ERM, 2018

Livelihoods

Table 9.11 shows the proportions of major livelihoods of the people within working age (18-60) in 24 surveyed households. The people in the surveyed households are engaging in two major livelihoods, which are agriculture-based (56.9%) and forest-based (12.3%). Within agriculture-based livelihoods, crop cultivation (i.e. cassava, upland and paddy rice) is more dominant (44.6%) compared to animal husbandry (12.3%). This proportion is homogeneous across the three villages (Hoong village, Cooc village and Miet village. However in Miet village, the gap between crop cultivation and husbandry is very big, with 55.6% versus 7.4%.

Table 9.11 Proportions of Major Livelihoods of the Adult People within the 24 Surveyed Households (only villagers aged 18 - 60)

	Livelihoods												
Village	Farmers (Planting)	Farmers (Husbandry)	Forestry	Hunting	Small-scale business	Handicraft worker	Gov. employee	Factory worker	Seasonal worker	Student	Retired	Unemployed	N

Cooc	38.7%	16.1%	16.1%	0.0%	0.0%	6.5%	3.2%	3.2%	0.0%	9.7%	0.0%	6.5%	31
Miet	55.6%	7.4%	7.4%	0.0%	3.7%	0.0%	3.7%	0.0%	3.7%	7.4%	0.0%	11.1%	27
Hoong	28.6%	14.3%	14.3%	0.0%	0.0%	0.0%	28.6%	0.0%	0.0%	14.3%	0.0%	0.0%	7
Total	**44.6%**	**12.3%**	**12.3%**	**0.0%**	**1.5%**	**3.1%**	**6.2%**	**1.5%**	**1.5%**	**9.2%**	**0.0%**	**7.7%**	**65**

Source: Socio-economic survey conducted by ERM, 2018

In Cooc village, higher proportion of people reported that forestry is their principle source of income (16.1%), which is higher than those in Miet village (9.1%) or Hoong village (10.0%).

The surveyed households in Cooc village has the same percentage of livelihood for husbandry and forestry, with 16.1%. This pattern also occurs in Miet village and Hoong village, with 7.4% and 14.3% respectively.

Small proportions of surveyed people engage in other livelihoods such as governmental officers or handicraft workers (i.e. 6.2% and 3.1%, respectively). There are also only one person who is engaging in small business, one factory worker and one seasonal worker, with proportion all below 1.5%.

There are 6 people who are students, and they are from the three villages, making up a total percentage of 9.2% of all the surveyed household members.

In terms of unemployment, it was recognized that 7.7% of the surveyed household members do not have a job. They are mainly adolescences who dropped out the school and are staying at home, helping their parents in doing housework, reclaiming lands, planting crops or do livestock grazing. Amongst these five unemployed people there is one person who has had a serious accident and is disabled..

There is no hunting or retired people in the surveyed group.

Table 9.12 shows the total amount of cultivation land that the surveyed households in Cooc village, Miet village and Hoong village possess as well as total production capacities from different crops. Regarding land ownership, the survey results reveal that apart from residential land, most of the surveyed households also own other types of land including garden, agriculture and forest. Table 9.12 reflects the area and productivity of the major crops that the surveyed households are cultivating. It was noted that the areas for acacia and cassava are dominant with a total areas of 25 ha and 17.6 ha, respectively, followed by *Litsea glutinosa* (boi loi) and rice (both upland and paddy) with 11.15 ha and 7.5 ha, respectively.

However, as indicated by the survey, cassava, though the average productivity is much lower than the communal average (14.15 ton/ha versus 17 ton/ha[1]), it is currently the major source of income for the families. This is because most other plantations, for instance acacia, *Litsea glutinosa* (boi loi) are long term species and are currently only 2-3 year old and thus, the households have to wait for several years to get the full harvest capacity. It was also reported that some households could sell some of the products from these perennial crops, but the earning is not stable and is at low rates. Most of the

[1] Huong Linh CPC's 2016 socio-economic report

surveyed households reported that they sell all their harvested cassava for family expenditure and reinvestment of production while upland and wet rice production is for self-consumption.

Rice is cultivated in both upland and lowland, and is often stocked by the families after crops for their daily consumption. The rice's average productivity of the surveyed households is 2.82 ton/ha, slightly higher than the communal average of 2.24 ton/ha[1] for paddy rice in 2016.

Some other plants such as *vernicia montana* (trau) or coffee are also planted, but the cultivated areas recorded are still small.

Table 9.12 Area and productivity of crops cultivated by the surveyed households

Crop	Village							
	Cooc (N=10)		Miet (N=10)		Hoong (N=4)		TOTAL (N=24)	
	Area (m2)	Productivity (kg)	Area (m2)	Productivity (kg)	Area (m2)	Productivity (kg)	Area (m2)	Productivity (kg)
Cassava	85,000	161,000	61,000	71,000	30,000	17,000	176,000	249,000
Rice	22,000	8,900	27,500	4,500	25,500	7,750	75,000	21,150
Acacia	70,000	N/A	50,000	N/A	130,000	N/A	250,000	N/A
Litsea glutinosa (Boi Loi)	32,500	N/A	79,000	N/A	0	N/A	111,500	N/A
Vernicia/ Coffee/others	10,000	N/A	3,000	N/A	0	N/A	13,000	N/A
TOTAL	**219,500**	**169,900**	**220,500**	**75,500**	**185,500**	**24,750**	**625,500**	**270,150**

Source: Socio-economic survey conducted by ERM, 2018.

Table 9.13 shows the number of livestock owned by the surveyed households at the time of the survey. Although animal husbandry is not a major income-generation source in the area, the types of animals/livestock raised by the households are relatively diverse.

In the three villages, the number of buffalo and cow per household is more than 1.2 livestock/ household, reflecting their preference of animal husbandry and used for agriculture activities (such as ploughing and transportation). Chicken, goats, pigs, and ducks are also raised in the area but at modest scales.

Table 9.13 Number and types of livestock owned by the surveyed households at the time of the survey

Livestock	Village							
	Cooc (N=10)		Miet (N=10)		Hoong (N=4)		TOTAL (N=24)	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%
Buffalo	10	29%	14	8%	4	4%	28	9%
Cow	3	9%	16	9%	10	11%	29	10%

[1] Huong Linh CPC' 2016 socio-economic report

Chicken	18	53%	129	73%	21	24%	168	56%
Goat	2	6%	10	6%	39	44%	51	17%
Pig	1	3%	7	4%	7	8%	15	5%
Duck	0	0%	0	0%	8	9%	8	3%
Total	**34**	**100%**	**176**	**100%**	**89**	**100%**	**299**	**100%**

Source: Socio-economic survey conducted by ERM, 2018

In total, the number of livestock is higher in Miet village, with 176 animals in 10 families, mainly due to its higher number of chicken. However, it is noted that Hoong villagers have a more developed husbandry system with 04 surveyed families owning up to 89 animals of all types, including a total of 14 buffalo and cow, which are considered high value livestock.

9.7.2 *Household Income and Expenditure*

Income

Table 9.14 shows the monthly average income of 24 surveyed households calculated from the questionnaires. In total, the average income per month of the 24 surveyed households is 3,699,000 VND. In the 24 surveyed households, up to 41.7% have a monthly income rate below 2 million VND per month; while the percentages of households with income rates of from 2 to 5 million VND and 5 to 8 million VND are the same, at 20.8%. Three households have the income in between 8 and 12 million VND/month (i.e. 12.5%) and only 1 households reported their monthly income surpass 12 million VND (i.e. 4.2%).

Table 9.14 Monthly Average Income of 24 Surveyed Households

Total household income per month (VND 1,000)	**Village**						**Total (N=24)**	
	Cooc (N=10)		**Miet (N=10)**		**Hoong (N=10)**			
	Number	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**
<=2,000	2	20.0%	7	70.0%	2	50.0%	10	41.7%
2,000 - < 5,000	4	40.0%	0	0.0%	1	25.0%	5	20.8%
5,000 - < 8,000	2	20.0%	3	30.0%	1	25.0%	5	20.8%
8,000 - < 12,000	1	10.0%	0	0.0%	0	0.0%	3	12.5%
>= 12,000	1	10.0%	0	0.0%	0	0.0%	1	4.2%
Total	10	100.0%	10	100.0%	4	100.0%	24	100.0%

Source: Socio-economic survey conducted by ERM, 2018.

The monthly average income of the surveyed households in Cooc village, with 4,942,000 VND/household, is higher than the other two villages while that of Miet village is the lowest, with an average of 2,717,000 VND/household. This is because three interviewed households have much higher incomes compared to the rest seven households. Cooc village also has the highest minimum and maximum monthly household income rates (i.e. 933,000 VND and 12,167,000 VND).

Miet village has more households with monthly income below 2 million VND (i.e. 7 households) and no household with monthly income surpass 8 million VND. Cooc village has more households who earn more than 5 million VND/month than the other villages and amongst them there are 2 households earning more than 8 million VND/month.

Table 9.15 Monthly Average Income of the 24 Surveyed Households

Village	Monthly Average Income ('000 VND/ household)	Monthly Average Income per capita (000 VND)	Minimum Monthly Household Income ('000 VND)	Maximum Monthly Household Income ('000 VND/
Cooc (N=10)	4,942	932	933	12,167
Miet (N=10)	2,717	513	708	7,625
Hoong (N=4)	3,049	718	492	6,918
Total (N=24)	3,699	705	492	12,167

Source: Socio-economic survey conducted by ERM, 2018

The rate of households who have poor household certificate (issued by local government for households that have special economic difficulty) are quite high in the surveyed groups, with 60% in Cooc village and 50% in Miet village, roughly close to that of the commune's of 65.82%[1]. No poor-household is found within the 04 surveyed households in Hoong village.

When asked whether their income has been stable for the last 3 years, as many as 12 households or 50% told "yes". However, it seems that this confirmation need to be further explored, given the expenditure situation presented in the ***Section 9.7.4.***

Table 9.16 Monthly Average Income by sources of income of the 24 Surveyed Households

Item/Village	Cooc (N=10)		Miet (N=10)		Hoong (N=4)		TOTAL (N=24)	
	'000 VND per HH/ month	%	'000 VND per HH/ month	%	'000 VND per HH/ month	%	'000 VND per HH/ month	%
Crop cultivation	1,862	37.7%	678	24.9%	589	19.3%	**1,156**	31.3%
Husbandry	656	13.3%	232	8.5%	817	26.8%	**506**	13.7%
Small business	300	6.1%	600	22.1%	-	0.0%	**375**	10.1%
Salary-based employment	1,457	29.5%	500	18.4%	1,638	53.7%	**1,088**	29.4%
Seasonal employment	66	1.3%	388	14.3%	6	0.2%	**190**	5.1%
	600	12.1%	321	11.8%	-	0.0%	**384**	10.4%

[1] Huong Linh CPC's 2016 socio-economic report

Others								
TOTAL	**4,942**	100%	**2,717**	100%	**3,049**	100%	**3,699**	100%

Source: Socio-economic survey conducted by ERM, 2018.

For the total 24 surveyed households, crop cultivation, salary-based employment, and husbandry are the three major sources of their monthly average income, with 31.3%, 29.4% and 13.7%, respectively.

In both Cooc and Miet village, crop cultivation is the highest source of income for the surveyed households, with 37.7% and 24.9%, respectively; while salary-based employment and husbandry contribute the most percentage of income for the surveyed households in Hoong village, at 53.7% and 26.8% respectively.

In Cooc village, the second contributor to the surveyed household's monthly average income is salary-based employment with 29.5%, followed by husbandry with 13.3%. Income from business or seasonal employment is very low, at 6.1% and 1.3% respectively.

In Miet village, the share of income sources of the surveyed households is relatively balance between crop cultivation (i.e. 24.9%) and small business (i.e. 22.1%). However, only two households are earning income from doing small business, while 80% of the total surveyed households are living on crop cultivation.

In Hoong village, salary-based employment was the highest income contribution to the surveyed households with 53.7%, and husbandry is the second-largest contributor with 26.8%. Crop cultivation only account for 19.3% of the surveyed households' monthly average income.

10.4% of the total monthly average income of the households are from other sources, such as allowances from forest protection or part-time job for the commune authority.

Expenditure

Table 9.17 and Table 9.18 present average monthly expenditure of the surveyed households. The result of survey shows that the expenditures of many households exceed their income. In the survey, 12 out of 24 households (50%) are identified as having monthly expenditure higher than monthly income. For the rest 12 households, up to seven households have monthly income-expenditure balance below 4 million VND.

Food, community activities, transportation, education, and production reinvestment are the highest expenditure categories of the surveyed households. In the last 12 months, four households had to sell their assets (i.e. buffalo or cow), two households had to borrow money from relatives, and nine households were reported to have loans from the banks to compensate for the variation.

Table 9.17 Average Expenditures per Household by types of expenditure

Items/Ward& Communes	Cooc million VND per household/ month	Cooc %	Miet million VND per household/ month	Miet %	Hoong million VND per household/ month	Hoong %	Total million VND per household/ month	Total %
Food and daily commodities	1,357	35.2%	724	21.4%	1,763	31.8%	1,161	29.5%
Clothes, communities and entertainment	967	25.1%	815	24.1%	438	7.9%	815	20.7%
Energy	122	3.2%	131	3.9%	76	1.4%	118	3.0%
Transportation (motorbikes)	299	7.8%	564	16.7%	954	17.2%	519	13.2%
Communication	162	4.2%	105	3.1%	193	3.5%	143	3.6%
Financial expenditure (debt interest payment)	145	3.7%	256	7.6%	598	10.8%	266	6.8%
Education	197	5.1%	459	13.6%	599	10.8%	373	9.5%
Health care	38	1.0%	108	3.2%	27	0.5%	65	1.7%
Unexpected serious health issue	***150***	***1.5%***	***217***	***5.9%***	***4***	***0.1%***	***153***	***2.3%***
House construction/rennovation	***5,958***	***59.8%***	***58***	***1.6%***	***417***	***7.0%***	***2,576***	***38.6%***
Inputs for family-need production (tools and materials)	569	14.8%	222	6.6%	899	16.2%	479	12.2%
Others	-	0.0%	25	0.7%	-	0.0%	10	0.3%
Total expenditures per household (without unexpected health issue and house construction/renovation)	3,855	100%	3,383	100%	5,545	100%	3,940	100%
Total expenditures per household	9,964		3,683		5,966		6,680	
Total income per household	4,942		2,717		3,049		3,699	

Source: Socio-economic survey conducted by ERM, 2018.

Table 9.18 Monthly Average Expenditure of the 24 Surveyed Households

Ward/	Monthly Average Expenditure ('000 VND/	Monthly Average Expenditure per capita ('000 VND)	Minimum Monthly Household Expenditure ('000 VND)	Maximum Monthly Household Expenditure ('000 VND/
Commune				
Cooc (N=10)	3,855	727	675	9,589
Miet (N=10)	3,383	609	530	8,495
Hoong (N=4)	5,545	1,305	735	14,815

Total (N=24)	3,940	752	530	14,815

(Note: table does not include unexpected expenditures that cover unexpected serious health issue and house constructions/renovations)

Source: Socio-economic survey conducted by ERM, 2018.

There are seven households reportedly spending money to build or renovate their house in the last 12 months, with expenditure ranging from 5 million VND up to 500 million VND for a household. In addition, four households cited that within the last 12 months, their family had to spend some money on treatment for serious medical problem, with expenses ranging from 3 million VND to 18 million VND. These expenditures are highlighted in items of "*Unexpected serious health issue*" and "*House construction/renovation*" in the ***Table 9.17*** above. Since these expenditures are unexpected or not regular on a monthly basis, they are not listed in the *Table 9.19* below on average household expenditure per month.

Table 9.19 Monthly Expenditure of the Surveyed Households

(Excluded house renovation/construction and sudden expenditure (serious medical treatment or accident) in the last 12 month)

Total Monthly Expense (VND 1,000)	Village						Total (N=24)	
	Cooc (N=10)		Miet (N=10)		Hoong (N=4)			
	Number	%	Number	%	Number	%	Number	%
<=2,000	4	40,0%	4	40,0%	2	50,0%	10	41,7%
2,000 - < 5,000	3	30,0%	4	40,0%	1	25,0%	8	33,3%
5,000 - < 8,000	2	20,0%	1	10,0%	0	0,0%	3	12,5%
8,000 - < 12,000	1	10,0%	1	10,0%	0	0,0%	2	8,3%
>= 12,000	0	0,0%	0	0,0%	1	25,0%	1	4,2%
Total	10	100,0%	10	100,0%	4	100,0%	24	100,0%

Source: Socio-economic survey conducted by ERM, 2018.

9.7.3 Land, Housing and Public Facility Accessibility

Land

Almost every surveyed household own the land use right certificates (LURC) for residential, garden, agriculture and forest land, with the percentage of 83%, 50%, 92% and 95.8%, respectively. In Cooc village, there are two households who have residential land but are under requesting for obtaining their LURCs from the authority and one household is living on their parent's land. There is one household in this village do not engage in any of agriculture-based livelihood since the family engage in other work (i.e. carpenter and tailor). A household in Hoong village is also living on their parent's land. In Miet village, one household is doing small business (i.e. grocery store) and does not do any agricultural activity. (See Table 9.20).

Table 9.20 Land Use Right among the Surveyed Households

Village	Residential		Garden		Agriculture		Forrest	
	Type of land							
	Number	%	Number	%	Number	%	Number	%
Cooc (N=10)	7	70%	4	40%	9	90%	10	100%
Miet (N=10)	10	100%	8	80%	9	90%	9	90%
Hoong (N=4)	3	75%	0	0%	4	100%	4	100%
Total	***20***	**83%**	***12***	**50%**	**22**	**92%**	**23**	**95.8%**

Source: Socio-economic survey conducted by ERM, 2018.

Notably, some of the rice fields of the households are scattered and intermixed with the other households'. It should be noted that some respondents are quite vague about the area or type of land that they have (i.e. they could not separate residential land and garden land), contributing into the fluctuation of the statistics on land use right ownership. Accordingly, residential land and garden land is combined in the flowing Table 9.21 below.

Table 9.21 Land Ownership among the Surveyed Households by Types

Village	Area of land (m2)								
	Residential and Garden			Agriculture			Forrest		
	Certified	Uncertified	Total	Certified	Uncertified	Total	Certified	Uncertified	Total
Cooc (N=10)	12,473	16,900	***29,373***	14,000	106,000	***120,000***	62,000	139,000	***201,000***
Miet (N=10)	61,200	50,000	***111,200***	47,130	77,700	***124,830***	65,500	125,000	***190,500***
Hoong (N=4)	6,000	20,000	***26,000***	31,500	500	***32,000***	70,000	80,000	***150,000***
Total	79,673	86,900	***166,573***	92,630	184,200	***276,830***	197,500	344,000	***541,500***

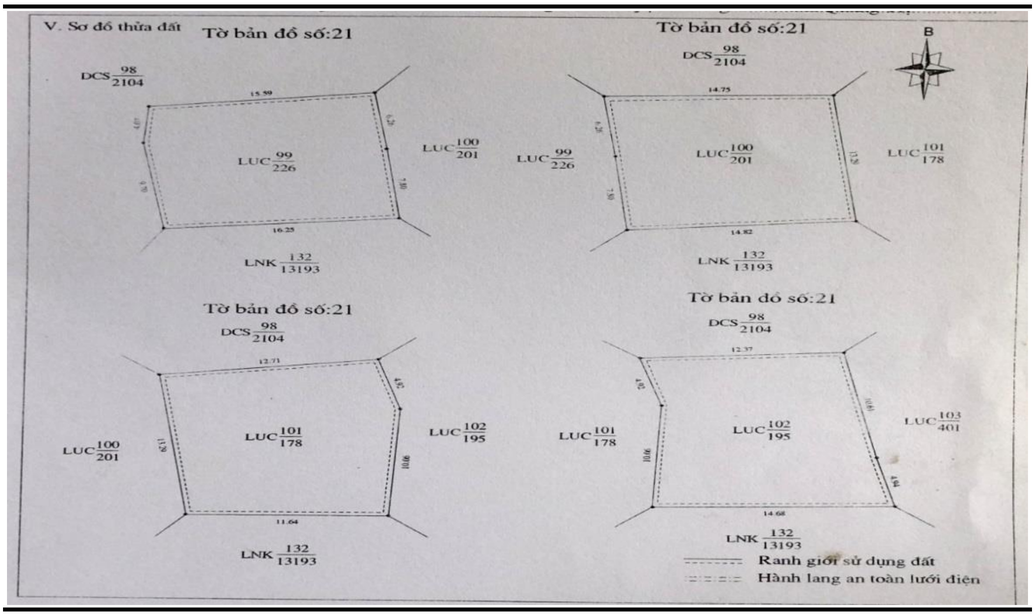
Source: Socio-economic survey conducted by ERM, 2018.

However, Table 9.21 presents the type of lands and types of ownership of the LURC for their land. The 10 surveyed households in Miet village have the highest total area of certified residential and garden, and agriculture land; while those in Hoong village champions the total area of certified forest land (7 ha), even they are only 4 households.

Forest land takes the highest proportion, with 54.15 ha, in the area of land of which all the surveyed households in the 3 villages have their LURC. As Table 7.14 in the previous section also suggests, nearly half of this area (i.e. 25 ha) is used by the households to plant acacia.

It is found that 24 surveyed households own about 27.9 ha of agriculture land (both certified and uncertified) and they used nearly 90% of this land to plant cassava and rice (17.6 ha for cassava and 7.5 ha for rice, see Table 9.21).

Figure 9.32 A map of certified agricultural lands of a household



For the households in Miet village, after the resettlement in 2006 for the construction of Rao Quan hydropower plant, most of the villagers were entitled with residential, garden, agriculture and forest lands, as a compensation for their displacement.

7.7.2.1 Housing

The typical house type of the surveyed area is stilt house which is made of either wood or concrete (as illustrated in *Figure 9.33* and *Figure 9.34*). Among 24 surveyed households, 9 households or 37,5% are living in wooden stilt houses, and 15 households or 62,5% are living in concrete stilt houses. Statistics are provided in the *Table 9.22* below.

Table 9.22 Number of Different Types of Houses Owned by the Surveyed Households

Commune	Wooden house		Concrete house		Total
	Original	Reallocated	Original	Reallocated	
Cooc	6	0	4	0	10
Miet	0	0	0	10	10
Hoong	3	0	1	0	4
Total	**9**	**0**	**5**	**10**	**24**

Source: Socio-economic survey conducted by ERM, 2018.

In the case of Miet village, 100% of its surveyed households (i.e. 10 households) are now living in a reallocated concrete stilt house provided by the resettlement project for the construction of Rao Quan hydropower plant project 12 years ago (i.e. in 2006).

Figure 9.33 A wooden house on stilts, a Typical House Type in the Studied Area

Source: Socio-economic survey conducted by ERM, 2018

Figure 9.34 A concrete house on stilts, a typical house type in Miet village

Source: Socio-economic survey conducted by ERM, 2018

9.7.4 House assets

Electricity is widely accessible in the area; however, there is still one household that did not have electricity for the past 8 years as they could not afford for the electricity expenses. Although the survey found that 62.5% of households have separate toilet, observation and additional information indicated that the conditions of their toilets are quite poor. The majority of toilets are simply home-constructed from the natural materials that the household owners collected from the surrounding environments. Table 9.23 shows main assets owned by the surveyed households. ….

On average, the number of motorbike per household is more than 1.12 unit/households, mobile phone 1.54, furniture (bed and wardrobe) 1.95. Not every household own a television, with a ratio of 0.79 unit/household. Six out of 24 households are using a fridge, or 25%. Only two households have a computer, making 0.08%. No car owner is recorded in the area.

Table 9.23 Number of Different Household Asset Items Owned by the 65 Surveyed Households

Household assets	Commune							
	Cooc (N=10)		Miet (N=10)		Hoong (N=4)		Total (N=24)	
	Availability/ Quantity	%	Availability/ Quantity	%	Availability/ Quantity	%	Availability/ Quantity	%
Electricity	10	100.0%	10	100.0%	3	75.0%	23	95.8%
Separate WC	5	50.0%	6	60.0%	4	100.0%	15	62.5%
Motorbike	12	90.0%	10	80.0%	5	75.0%	27	83.3%
Car	0	0.0%	0	0.0%	0	0.0%	0	0.0%
TV (color)	9	90.0%	8	80.0%	2	50.0%	19	79.2%
Fridge	2	20.0%	3	20.0%	1	25.0%	6	20.8%
Computer	1	10.0%	0	0.0%	1	25.0%	2	8.3%
Mobile phone	18	100.0%	11	70.0%	8	100.0%	37	87.5%
Furniture	9	50.0%	29	100.0%	9	75.0%	47	75.0%

Note: Some households have more than one asset.
Source: Socio-economic survey conducted by ERM, 2018

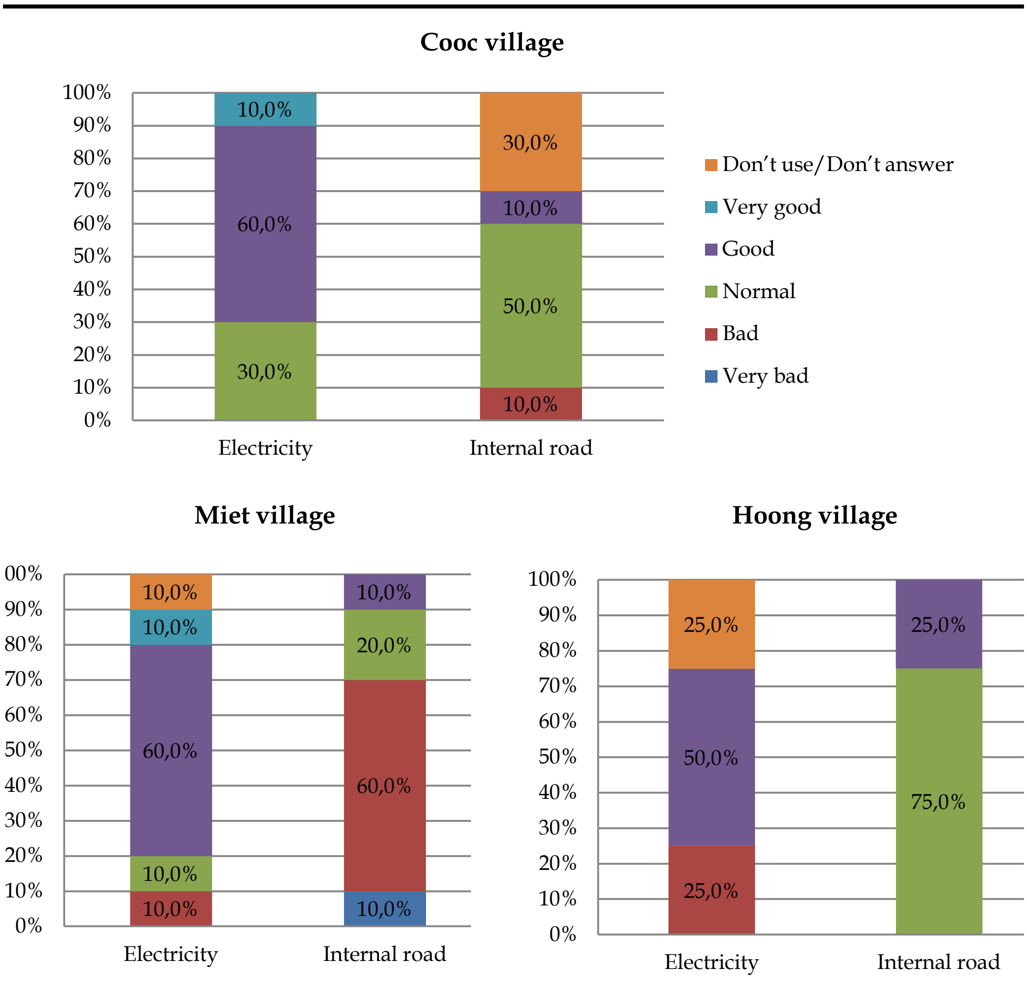
9.7.5 *Public Facility*

Public Facility Accessibility

The survey has conducted evaluation of local people on the conditions of three aspects including infrastructure, medical and healthcare, and education. Based on the engagement with the local authority and community during the survey, the Project has supported the construction and repair of some public facilities such as the construction of community play ground (used for community activities), the repair of cultural houses of Hoong and Cooc villages.

Basically, the infrastructure in the area is quite limited in terms of the availability as well as the accessibility. Overall, electricity is generally assessed by nearly 60% of surveyed people. Meanwhile, villages' internal road system was not highly graded especially in the case of Miet village as 60% households mentioned that some parts of the internal roads in the villages are currently in bad conditions (despite the fact that these roads have been recently constructed). Furthermore, roads are generally damaged, muddy and covered with thick dirt that are extremely difficult to make travelling or transportation in the rainy season. Also, there is no tap water available in the area, therefore, local people have to seek water from different sources including dug wells or drilled well, piped water from local stream/spring or rainwater (i.e. in rainy season only) for drinking and daily usage. Most of the respondents said that the water is "clean and drinkable "and they have not had any problem using it.

Figure 9.35   Evaluation on Infrastructure among the Surveyed Sample

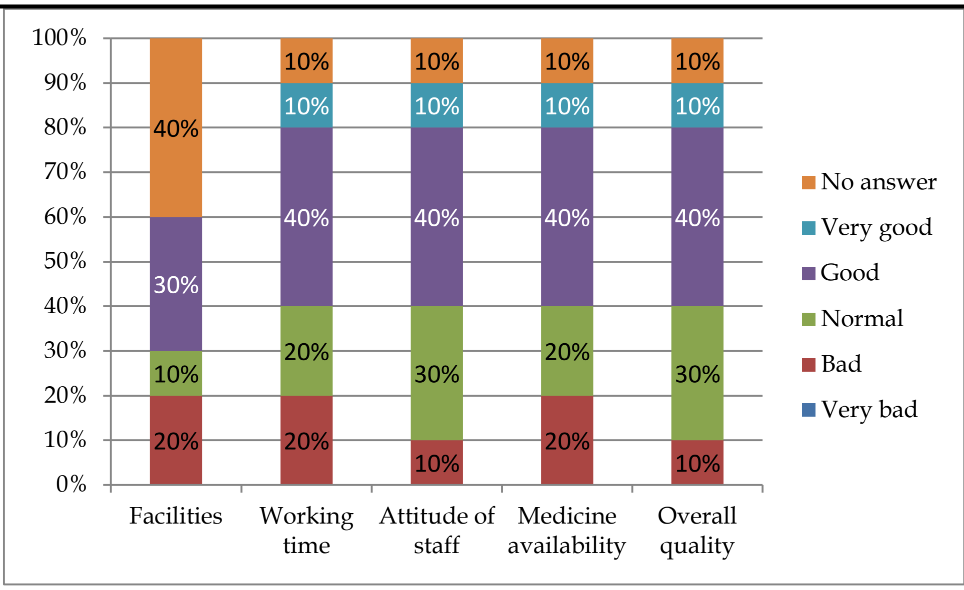


Source: Socio-economic survey conducted by ERM, 2018

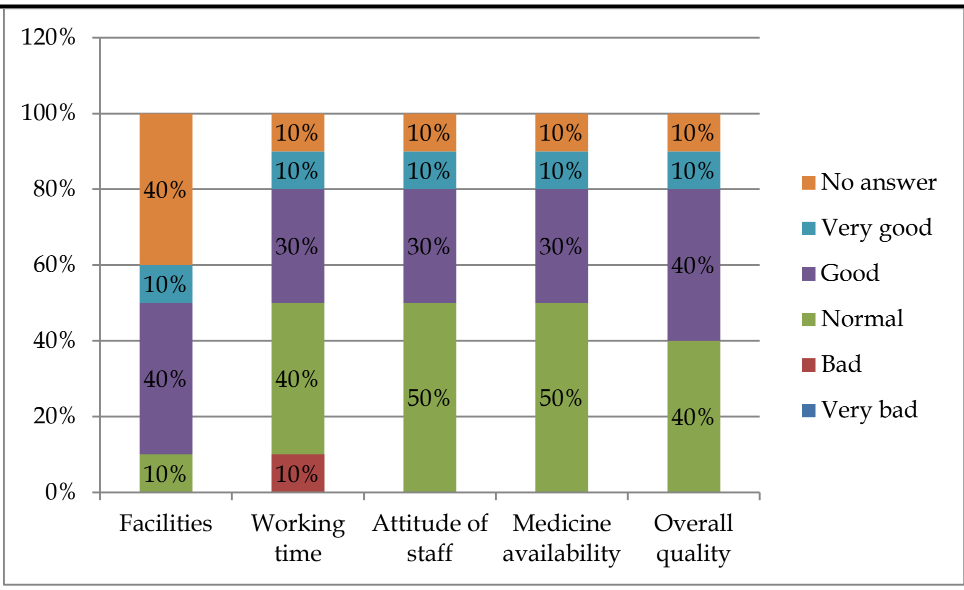
Medical services and infrastructure

For medical and healthcare services, all surveyed household have been in the commune clinic at least once in the last 12 months, 20% household visited a district hospital once and another 20% went to provincial and national hospitals. In all, 75% interviewees ranked the medical conditions from normal to good.

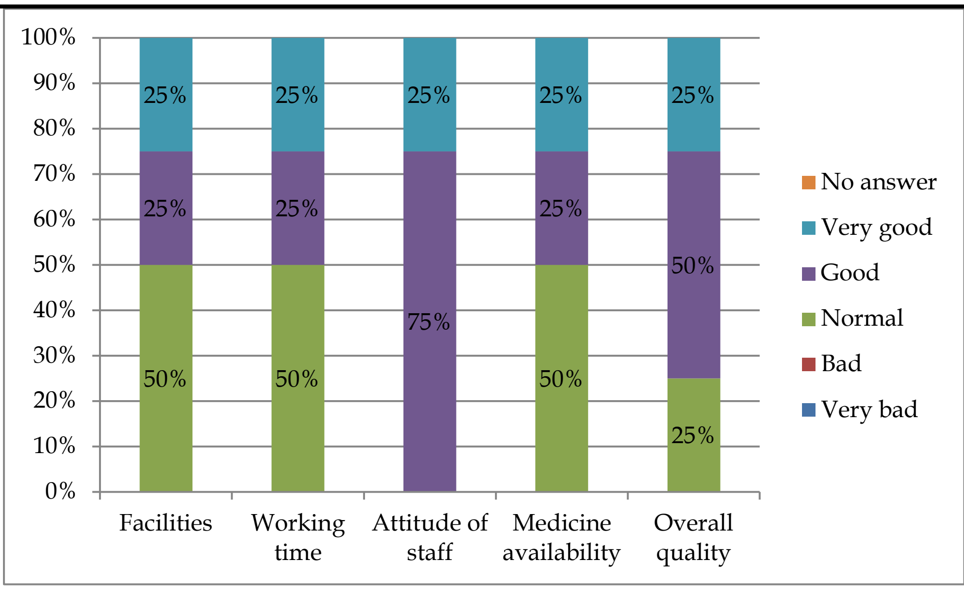
Figure 9.36 Evaluation on the Medical conditions



Cooc village



Miet village



Hoong village

Source: Socio-economic survey conducted by ERM, 2018

Educational services and infrastructure

On education, nearly 80% surveyed household of all three villages evaluated education from normal to good.

However, roads to school showed to be an issue within these communities, as both in Cooc and Miet villages, with 30% to 60% interviewees respectively assessed them as 'bad'. This result is well related to the evaluations of infrastructure on internal roads previously. It suggests that improving of road system in the area seems to be important in providing access to education.

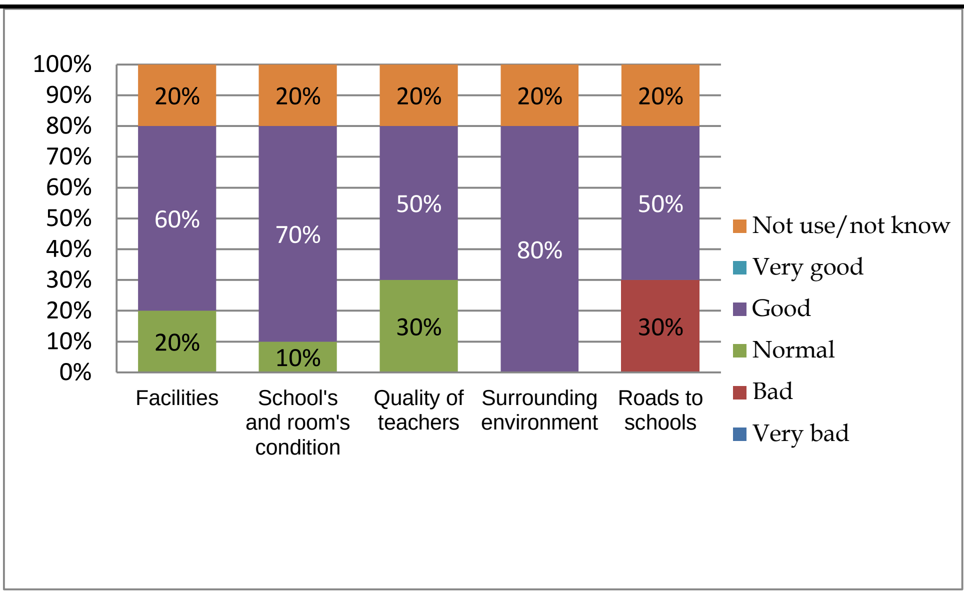
Other criteria including "facilities", "school's and room's condition", "quality of teachers" and especially "surrounding environment" received a good evaluation from the 24 respondents.

In Miet villager, about 10% of respondents gave negative evaluation on "facilities", "school's and room's condition" and "surrounding environment" of the local educational infrastructure.

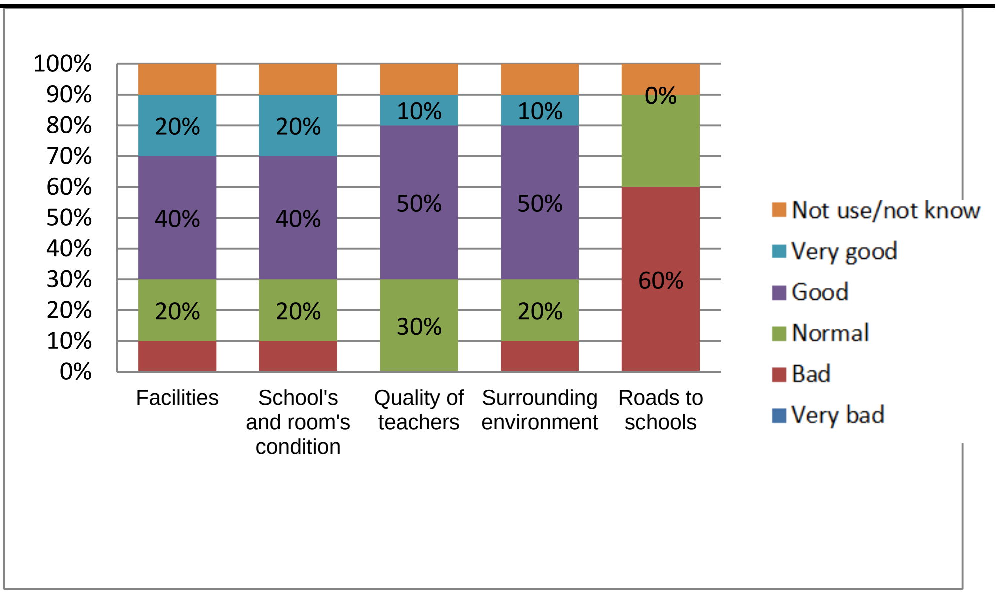
For Hoong villagers, all the respondents rate all the criteria either "good" or "very good".

20% of the respondents in Cooc village and 10% in Miet village did not answer since the households do not have any children attending the local schools.

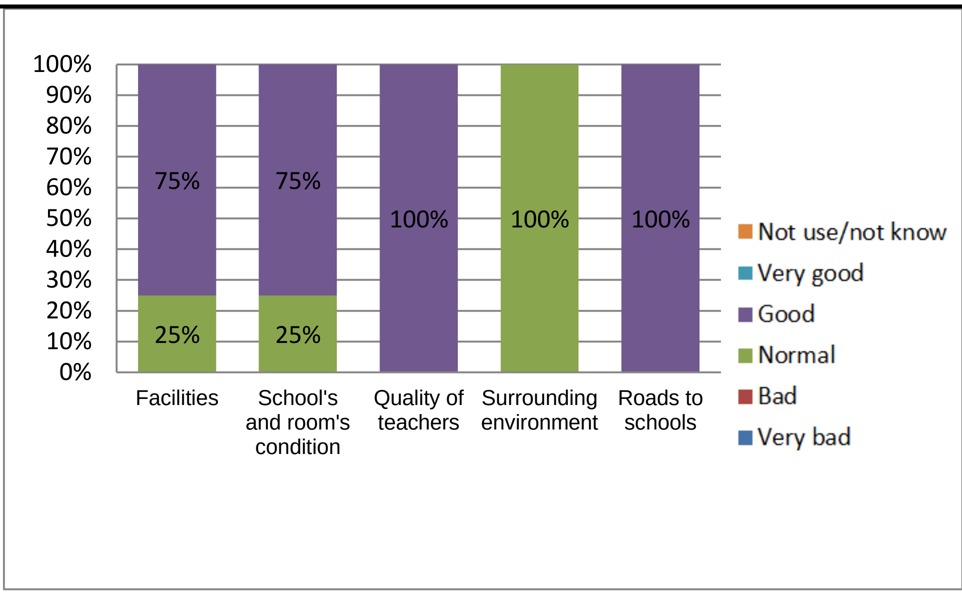
Figure 9.37 Evaluations on education



Cooc village



Miet village



Hoong village

Source: Socio-economic survey conducted by ERM, 2018

Cooking energy

100% surveyed households use woods for cooking, which can be collected from the nearby forests or in their gardens. There are only two households use electricity and gas as additional sources of energy for cooking.

Health issues

Table 9.24 below details the health issues of the surveyed households in the three villages. In the last 12 months, people in Huong Linh mostly caught flu with 32 recorded cases in our survey. 100% household s surveyed contracted flu either by the household head or one of the members in the families. The percentages of household that have at least one member contracted with flu last year were 60% and 80% respectively for Cooc and Miet communes. A small number of households have problems with non-infectious and behavioural diseases. There are several cases of other diseases including kidney failure, headache and backache that occurred in 7 out of 24 surveyed households.

Table 9.24 Diseases Suffered by Family Members among Surveyed Households over 12 Months

Diseases that family member suffer	Village						Total (N=24)	
	Cooc (N=10)		Miet (N=10)		Hoong (N=4)			
	Number of cases	% of surveyed households	Number of cases	% of surveyed households	Number of cases	% of surveyed households		
1. Communicable diseases								
Flu	11	60%	14	80%	7	100	32	75%
Measles	0	0	1	10%	0	0	1	4,2%
Tuberculosis	0	0	0	0	0	0	0	0

Dengue fever	0	0	0	0	0	0	0	0
Sexual transmitted diseases (HIV…)	0	0	0	0	0	0	0	0
2. Non-communicable diseases								
Diabetes	0	0	0	0	0	0	0	0
Hypertension	0	0	0	0	0	0	0	0
Heart disease	1	10%	1	10%	0	0	2	8,3%
Osteoporosis	0	0	0	0	0	0	0	0
3. Other diseases due to the lifestyle								
Lung cancer (smoking)	0	0	0	0	0	0	0	0
Mental health issues	0	0	1	10%	0	0	1	4,2%
Addiction to alcohol	0	0	0	0	0	0	0	0
Liver diseases (alcohol abuse)	2	10%	0	0	0	0	2	4,2%
4. Other diseases	4	30%	3	30%	0	0	7	20,8 %

Note: some household have more than one case
Source: Socio-economic survey conducted by ERM, 2018.

Table 9.25 Diarrhea within a month of surveyed households by communes

Cases/ Communes	*No infection*		*Once*		*Twice*	
	Number	***%***	***Number***	***%***	***Number***	***%***
Cooc	8	80	1	10	1	10
Miet	6	60	3	30	1	10
Hoong	4	100	0	0	0	0
Total	**18**	**75%**	**4**	**16,7%**	**2**	**8,3**

Source: Socio-economic survey conducted by ERM, 2018

Although having used the water from the ground, a very low percentage of households reported to have problem with diarrhea within a month from January 23, 2018. 75% of the surveyed households confirmed that they did not record any case in their families within 30 days at the time of the survey. Only 16.7% of households reported to be infected once and only 8.3% said they were in that situation twice, as showed in *Table 9.25*.

Traditional methods to treatment health problems

In parallel with using modern medicines, many households in the three villages are still resort to traditional methods to treat their health issues. *Table 9.26* shows that roughly 50% of the surveyed households do so. This proportion is homogeneous across the 3 villages.

Table 9.26 Households using traditional methods to treat health problems

Households using traditional methods to treat health problems	Village						Total (N=24)	
	Cooc (N=10)		Miet (N=10)		Hoong (N=4)			
	Number	%	Number	%	Number	%	Number	%
Yes	5	50%	6	60%	2	50%	13	54%
No	5	50%	4	40%	2	50%	11	46%
Total	10	100%	10	100%	4	100%	24	100%

Source: Socio-economic survey conducted by ERM, 2018

Many of the respondents reported that their families have many times asked for help from the local "fortune tellers" or "monks" (or "Thay Mo" in Vietnamese) when having sickness or being wounded, such as red eyes, snake bites, abdominal pain, headache, boils, dysentery, broken bones, and bleeding wounds. In the function, Thay Mo will diagnose the sickness and practice the medical blowing (see more in Chapter 9) on the patients.

Some respondents also cited that they have used some local medicinal herbs to cure some sicknesses of the adults, babies as well as improve the health for post-pregnancy women.

Actually, most of the respondents told that their families are drinking a kind of herb tea include a local root as their daily water. They believe it would keep them healthy.

9.7.6 *People's acknowledgment of the project*

The survey found that not many people are informed of the Project (Table 9.27). Totally, 15 out of 24 respondents, or 63%, reported that this is the first time they heard about the Huong Linh 1 Wind Power Project when being asked by the surveyors.

Three persons or 13% told that they have known about the Project less than 6 months and 6 informants or 25% told they heard about the Project from 6 months to 1 year. No person cited "he/she has known about the Project for over 1 year".

Table 9.27 Local acknowledgement of the project

Acknowledgement of the project	Village						Total (N=24)	
	Cooc (N=10)		Miet (N=10)		Hoong (N=10)			
	No	%	No	%	No	%	No	%
Heard about it for the first time	5	50%	6	60%	4	100%	15	63%
Have known it less than 6 months	2	20%	1	10%	0	0%	3	13%
Have known it for from 6 months - 1 year	3	30%	3	30%	0	0%	6	25%
Have known it for over 1 year	0	0%	0	0%	0	0%	0	0%

Acknowledgement of the project	Village							
	Cooc (N=10)		Miet (N=10)		Hoong (N=10)		Total (N=24)	
	No	%	No	%	No	%	No	%
Total	10	100%	10	100%	4	100%	24	100%

For community consultation, only 03 respondents said that they attended in a community consultation meeting, while the rest 21 informants told that they have not.

Table 9.28 Participation in community consultation meetings held by the project

Villages	Participation in community consultation meeting?	
	Yes	No
Cooc	2	8
Miet	1	9
Hoong	0	4
Total	3	21

Source: Socio-economic survey conducted by ERM, 2018.

In parallel with local knowledge about the project, the majority of surveyed population did not participate in any community consultation meeting. Only 3 out 21 respondents were given the chance to sit in a community consultation session. It is evident from community consultation meetings carried out by the project that mainly leaders at communal and village levels were invited to such meeting.

As a result, surveyed villagers expressed their willingness to know more about the project content, impacts and solutions of the projects to mitigate negative impacts.

It is however noted from the interview with the Project Management (see *Section 10*) that the Project have conducted a number of engagement and public consultation with affected people following the regulation (i.e. Law on Environmental Protection 2014 and Law on Land 2013). It is noted that the minutes of consultation with local authority and local community during the EIA process of the Project were provided for ERM review. No minutes of consultation with local authority and affected people during the land acquisition process were provided for ERM review. However, the consultation during land acquisition process has been verbally confirmed by local authority (i.e. Chairman of Huong Linh Commune People Committee). There is still a discrepancy between the baseline results (i.e. acknowledgement of affected people of the Project) and the information on public consultation provided by the Project Management and local EIA report such as minutes of meeting of the consultation with local authority and affected people during the EIA process (see *Section 10*). This discrepancy can be explained by the following reasons:

- Not all of surveyed households have land acquired by the Project (i.e. 14 out of 24 surveyed households (or 58.33%) from Hoong, Cooc, Miet villages did not have land acquired by the Project and thus, these households would not know about the land acquisition process, compensation prices and associated support; and

- The public consultation process during the EIA process of the Project with local authority and affected people were normally conducted directly with local authority and social groups (i.e. such as the Farther Front, the Farmer Union, the Women Union, etc.) and only limited number of households who are expected to be directly affected by the Project following the national regulation on EIA process (i.e. the Law on Environmental Protection 2014). Moreover, Huong Linh 2 Project, which is currently under operation phase, is also under the management of the same investor. Thus, local people may not be fully aware of the Huong Linh 1 Project.

Impacts on future livelihoods

As shown in *Table 9.29* below, 14 or 58.3% of the surveyed households think that the Project would impact their future livelihood, mostly because of land acquisition. Many of them are afraid that having less land force them to shrink their crop and provide them less options for livelihood development.

Table 9.29 Impact of the project's land acquisition on future livelihood of the surveyed households

Village	Impacted on future livelihood	
	Yes	No
Cooc	5	5
Miet	5	5
Hoong	4	0
Total	14 (58.3%)	10 (41.7%)

Source: Socio-economic survey conducted by ERM, 2018.

Table 9.30 Difficult to Change to Other Livelihoods?

Commune	Difficult to change to other livelihoods?		
	Yes	No	Don't know
Cooc	3	1	6
Miet	1	3	6
Hoong	0	0	4
Total	4	4	16

Source: Socio-economic survey conducted by ERM, 2018.

Given their high dependence on land and natural resources for their livings, while 16.6% of interviewed households see that it is difficult to change to other livelihoods, most of the respondents (16/24) are reluctant and/or have no idea about how and how much their livelihoods would change. This might be because the fact that on one hand they did not know much about the

Project's impacts on their land and livelihoods, on the other hand they did not see any viable options for land re-purchase and livelihood alternatives.

9.7.7 Key conclusions

Within the three surveyed villages, Cooc and Hoong villages shared origins and traditions, long development history and production patterns. The economy of the commune and surveyed households are mainly based on rice, cassava, acacia and animal husbandry. The project area includes villages with special difficulties, high poor household proportion and some malnutrition in children.

Most of the respondents reported that they had not attended any community consultation meeting related to the project initiation and implementation. Many cited in the survey that this was the first time they had heard about the Huong Linh 1 Wind Power Project. Most of the information on the project or compensation come from the Farmer association chairman, Women's union chairperson or village's head. It appears that there is a lack of community understanding regarding the proposed land acquisition procedure and price. This might be explained as provided in *Section 9.7.6*.

While the company has assigned agent to go directly to discuss and work with the family at their home, which may be appropriate and effective in a case-by-case context, community meetings are still essential for the company and authority to converse and disseminate the information and generate a consensus amongst the people, and at the same time get to know and tackle any unexpected issues during the implementation of the Project.

10 STAKEHOLDER ENGAGEMENT

Limited stakeholder engagement is conducted by the project. Formal engagement occurred during the EIA process and also as part of this ESIA.

The project does not currently have a dedicated stakeholder engagement function and stakeholder engagement and management occurs. At the present stage, stakeholder engagement is mainly conducted by the person in charge of land acquisition of HL1 Project and the site manager. Furthermore, local residents can direct communicate with the local authorities (e.g. Village Heads, the HL1's People Committee) when they have any concern related to the Project, then the concerns will be conveyed to the Project representitives.

Given identified concerns regarding the stakeholder engagement process and procedures adopted by the project, a recommended SEP and grievance process has been provided within the ESMP.

10.1 STAKEHOLDER ENGAGEMENT DURING EIA PROCESS

This section provide a brief description of the engagement activities that have been conducted by the Project before and during the ESIA process. As noted previously, the engagement appears to have been inadequate given that the majority of the interviewed households were not aware of the project.

The information on the engagement activities were collected from various document review (i.e. local EIA report), and interviews with Project's management staff, local authority (People Committee of Huong Linh commune) and local communities (i.e. village heads and households of Hoong village, Cooc village and Miet village) conducted during field work.

Based on the records in the local EIA report, during the early development phase, the Project has conducted various engagement activities with local authorities and local communities under regulatory requirements. These include:

- Indirect engagement with Ministry of Industry and Trade (MoIT) (i.e. through working with the People Committee of Quang Tri province) to obtain the Decision on approval for "Wind power development plan in Quang Tri province in the period of up to 2020, with a vision to 2030" (i.e. *Decision No. 6185/QD-BCT* issued on 19 June 2015);

- Official engagement with People Committee of Quang Tri province in November 2015 to obtain the Decision for Approval of Project Investment (*Decision No. 2800/QD-UBND*) on 16 December 2015;

- Official engagement with the Department of Planning and Investment (DoPI) of Quang Tri province to obtain Investment Registration Certificate (*No. 3700713720* issued on 17 December 2015)

Based on the records in the local EIA report, during the environmental impact assessment process in mid-2015, the Project has conducted various engagement activities with local authorities and local communities under regulatory requirements. These include:

- Direct engagement with Department of Natural Resources and Environment (DoNRE) through the regulatory appraisal process to obtain the Approval for local environmental impact assessment report;
- Direct engagement with local authorities in August – September 2015 (i.e. People Committees of Huong Linh and Dakrong communes) through consultation form distribution and feedback gathering and public consultations with key communities representatives (i.e. Chairman and Party Leader, Chairman of Fatherfront, Leader of Farmer Union, Head of Police of the communes, and village heads) to inform the potential environmental impacts, mitigation measures implemented and to obtain their opinion and support of the Project.
- Direct engagement with local communities in December 2015 (i.e. 22 households who are potentially directly or indirectly affected by the Project) to obtain limited information on their livelihood baseline as well as their opinion on the potential impacts of the Projects.

In general, the opinions of local authorities and local communities were consistent. These include:

- Local authorities and local communities agree with the mitigation measures provided by the Project regarding the potential environmental and social impacts;
- The Project and its contractors should to fulfil its commitment in providing mitigation measures for environmental and social impacts as provided in local EIA report;
- The Project should closely collaborate with local authorities during the land acquisition and compensation process to ensure full compensation to affected people; and
- The Project and its contractors should implement the construction as fast as possible to limit the impacts to local communities.

Based on the interview with the Project's management staff during the ESIA Process, the Project has collaborated with local authorities to conduct several public consultation activities (i.e. documents are not provided for review) during the land acquisition and compensation process. These include:

- Public consultation with local communities to announce about the Project as well as potential land acquisition;
- Public consultation with affected households of three villages (i.e. Hoong village, Cooc village and Miet village) to make agreement on compensation and supports during land acquisition process;
- Collaboration with local authorities to make census of for the land acquisition and compensation; and

- Collaboration with local authorities (i.e. People Committee of Huong Linh commune, experts from Office of Agriculture and Rural Development of Huong Hoa district) to conduct public consultation with households having land acquired on the livelihood restoration (i.e. providing advices on how to use compensation money effectively and directions for livelihood).

In addition to the above engagement activities, the Project has conducted several engagement activities with local communities in New Year and other public events through visits and gifts for poor households, flood-affected household and excellent pupils. Reportedly, the Project also supported the refurbishment of the cultural houses of Hoong village and Cooc village, and the playground of Huong Linh commune.

10.2 *STAKEHOLDER ENGAGEMENT DURING THE ESIA PROCESS IN 2018*

Within the scope of the ESIA Process, conducted by ERM Vietnam on behalf of the Project, in early 2018, a number of engagement activities with local authorities and local communities has been conducted. Refer to *Section 9.4* for detailed description of the engagement activities conducted in 2018. Table 9.31**Error! Reference source not found.** below summarises all the feedbacks collected during these activities.

Table 9.31 Consultation Activities Conducted in January 2018

Local Authorities and Affected Communities		Consultation methods	Purpose of the Meetings and Interviews	Date	Concerns/suggestions from engaged stakeholders
Affected communities	Potential directly and indirectly affected households of Cooc village	• Household interview; • Key Informant Interview via informal meeting (one on one) with head of village.	• Collect updated socio-economic conditions of the affected households; • Understand the current concerns and problems of the affected communities regarding their livelihoods and public service availability and accessibility; • Understand the traditional culture of the Indigenous People as well as their current concerns and problems regarding their livelihoods in relation to the Project's potential impacts; and • Collect suggestions/opinions from heads of villages and local communities on the development of mitigation measures (i.e. including livelihood related programs, where appropriate) of the Project.	24 January 2018	In general, the concerns and suggestions of potential directly and indirectly affected households of the three villages are similar. These include: <u>Major concerns included:</u> • Unstable livelihoods, mainly due to unfavourable weather conditions (foggy and windy), the lack of labour (households with many children) and the lack of technical guidance in agricultural production; • Temporary impacts on agricultural productions of households that having land acquired. However, most of the households still have surplus lands or can acquire other lands (through reclamation of natural land) for agricultural production; • Safety concerns (i.e. degradation of the road system and fast movement of trucks/ cars that can cause safety issues for local people, particularly children who often walk to schools); and • Environmental pollution (i.e. unpleasant/strange noise from turbine, soil erosion around the project office/ turbine sites leading to contamination of surrounding rice fields). <u>Suggestions raised:</u> • Provide general/unskilled job opportunities to villagers, if any; • Management of Project's traffic vehicles such as speed limit and using horn; and • Mitigate and control environmental impacts.
	Potential directly and indirectly affected households of Miet village	• Household interview; • Key Informant Interview via informal meeting (one on one) with head of village.		25 January 2018	
	Potential directly and indirectly affected households of Hoong village	• Household interview; • Key Informant Interview via informal meeting (one on one) with head of village.		26 January 2018	
Indigenous People	Potential directly and indirectly affected households of Bru - Van	• Focus Group Discussions (FGD) for	• Understand the traditional culture of the Indigenous People;	26 January 2018	<u>Major concerns included:</u> • Unstable livelihoods which are dependent on land and forest resources (i.e. particularly vegetables from the forest), mainly due to unfavourable

Local Authorities and Affected Communities		Consultation methods	Purpose of the Meetings and Interviews	Date	Concerns/suggestions from engaged stakeholders
	Kieu Indigenous People of Hoong village	Indigenous People (IP).	• Understand the resources that Indigenous People depend upon for their livelihood; and • Their current concerns and problems regarding their livelihoods in relation to the Project's potential impacts;		weather conditions (foggy and windy), the lack of labour (households with many children) and the lack of technical guidance in agricultural production; • Potential impacts on Sacred Forest of Bru - Van Kieu Indigenous People in Hoong village and Cooc village due to influx of workers and access to the forest. • Safety concerns (i.e. degradation of the road system and fast movement of trucks/ cars that can cause safety issues for local people, particularly children who often walk to schools); and • Environmental pollution (i.e. unpleasant/strange noise from turbine, soil errosion around the project office/ turbine sites leading to contamination of surrounding rice fields). <u>Suggestions raised:</u> • No Project components should be placed within or close to the Sacred Forest of Bru - Van Kieu Indigenous People of Hoong village and Cooc village; • No people should be allowed to access and cause damage to the Sacred Forest. Any damage to the Sacred Forest, even cutting small trees can be fined by traditional rules of Indigenous People (i.e. payment for at least a pig or a buffalo used for praying); • Provide general/unskilled job opportunities to villagers, if any; • Management of Project's traffic vehicles such as speed limit and using horn; and • Mitigate and control environmental impacts.
Local authorities	People Committee (PC) of Huong Linh commune	• Key Informant Interview via formal meeting with the	• Update the PC about the project current status;	25 January 2018	<u>Major concerns included:</u> • Temporary impacts on agricultural productions of households that having land acquired.

Local Authorities and Affected Communities	Consultation methods	Purpose of the Meetings and Interviews	Date	Concerns/suggestions from engaged stakeholders
	Chairman of PC of Huong Linh commune;	• Obtain updated socio-economic baseline data of the commune; and; • Seek opinions and experience in potential environmental and social impacts of a similar project within the commune in construction and operation phases and common mitigation and management measures; • Seek suggestions for what aspects the Project should pay more attention/consideration in on the development of mitigation measures (i.e. including livelihood related programs, where appropriate) of the Project.		• Degradation of road system and other public services (i.e. clinic); • Safety concerns (i.e. degradation of the road system and fast movement of trucks/ cars that can cause safety issues for local people, particularly children who often walk to schools); and • Environmental pollution (i.e. unpleasant/strange noise from turbine, soil erosion around the project office/ turbine sites leading to contamination of surrounding rice fields). Suggestions raised: • Provide affected people with technical guidance and seeds or animals that are suitable for agricultural production in the commune; • Provide general/unskilled job opportunities to villagers, if any; • Support for improvement of public services of the commune; • Management of Project's traffic vehicles such as speed limit and using horn; and • Mitigate and control environmental impacts.

11 ENVIRONMENTAL IMPACT ASSESSMENT

The overall approach to the rating and evaluation of impacts follows the methodology presented in *Chapter 5*. This section provides more detailed in the evaluation of the significant potential environmental impacts associated with the Project development activities. Where resource/receptor specific magnitude or sensitivity/vulnerability definitions apply, these are discussed in the relevant subsections.

11.1 AIR QUALITY IMPACTS

The assessment with respect to air quality of the study area has been done for the following Project activities:

- Construction activities including access road construction, site clearing, substation construction and excavation of WTG;
- Transportation of WTG components, construction materials, machinery and personnel;
- Operation of batching plant;
- Operation of disesl generator sets;
- Strengthening and maintenance of access roads; and
- Demolition activities during decommissioning phase.

The sensitivity criteria and impact magnitude criteria has been provided in Table 11.1 and Table 11.2 respectively.

Table 11.1 Sensitivity Criteria for Air Quality

Sensitivity Criteria	**Contributing Criteria**	
	Human Receptors	**Ecological Receptors**
Low	Locations where human exposure is transient	No
Medium	Few Receptors (settlements) within 500 m WTGs, batching plant	Nationally designated sites
High	Densely populated receptors(settlements) within 500 m of WTGs, batching plant	Internationally designated sites

Table 11.2 Criteria for Impact Magnitude for Assessment of Impact to Air Quality

Magnitude Criteria	**Negligible**	**Small**	**Medium**	**Large**
Air Quality	Soil type with large grain size (e.g. sand); and/or	Soil type with large grain size (e.g. sand); and/or	Moderately dusty soil type (e.g. silt); and/or	Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); and
	No emissions/dust generation due to Project across all phases	Limited emissions/dust generations for short duration	Dust generation and emissions from Projects for long duration	Significant process emissions from Project for the entire Project cycle.

Receptor Sensitivity

The receptor sensitivity has been assessed as **High** and **Medium** for human and ecological receptors, respectively. The receptor sensitivity is therefore **High** based on the criteria provided in Table 11.1. As observed during the ERM's site visit and illustrated in *Figure 11.2*, many local households are living within close proximity to the construction areas. With the exception of the areas of Turbine numbers T01-T05, there are no other likely receptors in the area.

Air Quality Impacts from the Construction Phase

Air quality impacts in the construction phase will be largely due to the following sources:

- Fugitive dust emissions from site clearance, excavation work, cutting and levelling work, stacking of soils, handling of construction materials, transportation of materials, emission due to movement of vehicles on unpaved roads, plying of heavy construction machinery, etc.
- Vehicular emissions due to increased traffic movement on site and on the approach roads;
- Particulate emission from operation of batching plant;
- Exhaust emissions from construction machinery and other heavy equipment such as bulldozers, excavators and compactors; and
- Emissions from diesel generators required to be run for construction power purposes.

Impact Magnitude

The main source of emissions in the construction phase is the fugitive dust emissions from construction activities. As the proposed wind farm site is small and requires very limited road construction, the fugitive dust emissions should be minimized. The construction activities are also going to occur for a small period of time (around 18 months). The soil in the region is a mixture of clay and sand and has therefore been classified as **Small**.

Embedded/In-built Controls

There is no in place controls for mitigating dust dispersed from the Project construction activities.

Significance of Impact

The impact significance for air quality in the construction phase is assessed as **Moderate**. There will be some impacts due to plying of vehicles on remote village roads and due to the proximity of the proposed WTG installation to nearby households.

Table 11.3 Assessment of Potential Impacts due to Fugitive Dust from Soil Disturbance during the Construction Phase

Impact	Fugitive Dust from Soil Disturbance				
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Scale	The scale of the impact may be limited to the project area and communities located down-wind from the site.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptor Sensitivity	Low	Medium	**High**		
Impact Significance	Negligible	Minor	**Moderate**	Major	
	Significance of impact is considered to be **Moderate**				

Additional Mitigation and/or Management Measures

The following mitigation measures are designed to minimize the impact:

- Water sprays should be applied at land preparation area, access roads, soil stockpiles and any other exposed surfaces which could be source of dust are to be watered in instances where rain hasn't fallen in the previous 24 hours, or as soon as visible dust emissions start to occur;

- Control speed limit of the trucks and other vehicles not to exceed than 10 km/h within the Project boundary;
- Areas of construction, stockpile areas and other exposed soils will be designated as such in order to minimize vehicle movements over these to the minimum amount possible;
- No cleared vegetation to be burnt. Cleared vegetation will either be composed or reused for stabilization purposes;

Significance of Residual Impact

With the implementation of the above mitigation measures, the residual impacts would be expected to be of **Minor** significance.

Air Quality Impacts from the Decommissioning Phase

Air quality impacts in the decommissioning phase will be largely due to the following sources:

- Fugitive dust emissions from demolition, handling of demolition materials and transportation of materials;
- Vehicular emissions due to increased traffic movement on site and on the approach roads;
- Exhaust emissions from demolition machinery and other heavy equipment such as bulldozers, excavators and compactors; and
- Emissions from diesel generators required to be run for demolition purposes.

Impact Magnitude

The main source of emissions in the decommissioning phase is the fugitive dust emissions from demolition activities. The demolition activities are likely to occur for a very small period of time (~3-4 months) and therefore the impact magnitude has been assessed as **Small** as per Table 11.2.

Embedded/In-built Controls

There is no in place controls for mitigating dust dispersed from the Project decommissioning activities.

Significance of Impact

The impact significance for air quality in the decommissioning phase is assessed as **Moderate**.

Table 11.4 Assessment of Potential Impacts due to Fugitive Dust from Soil Disturbance during the Decommissioning Phase

Impact	Fugitive Dust from Soil Disturbance				
Impact Nature	**Negative**	Positive		Neutral	
Impact Type	**Direct**	Indirect		Induced	
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
Impact Extent	**Local**	Regional		International	
Impact Scale	The scale of the impact may be limited to the project area and communities located down-wind from the site.				
Impact Magnitude	Positive	Negligible	**Small**	**Medium**	Large
Receptor Sensitivity	Low	Medium		**High**	
Impact Significance	Negligible	Minor	**Moderate**	**Major**	
	Significance of impact is considered to be **Moderate.**				

Additional Mitigation and/or Management Measures

The following mitigation measures are designed to minimize the impact:

- Assigning haul routes away from sensitive areas; and
- Control speed limit of the trucks and other vehicles not to exceed than 10 km/h within the Project boundary.

Significance of Residual Impact

With the implementation of the above mitigation measures, the residual impacts would be expected to be of **Minor** significance.

11.2 NOISE IMPACTS

This section presents a summary of the potential noise impacts identified in the Annex B preliminary noise screening assessment that was conducted for the Huong Linh 1 wind farm project.

This section is structured as such that it considers both unmitigated and mitigated (residual) impacts for the construction and operational activities that may have a significant noise impact.

11.2.1 Discussion of Impacts

Nuisance, or an unacceptable level of noise amenity, may arise from operational activities associated with new or existing wind farm sites.

This potential for noise issues to arise is associated with emissions from significant noise generating sources/assets such as wind turbines but in some cases may include other items such as transformers often situated within or near to a wind farm.

The noise screening assessment addressed these potential noise issues by predicting and assessing operational noise levels from the wind farm at nearby noise sensitive receptors. A qualitative assessment of potential short-term construction noise emissions has also been provided.

The preliminary noise screening assessment report documentesd the findings of the assessment, provided an evaluation of potential impacts, identified potential mitigation measures that may be required to achieve compliance and then highlighted any potential residual noise issues. These features are summarised herein.

11.2.2 *Impact Evaluation and Significance*

Screening noise criteria were established and are in accordance with recognised International Finance Corporation (IFC) guidelines. The key document adopted for the terms of reference from which noise screening criteria were established is the *World Bank Group: International Finance Corporation (IFC) - Environmental, Health and Safety Guidelines for Wind Energy*, dated August 2015 (IFC: Wind Energy Guideline, 2015).

In particular the requirements of Section 1.1.2 of the IFC: Wind Energy Guideline, 2015 were referenced for the purpose of the assessment. Other international noise guidelines and standards were applied where relevant to the assessment and potential impacts. Noise levels were predicted, compared to criteria and discussion provided regarding the wind farm's compliance with the IFC: Wind Energy Guideline, 2015 as relevant to noise.

Construction Impacts

The construction noise assessment concluded that some noise from construction sites is inevitable, such that good construction management practices focus on minimising noise impacts, rather than only on achieving numeric noise levels.

Good-practice construction noise management and noise mitigation techniques may be required during the HL1 project to reduce noise levels as far as practicable. These will need to be considered and then implemented, where necessary. In an unmitigated construction scenario **moderate** impacts may be expected, refer Table 11.5.

Table 11.5 UNMITIGATED Construction Noise Assessment

Impact Description	Construction phase noise impacts as a result of plant, equipment and machinery, or vehicle emissions			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	Small	**Medium**	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	Minor	**Moderate**	Major

Operational Findings

As summarised in Section 5.1 of the noise screening assessment, predicted levels for HL1 and HL2 projects would (under normal circumstances) be expected to exceed IFC noise criteria. In an unmitigated operational scenario **major** impacts may be expected, refer Table 11.6.

However, due to the economic (e.g. employment) opportunities provided by the HL1 and HL2 projects and the assumed local community acceptance of noise emissions associated with the wind farms, noise reducing mitigation, management measures and/or monitoring options have not been provided as recommendations.

It is beyond the scope of the noise screening assessment to comment further, or to provide recommendations associated with, the community and stakeholder consultation for the project.

Table 11.6 UNMITIGATED Operational Noise Assessment

Impact Description	Operational phase noise impacts as a result of wind turbine emissions			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	Small	Medium	**Large**
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	Minor	Moderate	**Major**

11.2.3 *Additional Mitigation Measures, Management, and Monitoring*

Construction Phase

Based on the findings of the qualitative construction noise assessment presented in Chapter 7 of the noise screening assessment it is recommended that:

- During construction of the HL1 project good-practice construction noise mitigation and management measures should be implemented to reduce noise levels and minimise any impacts as far as practicable. A range of mitigation and management measures are available and those that are considered feasible, reasonable and practical to implement the specific tasks should be considered for example:

- avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient;
- ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the site; and/or
- ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse.

- During the construction design, choose appropriate machines for each task and adopt efficient work practices to minimise the total construction period and the number of noise sources on the site. Select the quietest item of plant available where options that suit the design permit.
- High noise generating construction works and activities should be limited to the IFC daytime period (7AM to 10PM), and work should be avoided on Sundays or public holidays if possible.
- Construction road traffic and heavy vehicle movements have the potential to generate "peak" or "maximum" noise level events and these should be limited during the night time period, and avoided if possible. Where possible, significant noise generating vehicle movements should be limited to the daytime period if possible. Where it is not possible for this to occur drivers should be instructed to arrive and depart as quietly as possible. Whilst on-site and in close proximity to receptors the drivers should be instructed to implement good-practice noise management measures to reduce peak noise levels and minimise any impacts as far as practicable. During the works, instruct drivers to travel directly to site and avoid any extended periods of engine idling at or near residential areas, especially at night.
- If any validated noise complaints are received, the problem source and any potential noise reducing measures should be identified and evaluated for implementation during the works. If the noise complaint cannot be validated, no further mitigation or management measures are required.

Operational Phase

Should an agreement or documented acceptance of the projects noise emission not be reached it is recommended that a baseline noise monitoring campaign be considered and designed to address the existing HL2 project noise emissions. Following this baseline noise monitoring campaign, and where levels are still predicted to exceed criteria, noise reducing mitigation measures should be considered to minimise impacts and reduce emissions to compliant levels.

IFC: Wind Energy Guideline, 2015

Section 1.2.2-21 of the IFC: Wind Energy Guideline, 2015 states that "*Measures to prevent and control noise are mainly related to engineering design standards and turbine siting. With modern turbines, mechanical noise is usually significantly lower than aerodynamic noise, and continuous improvement in airfoil design is reducing the latter*".

Section 1.2.2-22 of the IFC: Wind Energy Guideline, 2015 states that "*Additional recommended noise management measures might include*:

- *Operating turbines in reduced noise mode.*
- *Building walls/appropriate noise barriers around potentially affected buildings (only an option in hilly terrain, due to the height of turbines).*
- *Curtailing turbine operations above the wind speed at which turbine noise becomes unacceptable in the project-specific circumstances*".

Section 1.2.2-23 of the IFC: Wind Energy Guideline, 2015 provides noise-related mitigation options with respect to offshore ecological receptors and does not apply to this assessment.

These features as presented in Section 1.2.2-21 to Section 1.2.2-23 of the IFC: Wind Energy Guideline, 2015 should be considered and implemented as part of the wind farms design where considered feasible, reasonable and practical to do so.

11.2.4 Significance of Residual Impact

Construction and operational noise levels will be reduced and impacts minimised with the successful implementation of the recommendations presented in the Annex B, noise screening assessment.

Impacts may not be reduced to negligible (or fully compliant levels) for all receptors during all construction and operational activities, however the recommendations are designed to ensure that any residual impacts are minimised as far as is practically achievable.

Based on the information available at the time of the noise screening assessment, implementation of the measures summarised above are likely to be able to assist in managing potential construction and operational impacts to be **minor**, refer Table 11.7 *and* Table 11.8.

Table 11.7 MITIGATED Construction Noise Assessment

Impact Description	Construction phase noise impacts as a result of plant, equipment and machinery, or vehicle emissions			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	**Minor**	Moderate	Major

Table 11.8 MITIGATED Operational Noise Assessment

Impact Description	Operational phase noise impacts as a result of wind turbine emissions			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	Small	**Medium**	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	Minor	**Moderate**	Major

11.3 TERRESTRIAL BIODIVERSITY IMPACTS

11.3.1 *Approach*

This chapter presents a viodiversity impact assessment based on the results of a one day site visit to the turbine locations and available desktop information. A March (Dry season and July (wet season) bird and bat survey is being undertaken and the impact assessment and mitigation measures will be revised based on the results of these surveys.

In accordance with IFC PS1 and PS6, the assessment process aims to predict and assess the Project's potential adverse impacts and risks to biodiversity values, in quantitative terms where possible. The objectives of the biodiversity impact assessment are to identify and quantify the potential Project impacts; design measures to avoid, minimise or mitigate potential adverse impacts; and identify likely residual impacts. To achieve this the following steps are used:

- **Background Assessment** to identify the potential biodiversity values that may exist within the Project area and vicinity;
- **Baseline Studies** to define the Project's area of influence and describe the relevant biodiversity conditions likely to occur. This includes identifying modified and natural habitat areas and determining the presence of critical habitat in accordance with IFC PS6 definition;
- **Impact Analysis** assesses the extent and complexity of potential adverse impacts considering the two parameters of habitat area (spatially) and threatened species individually;

- **Mitigation Measures** are developed to avoid and minimise potential adverse impacts to biodiversity with a priority given to impacts on features with significant biodiversity values; and
- **Residual Impacts** are determined and in the event significant residual impacts occur biodiversity offsets are considered.

A summary of the baseline conditions is provided in *Section 7*. It should be noted that specific bird and bat assessments are ongoing and will be completed by September 2018.

11.3.2 *Scoping of Likely Impacts to Biodiversity Values*

Table 11.9 broadly defines the types of threats to biodiversity values that have potential to occur as a result of a Project. These threats to biodiversity are derived from IFC PS6 and relate to the activities that are likely to occur during construction and post construction phases.

Table 11.9 Types of Threats to Biodiversity Values

Term	Description
Loss of habitat	Permanent loss of habitat or species due to permanent or temporary site activities.
Disturbance or displacement of individuals from light; noise and/or vibration impacts	Disturbance to, or displacement/exclusion of a species from foraging habitat due to construction activities, and operational and maintenance activities. Impacts from light, noise and vibration sources on surrounding habitats causing disturbance and displacement and changes in behavior
Barrier creation, fragmentation and edge effects	Creation of barriers to the movements of animals, especially fish, but also mammals, reptiles and amphibians and invertebrates and plants with limited powers of dispersal. Fragmentation of habitat, or permanent /temporary severance of wildlife corridors between isolated habitats of importance for biodiversity. Impacts that occur when a habitat is exposed to a different adjacent habitat type or structure. These impacts can include increased risk of parasitism or disease, increased risk of predation, adverse microclimate conditions (including drying out and subsequent fire risk), and competition from invasive species
Degradation of habitat from dust; water pollution; or invasive species	Disturbance or damage to adjacent habitat and species caused by changes in microclimate, vulnerability to predation and invasion and overall changes in conditions that can lead to a change in the community and its values for flora and fauna. This can include increased exposure to noise, light and dust. Introduction or spreading of alien species during the construction works.
Mortality – turbine strike, vehicle strike, hunting and poaching	Mortality due to potential flight of avifauna through the Rotor Swept Zone (RSZ) of the wind turbines. Mortality of individual fauna species as a result of vehicle or machinery strike or falling debris during clearing activities. Mortality to individual fauna species as a result of worker influx and hunting/poaching of extant fauna

Table 11.10 scopes the impacts likely during the construction, operational and decommissioning phases of the project. The impact assessment for these impact types are further assessed below.

Table 11.10 ***Scoping of potential impacts during construction and operational phases***

Type of Impact	Construction Phase	Operational Phase	Decommissioning Phase
Loss of Habitat	Yes	No	No
Disturbance or displacement of fauna	Yes	Continuing from construction phase	Reassessed for decommissioning phase
Barrier creation, fragmentation and edge effects	Yes	Continuing from construction phase	Continuing from operational phase
Degradation of habitat	Yes	Continuing from construction phase	Reassessed for decommissioning phase
Mortality – turbine strike, vehicle strike, hunting and poaching	Yes	Reassessed for operational phase	Continuing from construction/ operational phase

Notes:

Yes: considered to be likely impacts during the phase.

No: considered that there will be no impacts or negligible impacts during the phase

Continuing from construction and/or operation phase: the impact is likely to continue from the operation phase and the mitigations outlined are appropriate to manage impacts during construction, operational and/or decommissioning phases.

Reassessed for operational and/or decommissioning phase: the impact is likely to be different during the phase and hence is reassessed based on the likely impacts. Additional mitigations may be outlined to apply to this phase.

11.3.3 Biodiversity Impact Assessment (Construction Phase)

Loss of Habitat

The geospatial assessment undertaken to define Natural Habitat and Modified Habitat has classified the majority of the Project area as Modified Habitat. However. Given the project areas is located within an internationally recognized area (Annamese Lowlands EBA) and the DMU contains Critical Habitat species, all habitat (Natural Habitat and Modified Habitat)is considered as being Critical Habitat as required under the provisions of IFC PS6.

The distribution of Natural Habitat and Modified Habitat (and extent of Critical Habitat) in relation to the project footprint and Project area are shown in Figure 11.1.

There are 21 potential Critical Habitat triggers within the DMU which are outlined in Table 11.11. It should be noted that the terrestrial flora and fauna values identified as potential Critical Habitat is based on data that was collected in 2008 and hence may be out of date. Further assessment is required to determine if these values remain within the project DMU.

Table 11.11 Potential Critical Habitat Triggers within the Project DMU

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Critical Habitat
37.	Plants	*Aquilaria crassna*	Eagle Wood	EN	CR	Yes
38.	Plants	*Cinnamomum balansae*	-	VU	EN	Yes
39.	Plants	*Cinnamomum parthenoxylon*	-	CR	DD	Yes
40.	Mammals	*Pygathrix nemaeus*	Red-shanked Douc Langur	EN	EN	Yes
41.	Mammals	*Trachypithecus hatinhensis*	Hatinh Langur	EN	EN	Yes
42.	Mammals	*Nomascus leucogenys*	Northern White-cheeked Gibbon	CR	CR	Yes
43.	Mammals	*Nesolagus timminsi*	Annamite Striped Rabbit	EN	DD	No
44.	Mammals	*Manis javanica*	Sunda Pangolin	CR	NT	Yes
45.	Mammals	*Panthera pardus delacouri*	Leopard	CR		Yes
46.	Mammals	*Muntiacus vuquangensis*	Large-antlered Muntjac	VU	CR	Yes
47.	Mammals	*Pseudoryx nghetinhensis*	Saola	EN	CR	Yes
48.	Mammals	*Capricornis milneedwardsii maritimus*	Chinese Serow	EN	EN	Yes
49.	Mammals	*Murina beelzebub*	Beelzebub's Tubenosed Bat		NA	Yes
50.	Mammals	*Myotis annamiticus*	Annamite Myotis		DD	Yes
51.	Birds	*Lophura edwardsi*	Edwards's Pheasant	EN	EN	Yes
52.	Birds	*Stachyris herberti*	Sooty Babbler		LC	Yes
53.	Birds	*Emberiza aureola*	Yellow-breasted Bunting		CR	Yes
54.	Herp.	*Python molurus*	Burmese Python	CR	NT	Yes
55.	Herp.	*Ophiophagus hannah*	King Cobra	CR	VU	Yes
56.	Herp.	*Cuora galbinifrons*	Indochinese Box Turtle	EN	CR	Yes
57.	Herp.	*Cuora trifasciata*	Chinese three-striped Box Turtle	CR	CR	Yes

Notes:

CR : Critically Endangered; EN : Endangered; VU : Vulnerable; NT: Near Threatened; DD : Data Deficient; NA : Not Assessed; LC: Least Concern

Herp. : Herpetofauna

Natural habitat areas in particular provide habitat values for a variety of native flora and fauna species, including species listed on the IUCN Red list of threatened species. Albeit modified, the Modified Habitat areas also provide value to native species, in particular those adapted to disturbed environments such as the Sunda Pangolin (*Manis javanica*).

The areas of Natural Habitat and Modified Habitat to be cleared within the Project area and DMU are shown in Table 11.12. The area of habitat lost is considered to be minimal (0.5ha).

Table 11.12 Clearing of Habitats within the Project Area and DMU

Habitat Type	Footprint	Footprint %	Project Area	Project Area %	DMU	DMU %
Natural Habitat	0.5	1.1%	416.9	29.4%	43,506.8	88.5%
Modified Habitat	43.1	98.9%	1001.4	70.6%	5649.5	11.5%
Total	43.6	100%	1418.3	100%	49,156.3	100%

The nature of the impact will be **Negative** to resident fauna within the Project area. The impact type is likely to be **Direct**. The magnitude of impact is expected to be **Neglible** as the impact is within the normal range of variation in terms of habitat loss. Although the area to be impacted is substantially disturbed, the sensitivity of the receptor is considered to be **High** as it is within an internationally designated or recognised area (Annamese Lowlands Endemic Bird Area) and the Project area is considered to be Critical Habitat. The overall significance is therefore considered to be **Negligible**. The impact will continue into operation.

Table 11.13 Impact Evaluation and Significance: Loss of Habitat within the Project Area and DMU

Impact Description	**Construction phase impacts to biodiversity as a result of loss of habitat within the project area and DMU**			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	**Negligible**	Small	Medium	Large
Sensitivity/Vulnerability	Low	Medium	High	
Significance	**Negligible**	Minor	Moderate	Major

Additional Mitigation Measures, Management, and Monitoring

The following mitigation measures will be applied during construction and continue during operation:

- A *Biodiversity Action Plan* (BAP) will be prepared for the management and monitoring of Critical Habitats within the project DMU.

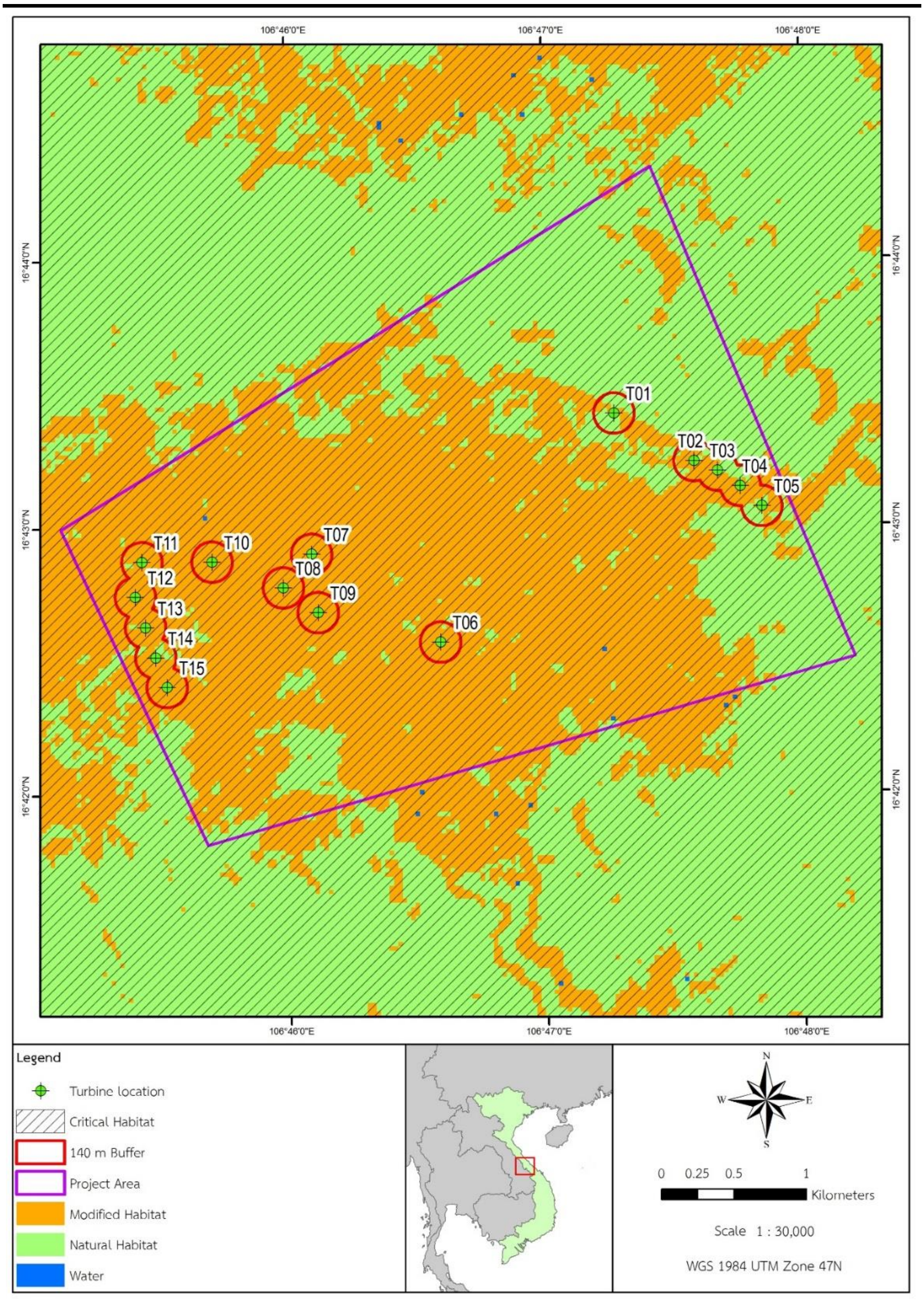
Significance of Residual Impact

The application of the mitigation measures is likely to reduce the impact due to loss of habitat within the project area to **Minor/Negligible** during construction and operation.

It is not considered necessary for the project to utilise biodiversity offsets to compensate for losses in habitat values within the DMU. However, given that the project is located within Critical habitat, a *Biodiversity Action Plan* (BAP) will be required to outline measures to manage Critical Habitat values.

It is recommended that further assessment of the presence of potential Critical Habitat values within the DMU be undertaken prior to the development of the BAP given the data used to identify these values is from 2008. The Plan will also contain a *Biodiversity Monitoring and Evaluation Plan* that outlines measures to assess Critical Habitat values within the DMU.

Figure 11.1 Critical Habitat, Natural Habitat and Modified Habitat within the Project Area



Disturbance or displacement of individual fauna

The disturbance and displacement of resident fauna species within the footprint will primarily be caused by light, noise and vibration impacts.

Noise, light and vibration disturbances have the potential to influence breeding, roosting or foraging behaviour of fauna. During the exploration/construction phase temporary impacts from the Project are expected. Noise will be the primary disturbance of this nature due to vegetation clearing, excavation, movement of materials, drilling and general construction activities. These activities will introduce noise sources to areas not currently exposed to these disturbances. In addition there may be vibration associated with drilling activities and the movement of any heavy vehicles/machinery.

The consequences of these influences are dependent on the extent of disturbance but in extreme cases these factors can influence local populations. For example if breeding and communication is inhibited influencing lifecycle, or, if individuals are displaced from noisy areas and home ranges are reduced. Excessive noise can impede fauna communication and deter the use of habitats nearby. Similarly, introducing light sources has the potential to deter foraging and dispersal activities of nocturnal species.

The duration of construction activities it is expected to be short-term. Similarly, it should be noted that the noise, light and vibration disturbances will not be continuous for the construction period, or focused on any one specific location for the total time. Noise light and vibration disturbances will occur throughout the Project Area during construction for the Project components identified.

Although temporary, the construction schedule is expected to be relatively short and not to span multiple breeding seasons. Noise, light and vibration disturbance are unlikely to occur at all locations simultaneously and will be localized.

There are a number of potential Critical Habitat species that exist in the DMU. These species are unlikely to inhabit the Project area during construction as suitable habitat does not exist within that area. These species are therefore unlikely to be disturbed or displaced due to project construction activities. Further assessment however is occurring regarding bird and bat fauna that may trigger Critical Habitat and inhabit the Project area.

Impact Evaluation and Significance

The nature of the impact will be **Negative** to resident fauna within the Project area. The impact type is likely to be **Direct**. The magnitude of impact is expected to be **Small** as the impact will likely effect a small proportion of a population, but does not substantially affect other species dependent on it, or the populations of the species itself. The sensitivity of the receptor is considered to be **Medium**[1] as it is likely that species present are listed on the IUCN Red List or Vietnam Red Book as Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD). The overall significance is therefore considered to be **Minor**.

Table 11.14 Impact Evaluation and Significance: Disturbance or displacement of individual fauna

Impact Description	**Construction phase impacts to biodiversity as a result of disturbance or displacement of individual fauna**			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	**Minor**	Moderate	Major

Mitigation Measures, Management, and Monitoring

The following measures will be implemented during construction:

- A *Fauna Shepherding Protocol* is be used within the Project area to ensure that any resident species have vacated the area prior to any clearance work.
- Fencing is to be placed around major project sites during construction to restrict access to fauna.

Significance of Residual Impact

The application of the mitigation measures is likely to reduce the impact due to disturbance or displacement of individual fauna to **Minor/Negligible** during construction and operation.

Barrier creation, fragmentation and edge effects

Construction activities relating to infrastructure have potential to create a barrier to fauna movement (for some fauna groups). This includes construction of the access roads, the transmission line and other infrastructure. Most other Project components are discrete areas that may be navigated around by fauna that may be moving through the area. The construction of the project will primarily be within Modified Habitat, however the Project area is located within an internationally recognized area (Annamese Lowlands Endemic Bird Area) and hence is considered to be Critical Habitat.

Edge effects are an indirect impact of land clearing during construction and throughout operation. Where vegetation clearing occurs, adjacent vegetation and habitats can be exposed to changes in noise, light (natural or artificial), dust, humidity and temperature factors as well as increased competition from

[1] This classification may change depending on the results of forthcoming surveys of the project area in relation to birds and volant mammals (bats)

predators and invasive species. The impact of edge effects to habitat value and forest composition has been widely recognized as a contributor to forest degradation and impacts to biodiversity. In extreme cases the effects have potential to alter the habitat characteristics of the ecotone and influence suitable habitat for native flora and fauna (including threatened species). Natural habitats surrounding the project area may be impacted due to project construction from dust and pollution.

Fragmentation of habitats can occur where currently linked habitats are disconnected through the construction of Project components. Fragmentation reduces the continuity of habitat and hence the ability for fauna to move within and between habitat patches. The resulting impact can cause reductions in foraging and breeding habitats. Species with limited home ranges may have a reduction in available area, leading to conflict over resources or negative interactions over territories. Fragmentation of existing habitats is not considered to be a significant impact as the infrastructure design does not lead to isolation of habitat patches and is primarily within Modified Habitat.

Impact Evaluation and Significance

The nature of the impact will be **Negative** to resident fauna within the Project area. The impact type is likely to be **Direct**. The magnitude of impact is expected to be **Small** as the impact will affect a small area of habitat, but without the loss of viability/function of the habitat. The sensitivity of the receptor is considered to be **High** as it is within an internationally designated or recognised area (Annamese Lowlands Endemic Bird Area). The overall significance is therefore considered to be **Moderate**. The impact will continue during operation.

Table 11.15 Impact Evaluation and Significance: Barrier creation, fragmentation and edge effects

Impact Description	**Construction phase impacts to biodiversity as a result of : barrier creation, fragmentation and edge effects**			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	Low	Medium	High	
Significance	Negligible	Minor	**Moderate**	Major

Additional Mitigation Measures, Management, and Monitoring

The following measures will be applied within the Project area:

- Appropriate rehabilitation of disturbed areas is to occur to facilitate movement of fauna species during operation.

Significance of Residual Impact

The application of the mitigation measures is likely to reduce the impact due to barrier creation, fragmentation and edge effects to **Minor/Negligible** during construction, operation and decommissioning.

Degradation of habitat

A range of Project activities have the potential to lead to degradation of native flora and fauna habitats including excavation, construction, land clearing, spoil disposal, movement of vehicles, drilling, refuelling, hazardous materials storage and maintenance. In general the impacts will cause: dust; runoff; release of potential contaminants; and invasive species. Construction activities have been assessed for these impact types, including: construction of the access roads, erection of wind turbines and construction of cables and associated infrastructure.

Dust

During construction, land preparation has the potential to generate dust which may settle on vegetation adjacent to the construction area (including access roads). Excessive dust deposition on flora may act to suppress growth through limiting photosynthesis and the dusted foliage may also become unpalatable to foraging fauna. The construction activities will be temporary and dust generation is likely to be localised to active work areas. Rainfall will generally remove dust from foliage and this impact has been assessed for significance as part of the edge effects impact assessment.

Runoff

Land preparation will expose earth areas to be vulnerable to erosion (wind and/or runoff) until infrastructure construction or replanting is completed to stabilise the surface. The Project Area experience varied topography including steep slopes. Erosive processes transport sediment downstream depositing mobilized sediment downstream/downslope of habitats (both aquatic and terrestrial). This indirect impact has potential to degrade downstream habitat areas or change habitat characteristics, and as such influencing suitability for native flora and fauna communities. Runoff may flow into the local river systems which may provide habitat for conservation significant and commercially utilised fish species (if present).

Release of Contaminants

Accidental release or spill of these materials can be toxic to flora and fauna locally and downstream if substances are released into the aquatic environment. Runoff from construction sites has potential to carry contaminants substantial distance downstream. Construction activities such as refuelling, storage and other activities that require oil and hazardous substances to be used are undertaken at risk of accidental release.

Invasive Species

Invasive species (flora and fauna) have the potential to be introduced or spread throughout the Project Area through increased movement of people, vehicles, machinery, vegetation and soil. An increase in the prevalence of weeds or other pests has the potential to reduce the quality of habitat for some native flora and fauna, including conservation significant species. Invasive flora species can rapidly germinate in disturbed areas whereby affecting the ability of native vegetation communities to re-establish. Invasive animals also have the potential to be introduced or increased in abundance. These animals may adversely impact native fauna as a result of increased competition for resources, predation or habitat degradation.

A list of potentially occurring invasive species can be found at *Annex C.*

Impact Evaluation and Significance

The nature of the impact will be **Negative** to resident fauna within the Project area. The impact type is likely to be **Direct**. The magnitude of impact is expected to be **Small/Medium** as the impact will likely effect a small proportion of a population within the Project Area, but does not substantially affect other species dependent on it, or the populations of the species itself. The sensitivity of the receptor is considered to be **Medium**[1] as it is likely that species present within the Project Area are listed on the IUCN Red List or Vietnam Red Book as Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD). The overall significance is therefore considered to be **Minor/Moderate**. The impact will continue into operation and decommissioning.

Table 11.16 Impact Evaluation and Significance: Degradation of habitat

Impact Description	Construction phase impacts to biodiversity as a result of degradation of habitat			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	**Minor**	**Moderate**	Major

Additional Mitigation Measures, Management, and Monitoring

It is recommend that the following mitigation measures be applied:

- All machinery and hand held equipment used must comply with required air and noise emission standards.
- Sediment and erosion control measures are to be used in all areas of construction to minimise soil contaminated runoff entering waterways. These measures are to be outlined in a *Sediment and Erosion Control Plan*.
- Hours of operation of the construction site are to be limited to the hours of 6.00am to 6.00pm Monday to Sunday.
- All light sources are to be directed away from areas of Natural Habitat.

Significance of Residual Impact

The application of the mitigation measures is likely to reduce the impact due to degradation of habitat to **Minor/Negligible** during construction and operation.

[1] This classification may change depending on the results of forthcoming surveys of the project area in relation to birds and volant mammals (bats)

Mortality –Vehicle strike, hunting and poaching

The use of construction vehicles on the project site may increase the opportunity for strike with resident flora during construction.

With greater human activity in the Project area and increased access points to the neighbouring forest there is a risk of increased hunting and poaching activities leading to fauna mortality from workers and also local people who may have access to habitats that were previously restricted or difficult to access. Hunting of wildlife, including conservation significant species is known to occur in Vietnam.

Through the installation of new roads, i.e. increased ease of access hunting and poaching may increase. Species located within the DMU and adjacent Nature Reserve include several species that are potential candidates for Critical Habitat. Some of these species are considered particularly susceptible to hunting and poaching, including the Sunda Pangolin (*Manis javanica*) that have been listed as Critically Endangered, primarily due to poaching and wildlife trafficking.

The list of species potentially impacted due to hunting and poaching are shown in Table 11.17.

There is a minor risk to fauna from vehicle strike during construction given that the project area is predominately modified.

Table 11.17 Species Potentially Targeted for Hunting and Poaching within the DMU

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Critical Habitat
1.	Plants	*Aquilaria crassna*	Eagle Wood	EN	CR	Yes
2.	Plants	*Cinnamomum balansae*	-	VU	EN	Yes
3.	Plants	*Cinnamomum parthenoxylon*	-	CR	DD	Yes
4.	Plants	*Dipterocarpus grandifloras*	-	VU	EN	No
5.	Plants	*Dipterocarpus hasseltii*	-	-	EN	No
6.	Plants	*Dipterocarpus kerrii*	-	-	EN	No
7.	Plants	*Erythrophleum fordii*	-	-	EN	No
8.	Plants	*Anoectochilus cetaceus*	-	EN	-	No
9.	Plants	*Dendrobium amabile*	-	EN	-	No
10.	Plants	*Asarum balansae*	-	EN	-	No
11.	Plants	*Madhuca pasquieri*	-	EN	VU	No
12.	Mammals	*Pygathrix nemaeus*	Red-shanked Douc Langur	EN	EN	Yes
13.	Mammals	*Trachypithecus hatinhensis*	Hatinh Langur	EN	EN	Yes
14.	Mammals	*Nomascus leucogenys*	Northern White-cheeked Gibbon	CR	CR	Yes
15.	Mammals	*Nesolagus timminsi*	Annamite Striped Rabbit	EN	DD	No
16.	Mammals	*Manis javanica*	Sunda Pangolin	CR	NT	Yes
17.	Mammals	*Neofelis nebulosa*	Clouded Leopard	EN	VU	No
18.	Mammals	*Panthera pardus*	Leopard	CR		Yes

S/N	Group	Scientific Name	Common Name	VRDB	IUCN	Critical Habitat
		delacouri				
19.	Mammals	*Arctictis binturong*	Binturong	EN	VU	No
20.	Mammals	*Muntiacus vuquangensis*	Large-antlered Muntjac	VU	CR	Yes
21.	Mammals	*Helarctos malayanus*	Sun Bear	EN	DD	No
22.	Mammals	*Ursus thibetanus*	Asian Black Bear	EN	VU	No
23.	Mammals	*Pseudoryx nghetinhensis*	Saola	EN	CR	Yes
24.	Mammals	*Capricornis milneedwardsii maritimus*	Chinese Serow	EN	EN	Yes
25.	Birds	*Lophura edwardsi*	Edwards's Pheasant	EN	EN	Yes
26.	Herp.	*Varanus salvator*	Water monitor	EN	LC	No
27.	Herp.	*Python molurus*	Burmese Python	CR	NT	Yes
28.	Herp.	*Pytas mucosus*	Common Rat Snake	EN	LC	No
29.	Herp.	*Bungarus fasciatus*	Banded Krait	EN	LC	No
30.	Herp.	*Naja naja*	Indochinese Cobra	EN	LC	No
31.	Herp.	*Ophiophagus hannah*	King Cobra	CR	VU	Yes
32.	Herp.	*Cuora galbinifrons*	Indochinese Box Turtle	EN	CR	Yes
33.	Herp.	*Cuora trifasciata*	Chinese three-striped Box Turtle	CR	CR	Yes

Notes:

CR : Critically Endangered; EN : Endangered; VU : Vulnerable; NT: Near Threatened; DD : Data Deficient; NA : Not Assessed; LC: Least Concern

Herp. : Herpetofauna

Impact Evaluation and Significance

The nature of the impact will be **Negative** to resident fauna within the Project area. The impact type is likely to be direct. The magnitude of impact is expected to be **Small** as the workforce is only small and will be in the project area for a period of approximately 7 months only. The sensitivity of the receptor is considered to be **High** as it is likely that species present within the DMU are listed on the IUCN Red List or Vietnam Red Book as Critically Endangered (CR) or Endangered (EN). The overall significance is therefore considered to be **Moderate**. The impact will continue into operation.

Table 11.18 Impact Evaluation and Significance: Mortality –vehicle strike, hunting and poaching

Impact Description	**Construction phase impacts to biodiversity as a result of mortality – vehicle strike, hunting and poaching**			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	Small	**Medium**	Large
Sensitivity/Vulnerability	Low	Medium	High	
Significance	Negligible	Minor	**Moderate**	Major

Additional Mitigation Measures, Management, and Monitoring

It is recommend that the following mitigation measures be applied during all phases of the project:

- Hunting and poaching will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation.
- All vehicles are to maintain a speed of a maximum of 20km/hr within work sites to reduce the risk of fauna strike.
- Measures to manage hunting and poaching in the DMU by the local community are to be outlined in a *Biodiversity Action Plan*.

Significance of Residual Impact

The application of the mitigation measures is likely to reduce the impact due to mortality – vehicle strike, hunting and poaching to **Minor/Negligible** during construction and operation.

11.3.4 Biodiversity Impact Assessment (Operation Phase)

Mortality – turbine strike to avifauna

Potential mortality to avifauna during operation of the windfarm may be a risk to bird and volant mammal (bat) fauna within the project area. A total of 116 bird species and 31 bat species have been identified to be possibly present that may pose a risk of flight within the Rotor Swept Zone (RSZ) of the turbines that will be erected within the project area. Two of these birds and two bats have been identified as being potential Critical Habitat triggers. These species are listed in *Chapter 7, Environmental Baseline*.

Further surveys will be conducted within the Project Area in March and August 2018 to determine whether these species will utilize the project area. ERM will assess the likely impact using methods as outlined by Scottish Natural Heritage[1] *Recommended bird survey methods to inform impact assessment of onshore wind farms* and the IFC *Wind Energy EHS Guidelines*[2].

Impacts to avifauna consist of direct strike to individuals flying through the Rotor Swept Zone (RSZ) of the windfarm. Bats can suffer from barotrauma, which is when sudden changes in air pressure when flying close to turning blades collapse the lungs of the bats.

Avifauna are most susceptible when they fly at RSZ height, either at level flight or through diving behavior. This mostly impacts raptors (hawks and eagles) diving to capture prey, flocking birds that utilize open fields for foraging, migrating birds flying in transit, or single individuals foraging or in

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[1] SNH (2014) Recommended bird survey methods to inform impact assessment of onshore wind farms Downloaded 8/2/2018 from: https://www.nature.scot/sites/default/files/2017-09/Guidance%20note%20-%20Recommended%20bird%20survey%20methods%20to%20inform%20impact%20assessment%20of%20onshore%20windfarms.pdf

[2] IFC (2015) Environmental Health and Safety Guidelines for Wind Energy. Downloaded 8/2/2018 from: https://www.ifc.org/wps/wcm/connect/2c410700497a7933b04cf1ef20a40540/FINAL_Aug+2015_Wind+Energy_EHS+Guideline.pdf?MOD=AJPERES

transit between habitats.

Flight times of birds at times when the windfarm is operational can also lead to increased susceptibility of strike. This includes birds that pass through the RSZ either at dawn or dusk or birds that forage at night in open spaces (such as owls).

Similarly for bats, flight through the RSZ may occur based on foraging or transit behavior. Flight times however increase the susceptibility of strike with most bats likely to transit the RSZ at dawn or dusk or during the night. Bats that form colonies and fly in large numbers also increase the risk of strike.

Impact Evaluation and Significance

A preliminary impact assessment is presented below and is based on the assumed presence of species of conservation significance identified during the careening process. This will be updated following the completion of seasonal surveys.

The nature of the impact will be **Negative** to resident fauna within the Project area. The impact type is likely to be direct. The magnitude of impact is expected to be **Medium** as the impact is likely effect a sufficient proportion of a species population that it may bring about a substantial change in abundance and/or reduction in distribution over one or more generations, but does not threaten the long term viability of that population or any population dependent on it. The sensitivity of the receptor is considered to be **High** as it is likely that species present within the DMU are listed on the IUCN Red List or Vietnam Red Book as Critically Endangered (CR) or Endangered (EN). The overall significance is therefore considered to be **Major**. The impact will continue into operation.

Table 11.19 Impact Evaluation and Significance: Turbine Strike

Impact Description	**Turbine stike causing injury or mortality to bird and bat species**			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	Small	**Medium**	Large
Sensitivity/Vulnerability	Low	Medium	**High**	
Significance	Negligible	Minor	Moderate	**Major**

Additional Mitigation Measures, Management, and Monitoring

Mitigation measures will be confirmed following completion of an updated impact assessment following the completion of bird surveys. Expected management and mitigation measures may include:

- All tower structures are to be free of holes that can be used for nesting. Roosting habitats (wires and ledges) are to be kept to a minimum.
- Shut down-on-demand shall be enabled for all wind turbines.
- Contrasting colours are to be trialled on wind turbines in order to make turning blades visible to avifauna.

- Turbine cut in speed is to be made slower in order to increase the opportunity for avifauna avoidance during start up.
- Seasonal bird and bat studies during the first two years of operation;
- A carcass monitoring program is to be conducted on a weekly basis at the base of all turbines. All carcasses are to be identified and a database kept of the number and taxa of the species.

- A review of the data collected from monitoring and carcasses is to be undertaken every 6 months for 2 years to identify particular species susceptible to strike risk by a suitably qualified person. Wind farm operations may be altered based on the lifecycle characteristics of any species identified that are susceptible to strike. Assessment of data is to occur yearly from the 3rd year of operation.

Significance of Residual Impact

Based on ERM's experience, and pending the results of the seasonal studies, the application of the mitigation measures is likely to reduce the impact due to degradation of habitat to **Moderate/Minor** during construction and operation.

11.3.5 *Biodiversity Impact Assessment (Decommissioning Phase)*

The impacts screened in during the decommissioning phase include: disturbance and displacement of fauna; and degradation of habitat.

Disturbance or displacement of individual fauna

Disturbance and displacement of individual fauna will occur during decommissioning due to the dismantling and removal of infrastructure at the project site, including wind turbines and cabling. Impacts will result from the increase in machinery and human presence during dismantling activities disturbing resident fauna. Increases in noise, light and vibration at the project site will be the primary sources of impact.

Reference should be made to the description of impacts in the construction phase for specific information on the type of impacts expected.

Impact Evaluation and Significance

The nature of the impact will be **Negative** to resident fauna within the Project area. The impact type is likely to be **Direct**. The magnitude of impact is expected to be **Small/Medium** as the impact will likely effect a small proportion of a population within the Project Area, but does not substantially affect other species dependent on it, or the populations of the species itself. The sensitivity of the receptor is considered to be **Medium**[1] as it is likely that species present within the Project Area are listed on the IUCN Red List or Vietnam Red Book as Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD). The overall significance is therefore considered to be **Minor/Moderate**.

[1] This classification may change depending on the results of forthcoming surveys of the project area in relation to birds and volant mammals (bats)

Table 11.20 Impact Evaluation and Significance: Disturbance or displacement of individual fauna

Impact Description	Construction phase impacts to biodiversity as a result of degradation of habitat			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	**Minor**	**Moderate**	Major

Additional Mitigation Measures, Management, and Monitoring

The following additional measures are to be applied during decommissioning:

- A *Decommissioning Plan* should be prepared to outline the specific measures to be undertaken during the dismantling and removal of all project infrastructure.
- All project infrastructure is to be inspected prior to dismantling and removal for resident fauna. A *Fauna Shepherding Protocol* is to be utilised to reduce impacts on resident fauna.

Significance of Residual Impact

The application of the mitigation measures is likely to reduce the impact due to degradation of habitat to **Low/Negligible** during decommissioning.

Degradation of habitat

Rehabilitation of the Project area will be required following the removal of project infrastructure. This will result in positive impacts to biodiversity values in the project areas through the replacement of habitats for species, increasing the available area. Any residual impacts on species populations due to the operation of the windfarm (including potential impacts to avifauna) will be removed, resulting in potential increases in affected populations.

Impact Evaluation and Significance

The nature of the impact will be potentially **Positive** to resident fauna within the Project area. The impact type is likely to be **Direct**. The magnitude of impact is expected to be **Small/Medium** as the impact will likely effect a small proportion of a population within the Project Area, but does not substantially affect other species dependent on it, or the populations of the species itself. The sensitivity of the receptor is considered to be **Medium**[1] as it is likely that species present within the Project Area are listed on the IUCN Red List or Vietnam Red Book as Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD). The overall significance is therefore considered to be **Negligible**.

[1] This classification may change to depending on the results of forthcoming surveys of the project area in relation to birds and volant mammals (bats)

Table 11.21 Impact Evaluation and Significance: Degradation of habitat

Impact Description	**Decommissioning phase impacts to biodiversity as a result of Degradation of habitat**			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	**Low**	Medium	High	
Significance	**Negligible**	Minor	Moderate	Major

Additional Mitigation Measures, Management, and Monitoring

The following mitigations are recommended:

- A *Decommissioning Plan* is to be prepared that outlines the habitat rehabilitation requirements once project infrastructure are removed. The habitat rehabilitation shall be undertaken with flora of native provenance.
- Measures are to be undertaken to manage the introduction of invasive species during decommissioning and site rehabilitation. The measures are to be outlined in the *Decommissioning Plan*.
- All machinery to be used in the Project area are to exert a low pressure on the ground surface so as to minimise soil compaction.
- All machinery and hand held equipment used must comply with required air and noise emission standards.
- Sediment and erosion control measures are to be used in all areas of decommissioning to minimise soil contaminated runoff entering waterways. These measures are to be outlined in the *Decommissioning Plan*.
- Hours of operation of the decommissioning site are to be limited to the hours of 6.00am to 6.00pm Monday to Sunday.
- All light sources are to be directed away from areas of Natural Habitat.

Significance of Residual Impact

The application of the mitigation measures is likely to reduce the impact due to degradation of habitat to **Low/Negligible** during decommissioning.

11.4 SHADOW FLICKER IMPACTS

A shadow flicker, blade throw and visual assessment study was conducted by ERM and is provided at Annex I. This described in detail the methodology and findings of the study.

Shadow flicker is a term used to describe the pattern of alternating light intensity observed when the rotating blades of a wind turbine cast a shadow on a receptor under certain wind and light conditions. Shadow flicker occurs under a limited range of conditions when the sun passes behind the hub of a wind turbine and casts an intermittent shadow over neighbouring properties. ERM's assessment of shadow flicker impacts on receptors is based on the SHADOW WindPro calculation module.

SHADOW is the WindPro calculation module that calculates how often and in which intervals a specific neighbour or area will be affected by shadows generated by one or more WTGs. These calculations are worst-case scenarios (astronomical maximum shadow, i.e. calculations which are solely based on the positions of the sun relative to the WTG). Shadow impact may occur when the blades of a WTG pass through the sun's rays seen from a specific spot (e.g. a window in an adjacent settlement). If the weather is overcast or calm, or if the wind direction forces the rotor plane of the WTG to stand parallel with the line between the sun and the neighbour, the WTG will not produce shadow impacts, but the impact will still appear in the calculations. In other words, the calculation is a worst-case scenario, which represents the maximum potential risk of shadow impact. A calendar can be printed for any specific point of observation, which indicates the exact days, and time periods where shadow impact may occur.

11.4.1 Potential shadow flicker impact due to HL1 project

Given the guidelines of 30 hours or less per year is considered to be acceptable, the operation of the wind farm theoretically results in shadow flicker impacts that could be considered as significant for the purposes of this study. The results show that theoretical shadow flickers in real case scenario occur at 35 shadow receptors. The maximum shadow flicker occurs at receptor '112', located close to the wind turbines *T11* and *T10*, with a maximum of 82:47 hr/year followed by receptor '49', located close to wind turbine *T09*, with a maximum of 75:07 hr/ year, followed '114' (located close to *T11 and T10*) with 67:31 hr.

11.4.2 Potential cumulative impacts due to HL2 project

Potential cumulative impacts within the HL1 wind farm have been envisaged at receptors '11' (32:42 hr/ year), '12' (41:47 hr/ year) caused by the interaction between WTGs T14 and T15. Cumulative impacts are also envisaged at Receptors '110' (36:11 hr/ year), '111' (51:21 hr/ year), '112' (82:47 hr/ year), '113' (52:44 hr/ year), '114 (67: 31 hr/ year), '115' (58:40 hr/ year), '116' (56:16 hr/ year) and 117 hr/ year). With regards to the HL2 windfarm, there is likelihood that receptor '133' may experience shadow flicker impacts as a result of the interaction between WTG T11 (of HL1 wind farm) and W14 (of HL2 wind farm).

It is relevant to emphasise that predicted hours of shadow flicker effects are real case scenarios with certain assumptions. Assumptions made during the analysis include optimal meteorological, natural light and geometrical conditions for the generation of shadow flicker. The assessment does not account for trees or other obstructions that intervene between receptor and turbine during times when effects may occur. The assessment calculation is therefore an over estimation in the probability of effects. It should also be noted that for shadow effects to occur, properties need to be occupied, with blinds or curtains open and views to the wind turbine unobstructed. However, for the purposes of assessment, it has been assumed that all worst-case circumstances apply.

Table 11.22 Impact Significance of Shadow Flickering pertaining to the HL1 Turbine

Impact Description	Shadow flicker due to the wind farm			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	Small	**Medium**	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	Minor	**Moderate**	Major

11.4.3 *Mitigation Measures*

- In case the locations have been finalised by the project proponent and earmarked for construction, there needs to be close monitoring through engagement with residents during the operational phase where there are predicted impacts from shadow flicker.
- The likelihood of direct line of sight to the location of proposed turbine locations can be assessed visually and the potential for using screening like higher fencing and planting trees can be explored at problem locations. The use of curtains can also be explored.
- If these prove effective and the impacts mitigated, the shutting down of turbines during certain environmental conditions, which meet the physical requirements for theoretical shadow flicker to occur, will not be required.

Should the impact of shadow flicker be identified, and the mitigation measures proposed above prove ineffective, further analysis can be carried out to identify the exact timings and conditions under which shadow flicker occurs, and a technical solution sought. This is likely to involve pre-programming the turbine with dates and times when shadow flicker would cause a nuisance for nearby receptors. A photosensitive cell can be used to monitor sunlight, and the turbine could potentially then be shut down, when the strength of the sun, wind speed and the angle and position of the sun combines to cause a flicker nuisance.

11.4.4 *Assessment of Residual Impacts*

The results of the windPro shadow flicker assessment show a real case estimate with certain assumptions and the mitigation measures above will be implemented for the identified properties that experiences shadow flicker.

Residual impacts following the application of required mitigation measures, as discussed above, is likely to result in **minor** impacts.

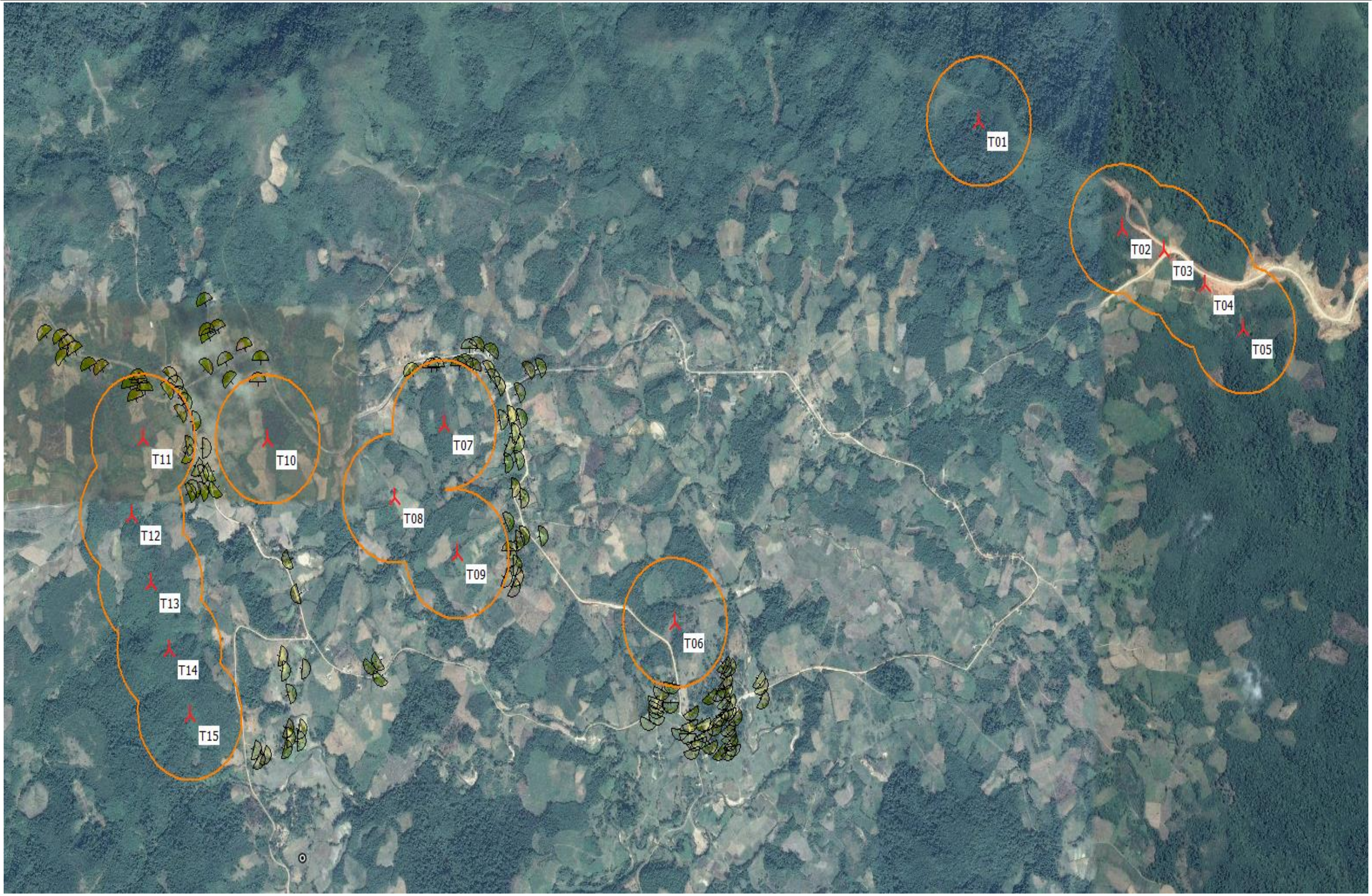
11.5 *BLADE THROW*

A qualitative blade throw assessment was prepared by ERM and is provided at Annex I.

The impacts from blade throw may result in various scenarios as property damage, injuries and/or fatality depending on where the missile/fragment lands. It might not affect any property or person if it lands on vacant land. The probability of fatality within occupied properties would also be subject to Impact Impulse, type of structure, number of occupants at the time of the impact etc (coverage beyond the scope of this qualitative study).

Based on the qualitative analysis of blade throw considering the setback distance as proposed by the IFC, blade throw impacts are envisaged at 16 receptors out of total 133 receptors identified around the proposed wind turbines of HL1 project, which are located between 125 m to 198 m from the nearest wind turbines (T07, T09, T10,and T11,). As can be observed from ***Figure 11.2 and Table 11.23***. Turbine T-11 has the largest number of receptors ie 11 receptors within the impact zone followed by T-07 (3 receptors), T-09 (1 receptor) and T-10 (1 receptor).

Figure 11.2: Impacts of blade throw



Although the incident data for blade isn't extensive, there are now over 200,000 turbine years of operating experience in Europe for which reliable data is available. This includes around 100 incidents of blade failure in Europe over the period 1995 to 2009. The failure frequency per 1 MW turbine per year = 5 x 10^{-4} blade failures/turbine /year[1]. Note however, this approach cannot be used to identify the blade failure frequency as a function of WT power rating.

Based on the above the significance of the impact is assessed to be **moderate**.

Table 11.23 Significance of impacts of blade throw

Impact Description	Impacts of blade throw			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	Small	**Medium**	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	Minor	**Moderate**	Major

11.5.1 Mitigation/Management Measures

- Mitigation measures, in this case, would be possibly to relocate the proposed WTG locations, specifically for WTG's T-11 which has maximum number of receptors in the Section 7.4.1. Although the IFC suggests a setback distance for avoiding blade throw impact in the EHS guidelines for wind power projects, a more holistic approach would be to establish a setback distance of about 300 m or more to encompass the findings in the shadow flicker and noise modelling studies.
- If relocation of either turbines or receptors are not feasible options the potential risk reduction options to consider include:
    - 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.
    - Carry out periodic blade inspections and repair any defects that could affect blade integrity.
    - Ensure that lightning protection systems are properly installed and maintained.
    - Equipping wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.
    - Create awareness amongst the community about any potential impacts and bringing to immediate notice of the client any

[1] [1] Study and development of a methodology for the estimation of the risk and harm to persons from wind turbines. HSE Report No. RR968, 2013

abnormal sound/changes noticed by the residents regarding operations of the turbines;

- Alternatively, a more detailed Quantitative Risk Assessment may be recommended to better understand the magnitude of impact of blade throw or turbine collapse prior to installation of the wind turbines.

11.5.2 *Assessment of Residual Impacts*

Residual impacts following the application of required mitigation measures, as discussed above, is likely to result in **minor** impacts.

11.6 LANDSCAPE AND VISUAL IMPACTS

Visual impact assessment means assessing the impacts on specific views and on the general visual amenity experienced by people. Landscapes are not static but are dynamic, not least due to the range of natural and human factors that define their characteristics, but also due to the many different pressures that have altered landscapes in the past and will continue to do so in the future. Therefore, determining the significance of visual effects identified can be particularly challenging.

A detailed assessment is provided at Annex I.

It is understood from the google imagery that the turbine locations T-01, T-02, T-03, T-04 and T-05 are far away (> 1 km) from the habitation/houses and would not pose direct impacts on the visual aesthetics of the area or the people. However, these turbines are located close to a road and may have transient impact on the people traversing through the road. The other ten turbines are located in and around houses within a range of < 2 km and most likely be visually dominating (refer to Figure 11.3). However, there are dense vegetation between the houses and the turbines at T-06, T-07, T-08, T-10, T-12, T-13, T-14 and T-15, which may significantly make the turbines as visually noticeable from a distance range.

11.6.1 *Analysis of sensitivity of visual receptors*

The visual receptors in this case are residents in the houses within the project area of influence and the people traversing through the roads in the project area. As discussed earlier, there is no associated importance of the views with respect to the landscape of the area as a tourist place/scenic view and the review of information in the public domain shows no evidence of the same. Also, the change is expected to not be new or unprecedented as the people of the area are already used to view of turbines due to the existing HL-2 project. Therefore, the sensitivity of visual receptors is assigned as *low*.

11.6.2 *Visual Magnitude of the effect*

The visual magnitude of the effect is assessed as *Medium* as the project will result in noticeable change in the view at an intermediate distance and less concentrated change across an expansive area. The change will be medium to long term though not irreversible.

Figure 11.3 View of HL1 and HL2 wind farms

11.6.3 *Embedded controls*

- The siting has been carried out appropriately so that the site can comfortably accommodate the proposed number of turbines without being visually overwhelming.
- The turbines are white in colour which will help them in blending into the background and make it less visually obtrusive.

Based on the above analysis, the impact of the project on the visual aesthetics is assessed as ***Minor.***

Impact Description	Impact on visual aesthetics during operations			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	Small	**Medium**	Large
Sensitivity/Vulnerability	**Low**	Medium	High	
Significance	Negligible	**Minor**	Moderate	Major

11.6.4 *Mitigation Measures*

- Use of materials that will minimize light reflection should be used for all project components.
- Bright patterns and obvious logos should be avoided.
- The replacement of wind turbines with visually different wind turbines can result in visual clutter, so replacing wind turbines with the same or a visually similar model over the lifetime of the project may be an important requirement.
- Existing vegetation should be retained to the greatest extent possible. Vegetation should be retained along roads and around turbine pads, substations, and other project infrastructure.

12 SOCIAL IMPACT ASSESSMENT

This section provides discussion on the potential social and community health impacts of the Project.

The key impact areas, which are further discussed in this section are:

- Land Acquisition;
- Economy and Livelihoods;
- Indigenous People;
- Community Health; and
- Community Safety.

Impact for occupational health and safety will be assessed in *Section 12*

12.1 LAND ACQUISITION IMPACT ASSESSMENT RESULT

According to the local Environmental Impact Assessment report and as confirmed by the Project management, the Project is located within Huong Linh commune, Huong Hoa district, Quang Tri province, Vietnam. The main components and their locations are as follow:

- The main Project's powerhouse and 110 kV powerline are located within four villages including Hoong village, Miet village, Cooc village and Pa Cong village of Huong Linh commune; and
- The remaining of 110 kV powerline is located in Vung Kho village, Dakrong commune, Dakrong district.

According to the local EIA report of the Project, a total of 272,394 m^2 of land is required for the Project development, including:

- The permanent land acquired is 94,224 m^2 for 15 turbines, internal roads, 110 kV transformer substations, and 110 kV and 22 kV powerlines; and
- The temporary land acquired during the construction process , which is estimated within 18 months with the main construction period of 12 months (i.e. to be returned to the local communities when construction completed) is 178,150 m^2 for temporary worker accommodation, equipment laydown area, and safety corridor for 110 kV and 22 kV powerlines. It is noted that the land used for safety corridor area for the powerlines (i.e approximately 170,450 m^2) will be kept untouched. No information is given on the type of land currently in the safety corridor for 110 kV and 22 kV powerlines.

As such, the land acquired for clearance will be 101,944 m^2, which mainly include the following types:

- Agricultural production land (i.e. mainly cassava production): 55,490 m^2;
- Forestation land (i.e. mainly *Melaleuca cajuputi*): 11,123 m^2;
- Bare land/ hills: 18,786 m^2; and
- Secondary forest (i.e. mainly shrubs and tall grasses): 16,545 m^2.

Of the above 101,944 m^2 of land, 94,244 m^2 will be permanently acquired and 7,700 m^2 of land will be temporary acquired. The acquired land is located in Hoong village, Cooc village and Miet village, Huong Linh commune, Huong Hoa district, Quang Tri province.

According to the Project management and as confirmed by the local authority, at the time of reporting, the land acquisition process has nearly been completed (i.e. as noted by the Project's management staff, 80% of the land acquisition has been completed). According to the Project management, currently, total acquired land is 84,000m^2 for the construction of turbines foundations and access roads to the turbine locations. These include:

- Forestation land: 40,000m^2;
- Land for long term trees: 20,000m^2; and
- Land for other trees: 22,000m^2.

According to the plan, a further 6000m^2 of land will be acquired from additional three households for the construction of turbines foundations and access roads.

Currently, a total of 15 households have been identified as having agricultural land permanently acquired and no physical displacement will be occurred from the land acquisition of the Project as confirmed by the Project management. A further three households will have land acquired for the Project. Therefore, a total of 18 households will be directly affected by the Project. The Compensation, Support and Resettlement (CSR) process of the Project is a government-led process and thus, it is expected to have been conducted in accordance with applicable national regulations (i.e. *Law on Land No. 45/2013/QH13* and its related sublaw regulatory documentations). At current stage, the total amount of compensation money for 15 households that have had land acquired by the Project is 2,800,000,000 VND.

Through the interviews with the Project management, Huong Linh commune People Committee (PC) and the village heads of the three villages, it is confirmed that the land acquisition process has been conducted according to the national regulatory procedures/requirements, which included a direct consultation process with the affected households, and the compensation was agreed based on the provincial land compensation and support rates issued by the province. It is noted that the compensation prices for land and assets on land and other supports provided by the Project to economically displaced households were based on the following regulatory documentations:

- *Land Law No. 45/2013/QH13*;
- *Decree No. 47/2014/ND-CP* – Regulations on Compensation, Support, and Resettlement upon Land Expropriation by the State;
- *Decree No. 43/2014/ND-CP* - Detailing a Number of Articles of the Land Law;
- *Decision No. 07/2015/QD-UBND* of the People Committee of Quang Tri province on the revision of *Decision No. 38/2014/QD-UBND* on the regulations on compensation, support and resettlement when land acquisition occurred in Quang Tri province; and
- *Decision No. 01/2013/QD-UBND* of the People Committee of Quang Tri province on the prices for assets including houses, structure and plants in Quang Tri province; and
- *Decision 51/2016/QD*-UBND of the People Committee of Quang Tri province on the prices for the construction of architectural structures, trees and crops in Quang Tri province.

At this stage, the information on land acquisition and compensation was provided by the Project management and no land acquisition and compensation documentations were provided for ERM's review during the ESIA Process.

12.1.1 Economic Benefit from Land Compensation

Discussion of Impacts

At current stage, there have been little records of economic benefits to the livelihoods of the affected households from the land compensation given that no land acquisition and compensation documentations were provided for ERM review during the ESIA Process. Therefore, it is difficult to have a direct comparison between the compensation and the income of the households. However, according to the Project management, at current stage, the total amount of compensation money for 15 households that have had land acquired by the Project is 2,800,000,000 VND following the provincial issued prices for land and associated assets on land. It is noted that the average monthly household income is approximately VND 3,699,000 excluding operational and labour expenses and mainly from agricultural activities (i.e. cropping and husbandry). Therefore, the compensations for the land acquisition is a reasonably fair amount for the 15 affected households given that many of them are poor households (i.e. 60% in Cooc village and 50% in Miet village). It was noted by the Project management that the compensation package is relatively good in the local context and to some extent better than the market prices (i.e. land transfer price between the households). According to most of the economically displaced households, agricultural production, particularly upland cassava and rice cultivation is their main livelihoods. However, some of them have mentioned that they plan to use the compensation from land acquisition to further engage in other types of livelihood such as animal husbandry (i.e. cattle, buffalo or goat) in addition to current agricultural cultivation, which is considered economically more effective in the area as the weather conditions (i.e. mostly foggy and windy) are not favourable for agricultural production and forestation activities. It is noted from the socio-economic baseline results that almost all of the affected households have been engaging in animal husbandry even before the land acquisition process at small scale level (i.e. number of buffalo or cow of less than 10 individuals).

Impact Evaluation and Significance

The impact significance of the Project's land acquisition in terms of economic benefit for the land users is assessed as being *Positive* **(**Table 12.1**)**. This judgement is taken based on the fact that the land users will receive compensation for the land and have planned to use it as the capital to engage in other types of livelihood, which could improve their income. However, at this stage, the scale of positive impact to the livelihood of affected households cannot be assessed as there is no information about the land compensation price or compensation amount provided for review.

Table 12.1 Economic Benefit from Land Compensation

Impact Description	Economic benefit to the land user from the Project land acquisition	
Impact Nature	**Positive**	Negative

Proposed Measures for Enhancing the Positive Impact

In order manage land acquisition processes and evaluate the impact of this, the Project should;

- Work closely with the authority who is in charge of the implementation of the CSR process to:
    - Monitor the process;
    - Keep records of all consultation under the process;
    - Consider if additional support is required in addition to the compensation and support from the government to meet the requirements of IFC in terms of full replacement cost and livelihood restoration.

Develop and implement a Grievance Mechanism to support the authorities in disclosure of the grievance mechanism to affected communities and receiving the CSR related grievances to forward to the in charge authority for resolution. Closely monitor and regularly report the grievance resolution process internally and externally to the Lenders (the frequency can be discussed and agree between the Project and Lenders).

12.1.2 *Impact to Loss of Access and Income for Land Users*

Discussion of Impacts

As noted above, currently, a total of 15 households (i.e. the total may reach 18 households by the end of land acquisition process) have been identified as having agricultural land permanently acquired and no physical displacement will be occurred from the land acquisition of the Project as confirmed by the Project management. Before the land acquisition, reportedly the land user utilized the land mainly for agricultural production (i.e. cassava and upland rice from February to September, and wetland rice from September – December of each year) as the main income sources. According to the socio-economic baseline results, the monthly average gross income of 24 surveyed households was approximately VND 3,699,000 excluding operational and labour expenses and mainly from agricultural activities (i.e. cropping and husbandry). However, the surveyed households also claimed to possess or reclaim other plots of land nearby or further away within Huong Linh commune. According to the 58.3% of surveyed households from the socio-economic baseline, the loss of land and related income from the Project land acquisition would impact their future livelihood, mostly because of having less land for agricultural production, which is their main livelihood. Moreover, 16.6% of interviewed households considered that it is difficult to change to other livelihoods, most of the respondents (16/24) are reluctant and/or have no idea about how their livelihoods would change. On the other hand, it is also noted that:

- Affected households appear to have received fair amount of compensation (i.e. total of 2,800,000,000 VND for all 15 households at current stage) ;
- Agricultural production was not effective on the acquired land (i.e. due to unfavourable weather conditions such as windy and foggy); and
- Land still available for their agricultural production or reclamation.

In addition, according to the households that have land acquired, the compensation from land acquisition may allow them to further invest in other types of livelihood such as animal husbandry (i.e. cattle, buffalo or goat), which is considered economically more effective in the area as the weather conditions (i.e. mostly foggy and windy) which are not favourable for agricultural production and forestation activities. The affected households expect to have a future support from the Project for their livelihood restoration and improvement, including provision of technical guidance and animal breeds/ plant seeds. It is also noted that the number of affected households are small in comparison with the total population (i.e only 15 households, and possibly reaching up to 18 households at the end of land acquisition process, out of 239 households in Hoong village, Cooc village and Miet village).

Impact Evaluation and Significance

The impact of the Project land acquisition on the loss of access and income for the land users is evaluated as being ***Medium*** **(**Table 11.2**)**. This judgement is based on the fact that the impact magnitude is *Small* as the impact only affects a few community members (i.e. at current stage, approximately 15 households, and possibly reaching up to 18 households by the end of land acquisition process, out of approximately 239 households from Hoong village, Cooc village and Miet village based on information provided by village heads). Moreover, according to local people, there is no loss of access to the lands during the construction and operation phases of the Project. It is noted that the vulnerability is *High* given that most of the affected households are poor households, though lands are still available for their continuing agricultural production/livelihood. In addition, it is noted that most of affected households in Miet village have been resettled to the area by Rao Quan hydropower plant since 2006. They are now being economically displaced again by Huong Linh 1 Wind Power Project. Therefore, they are considered more vulnerable than the other affected households from Hoong and Cooc villages.

Table 12.2 Economic Impact from Land Acquisition

Impact Description	Loss of income for land users as a result of the Project land acquisition			
Impact Nature	Positive		**Negative**	
Impact Type	Direct		**Indirect**	
Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	Low	Medium	**High**	
Significance	Negligible	Minor	**Moderate**	Major

Proposed Additional Measures

It is understood that the land that has been acquired in accordance with applicable national regulations. As regulated by the *Law on Land 2013* and its related sublaw regulatory documentations, particularly the *Decree No. 47/2014/ND-CP*, the compensation must be made in the form of allocating new land with the same land use purpose with the recovered land. If there is no land available for compensation, the land users shall receive compensation in money calculated according to the specific land price of the type of land acquired, which is issued by the provincial-level People's Committee at the time of the land acquisition decision.

According to the Law on Land 2013, affected households whose livelihoods are land-based will receive support to stabilize their lives. These include:

- Support for life stabilization;

- Support for production stabilization (i.e. including: plant varieties, breeds of domestic animals for agricultural production, agricultural and forestry extension services, plant protection services, veterinary medicine, cultivation and cattle-breeding techniques, and professional skills for production and business in industry and trade services);
- Support for vocational training, occupation change and job seeking in addition to the compensation in money made for the area of agricultural land acquired;
- Support for households benefitting from social allowances; and
- Support for poor households.

In order for the Project to meet IFC PS5, the Project should conduct the following:

- Consult with local authority and affected people, particularly Indigenous People, to understand the supports for vocational training, occupation change and job seeking activities that have been conducted by local government for economically displaced households, if any;
- Analyse the limit and effectiveness of the supports for vocational training, occupation change and job seeking activities that have been conducted by local government for affected households having agricultural land acquired; and
- In the case that there is no or limited supports for vocational training, occupation change and job seeking activities that have been conducted by local government, the Project should consult with local authority, affected households and other relevant third parties to develop and implement an extended Community Development Plan (CDP) that should incorporate the Livelihood Restoration Programs/ Initiatives specifically designed for households having agricultural land acquired.

It is noted that the above recommendations are based on the following reasons:

- The impacts on the livelihood of the affected communities are assessed as *Minor* as only a small proportion of households (i.e. 15 households, and possibly reaching up to 18 households by the end of land acquisition process, out of approximately 239 households in Hoong village, Cooc village and Miet village) of the communities were affected and the affected households still have enough lands for sustaining their livelihood. Therefore, the development of a whole Livelihood Restoration Plan for the economically displaced households may not be necessary but specific Livelihood Restoration Programs/Initiatives can be incorporated into an extended CDP, which can also provide benefits for a larger community (i.e. the communities of the three villages);

Residual Impacts

As a result of implementation of proposed additional measures, the residual impact associated with loss of access and income to land users is considered as ***Minor***.

12.2 *ECONOMY AND LIVELIHOODS*

12.2.1 *Impact to Local Economy from Employment and Business Opportunities during the Project Construction and Operation*

Discussion of Impacts

It is noted that when the operation phase starts, the Project will contribute tax revenue to the Province's budget. At current stage, the amount of annual tax revenue that the Project will contribute to the Province's budget is not provided.

According to the local EIA report of the Project, during the construction phase, the Project will require approximately 100 workers/staff of both EPC contractors and Project staff. The construction phase is projected to be completed in 18 months after the commencement. At this stage, there is no information on the proportion of unskilled jobs that can be filled by local community members. Based on the socio-economic baseline results, local people have low education and skill levels and as such, it would be difficult for them to meet the recruitment requirements for skilled positions.

During the operation phase, the Project is projected to employ 30 workers/staff. According to the local EIA report, while most of the labours during the operation phase will be the skilled labourers and will be likely recruited from outside of the area, priority will be given to the local community of Huong Hoa district and Quang Tri province to fill the required unskilled/semi-skilled positions such as security personnel and kitchen support workers.

Although the Project has no specific commitment in the local EIA to prioritize and employ local workers, particularly from those directly affected by the Project in Huong Linh commune, it is expected that a similar number of local workers of Huong Linh 2 project will be employed for the construction and operation of Huong Linh 1 Project. In particular, through the interview with local authority and the Project's management within the scope of ESIA, during the construction phase of the Huong Linh 2 the Huong Linh 2 project has employed 12 local people as security personnel and one as a kitchen hand.

In addition to the employment opportunity, the Project will also require goods and services for its construction and operation activities such as construction materials, equipment, cleaning, catering and other hospitality services. However, it is noted from the socio-economic survey that there is currently very small to none of such services are existing in Huong Linh commune.

Most of local people living close to the Project Site has very limited or none commercial activities, mainly with mobile traders who are from Khe Sanh town, Huong Hoa district. Therefore, the above mentioned opportunities will probably provide additional markets for the existing small and medium local businesses of the Khe Sanh town which is located approximately 25 km from the Project Site. These may include sands and rocks suppliers, excavator and bulldozer equipment suppliers, restaurants, and lodging providers. On the other hand, grocery suppliers and for some extent, restaurant services can have the potential to be provided by local community close to the Project location if there is opportunities and enhancement.

Impact Evaluation and Significance

The Project has no specific commitment in the local EIA report to prioritize local workers employment during the construction and operation phase. Also, the number of employment opportunities are very limited. It is expected that the Project will provide local procurement opportunities for the small and medium scale businesses in Khe Sanh town and induced job opportunities potentially for local people around the Project location (i.e. Huong Linh commune) if local business is enhanced and prioritized. Based on this analysis, the Project most likely has a Minor Positive impact in terms of employment and procurement and induced job opportunities and increase the economic condition of the local people (Table 12.3).

Table 12.3 Economic Benefits from Employment and Business Opportunities

Impact Description	Economic benefit to locals as a result of the Project employment and business opportunities	
Impact Nature	**Positive**	Negative

Proposed Additional Measures

To optimise the Project benefits to local community through employment and business opportunities, the Project should implement the following additional mitigation measures:

- It is very important for the Project and Engineering Procurement and Construction (EPC) contractors to work closely with the local government agencies, particularly in Huong Linh commune, to synchronize the Project's needs and the local's capacity.
- To have a clear stipulation/commitment of using local labour, particularly in regards of economically displaced households, in the EPC contract and instruct the EPC contractors to prioritise qualified local people as construction workers in accordance with the needs of the Project;
- Provide and communicate clear information about the Project's requirement related to employment and business opportunities and prioritise locals where feasible. Such communication should be conducted

at least four months before the recruitment as such the local people are able to have enough time for their preparation for the recruitment (e.g. attend short training courses to improve their skills);

- Establish a clear grievance mechanism (as set out in *Annex A* to ensure all community issues related to the Project are addressed in a timely manner. In addition, the grievance mechanism should be fully disclosed to local authority, EPC contractors and local community so that they are able to be well aware of the process and their roles/ rights in its implementation; and

It is noted that the Livelihood Restoration Programs/ Initiatives as mentioned in *Section 12.1.2* (i.e. specifically designed for households who have land acquired by the Project) can be extended to as Community Development Programs/ Initiatives to cover the need of local communities (i.e. specifically target the local people of Hoong village, Cooc village and Miet village of Huong Linh commune).

12.2.2 Disturbance to Agricultural Production as a Result of Project Construction and Operation Activities

Discussion of Impacts

The socio-economic baseline survey results reveal that the majority of Bru - Van Kieu People engage in agricultural production (i.e. some still practice shifting cultivation) and small scale husbandry sectors. As mentioned in *Section 1.1*, the Project will acquire a permanent land plot of 101,944 m^2, of which 55,490 m^2 are agricultural land, mainly as cassava production land, and 11,123 m^2 of forestation land (i.e. mainly *Melaleuca cajuputi*) by the land users and as grazing land by some of the villagers. The area is also surrounded by agricultural lands where people plant cassava, upland rice, paddy rice and forestation.

It is noted during the consultation with local authority and local community that as experienced from Huong Linh 2 project, the Project activities, particularly during the land clearing and construction phase, are anticipated to cause soil erosion around the turbine locations in raining season. It is noted from the local EIA report that the annual rainfall is ranging from 2,000-2,800 mm with average annual rainfall of approximately 2,260 mm. The rainy season is normally from April to November, which contribute about 75-80% of the total annual rainfall. In rainy season, there might be high rainfall events that cause flash flood. As such, the water runoff with sediment would cause the accumulation of sediment and disturbance to the paddy rice fields located close to the turbines and the Project's Site.

Similarly, there has been a concern from local authority and communities regarding the same problem during the operation phase leading to disruption of agricultural production of paddy rice around the Project's facilities (i.e. turbines, Project's Site Office and other related facilities such as access roads).

Impact Evaluation and Significance

The impact of increased soil erosion to disruption of paddy rice production during the land clearing and construction phase and to some extent the operation phase of the Project is assessed as *Minor* significance. The magnitude is relatively *Small* as the area of paddy rice fields located close to the Project's facilities is small in comparison with other types of land. Although it is unlikely that the Project will have significant impact to the community incomes generated from paddy rice production, the sensitivity of the receptors is assessed as *Medium* due to potential concerns from local farmers as farming is their main livelihood (i.e. mainly as self-consumption) (Table 12.4), and as according to the local people and as observed on Site, it can completely disrupt the production of paddy rice.

Table 12.4 Disturbance to Agricultural Production

Impact Description	Disturbance to paddy rice production is potentially occurred as a result of soil erosion from the Project construction and operation			
Impact Nature	Positive		**Negative**	
Impact Type	Direct		**Indirect**	
Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	**Minor**	Moderate	Major

Proposed Additional Measures

The local EIA provides some mitigation measures such as:

- Conduct land clearance and construction in dry seasons;
- Cover the construction area during heavy rainfall events;
- Concrete the stormwater drainage system; and
- Prepare emergency response plan for flash flood events.

Although the assessment in this ESIA results that the impact is Minor, the Project is still expected to implement the following measures in addition to the measures provided in the local EIA report as listed above to manage the impacts within this Minor . These include:

- Provide and communicate detailed information about the Project's plan and schedule particularly related to land clearing and construction to the community with a special attention to farmers nearby the project locations;
- The projects Construction Environmental Management Plan (CEMP) should stipulate measures to manage and control erosion and runoff during construction;

- The Project's plan and schedule particularly related to land clearing and construction should avoid the rainy season and paddy rice production season (i.e. according to local authority and local community, the paddy rice production season is from September to February of the next year); an

- Establishment of a grievance mechanism (i.e. as provided in *Annex A*) that is understood by and accessible for all villagers. The mechanism will be simple, efficient and timely and fully consultative.

Residual Impacts

As a result of the implementation of the proposed measures, the impact on the disturbance to farming activities associated with soil erosion during construction and operation phases will be maintained *Minor*.

12.3 IMPACT ON INDIGENOUS PEOPLE ASSESSMENT RESULT

12.3.1 Impacts on Lands, Natural Resources and Critical Cultural Heritage Subject to Traditional Ownership or Under Customary Use

Discussion of Impacts

As described in the socio-economic baseline chapter (Chapter 9), the Project area include agriculture land, forest plantation land, secondary forest and bare land. This area is reportedly the area of Bru-Van Kieu People for cassava and rice cultivation, forest plantation, animal grazing and forest products collection. Bru-Van Kieu People has lived in this area for a long time and they are identified as a forest/natural resource dependant community. Through the observation and interview with the local people and local authority during the site survey, it is recognized that this People rely very much on the natural resources for subsistence, medicine and livelihoods.

It is noted during the interview with Bru-Van Kieu People that in terms of forest-based products such as fuel wood, vegetables, timber for local traditional houses building and to very limited extent the traditional medicines used for household consumption, according to local community, they are able to access other forest lands, which are still available surrounding the villages to collect such products. In addition, only few people (i.e. 3-5 people in each village) still practice traditional medicines (i.e. using specific forest plant's roots as medicines, mainly to cure gastrointestinal tract diseases). According to local community, the traditional medicines are only used when the cure by national medical system (i.e. having medicines from commune clinics) is unsuccessful. Essentially, there is no commercial activities conducted relating to traditional medicine practices. Such traditional medicine practices are only for household uses and such knowledge will not be transferred to other people.

At the time of the site survey, 15 households, and possibly reaching up to 18 households by the end of land acquisition process, have been identified as economically displaced household from the land acquisition of the Project so far. Of which, 93.3% are Bru-Van Kieu People (i.e. 14 out of 15 households). No physical displacement will be occurred from the land acquisition of the Project as confirmed by the Project management. It is important that since Bru-Van Kieu is identified as the Indigenous People following the criteria as set out by IFC (refer to ***Section 0***), it is required for the Project to be aware and implement the free, prior and informed consent (FPIC) when the Project acquires their land and natural resources, which are subject to traditional ownership or under customary use. However, it is understood that the CSR process of the Project is currently implemented by the government and in Vietnam there is no specific legal requirement for the FPIC; and thus no FPIC has been conducted.

It is also noted from the consultations with local authority and community within the scope of this ESIA, though there is no internationally, nationally or provincially recognised critical cultural heritages located within the Project location, the People has their own cultural value/ resources and it is their Sacred Forest. In particular, according to local Bru – Van Kieu People, the Sacred Forest is a place to rest for their ancestors and forest-Holy.

It is reported that, no one is allowed to damage the Sacred Forest, even at the very minimum activities such as cutting small trees. Should activities that cause damage to the Sacred Forest, the people who cause the damage will be punished by traditional rules of Bru - Van Kieu People, often in terms of payment equivalent to a buffalo or a pig for praying ceremony subsequently conducted to the forest-Holy, asking for apology.

At current stage, the Project is estimated approximately within 1 Km from the Sacred Forest of Hoong and Cooc village. It is confirmed by local authority, local community and the Project's management that the Project is aware of this cultural belief and no Project activities will be placed within or close the Sacred Forest.

During the interviews, the community expressed concerns such as:

- Unstable livelihoods which are dependent on land and forest resources;
- Potential impacts on Sacred Forest of Bru - Van Kieu Indigenous People;
- Safety concerns (i.e. degradation of the road system and fast movement of trucks/ cars that can cause safety issues for local people, particularly children who often walk to schools); and
- Environmental pollution (i.e. unpleasant/strange noise from turbine, soil erosion around the project office/ turbine sites leading to contamination of surrounding rice fields).

Impact Evaluation and Significance

The impacts on lands, natural resources and critical cultural heritage subject to traditional ownership or under customary use during the land clearance and construction phase and to some extent the operation phase of the Project is assessed as *Moderate* significance. The magnitude is relatively *Medium-Small* as the area of impacted lands are small in comparison to the land owned by local people and it will be possible to acquire additional land within the area. The scope of land acquisition is relatively limited and is unlikely to significantly affect local community members way of life. Due to the awareness of Project management and local authority on the importance of the Sacred Forest of Bru-Van Kieu People limited impacts would be expected to their traditional cultural values or practices. The sensitivity of the receptors is assessed as *Medium* given that a significant number of households are poor and assessed as being vulnerable.

Table 12.5 The impacts on lands, natural resources and critial cultural heritage subject to traditional ownership or under customary use

Impact Description	The impacts on lands, natural resources and critial cultural heritage subject to traditional ownership or under customary use			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	**Small**	**Medium**	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	Minor	**Moderate**	Major

Proposed Additional Measures

The Project is expected to implement the following mitigation measures:

- Establish a stakeholder engagement plan during construction and operations. An outline of this is provided in the ESMP and includes specific requirements to further inform local community members about the project,
- Provide and communicate detailed information about the Project's plan and schedule particularly related to land clearing and construction to the community with a special attention to farmers nearby the project locations; and
- Establishment of a grievance mechanism (i.e. as provided in *Annex A*) that is understood by and accessible for all villagers. The mechanism will be simple, efficient and timely and fully consultative.
- Review all public consultation process and compensation packages to ensure:
    - affected Communities of Indigenous Peoples are informed of their land rights under national law, including any national law recognizing customary use rights;

- proper and adequate compensation and supports based on national regulatory requirements;
- the continued access to natural resources independent of Project's land acquisition; and
- the provision of access, usage, and transit on land that the Project is developing on (i.e. access and use of land within the Project's footprint), subject to overriding health, safety, and security considerations to the Affected Communities of Indigenous Peoples.

- Conduct subsequent consultation with Affected Communities of Indigenous People to understand their satisfaction over the land acquisition and compensation process. Since the land acquisition and compensation process has nearly completed and is under control of local government, in the case that the Affected Communities of Indigenous People do not satisfy with the land acquisition and compensation process, a "good faith" negotiation would be conducted by the Project with the Affected Communities of Indigenous People (i.e. households having land acquired) to have a mutual agreement on the additional support. These mutually agreed supports should be fully documented and incorporated into an expanded Community Development Plan (as also mentioned in ***Section 12.1.2***) which includes the Indigenous People Development Programs/ Initiatives specifically designed for affected Indigenous People.

Residual Impacts

As a result of the implementation of the proposed additional measures, the residual impact on lands, natural resources and critical cultural heritage of the Bru-Van Kieu People during construction and operation phases is considered *Minor*.

12.4 COMMUNITY HEALTH AND SAFETY

Community health and safety impacts as a result of the mobilization of construction and operational workforce, Project induced immigrants to the Project area and noise from the Project construction and operation activities have been one of the main social concerns in many industrial projects. This section provides the assessment on such impacts.

12.4.1 Health and Safety Impacts Associated with Non-Local People Presence during Project Construction and Operation

Discussion of Impacts

Based on information from the local EIA report, the Project is likely to employ approximately 100 workers/ staff during the construction phase and approximately 30 workers/ staff during the operation phase. At this stage, the Project has no plan for employing local workers during construction phase, and unknown number of total operation worker will be from local labour market. As such it supposes to have 100 non-local workers in construction, which is accounted for approximately 10% of total population of the three affected villages (i.e. Cooc, Miet and Hoong villages). These migrant workers are expected to stay in a temporary worker accommodation which is located near the Site since from observation onsite the boarding house service is not available and predicted yet to develop at the time of the construction phase at the Project area and its vicinity. These workers will be expected to stay for 18 months during the construction. Additionally, the presence of the Project can lead to an immigrant influx of people who come to the Project area to open their businesses. As a result, during construction and operation, the following potential impacts from this influx are considered:

Increased Risk of Infectious Diseases including Sexual Transmitted Infection

During construction phase, the local community and the workers may be exposed to water-borne diseases due to poor sanitation and vector borne diseases such as yellow fever and dengue fever. In addition, the presence of a number of non-local workers in the area may lead to an increased risk of diseases, including:

- sexually transmitted infections (STIs) and HIV/AIDS;
- influenza outbreaks; and
- gastro-intestinal diseases and other food borne diseases such as Hepatitis A due to poor standards of food hygiene in site catering facilities including facilities provided in workers' accommodation.

General Disturbance and Tension between Migrants and Local Communities

The majority of the local people are Bru-Van Kieu People and their life styles and customs are different from other ethnic groups. As such, the presence of a non-local workforce and induced immigrants who may be not Bru-Van Kieu People may result in the presence of behavioural traits, habits and lifestyle in the community, which may at times be alien to the local community. These behavioural traits may cause discomfort/ inconvenience to the community resulting in disagreement and at times conflicts.

The consultations with key informants in Hoong village, Cooc village and Miet village indicate that communities in such villages are very open towards migrants. The similar Huong Linh 2 project (i.e. now in operation) experiences no significant issue between locals and migrants to date. The interaction of local people (i.e. 99% Bru - Van Kieu Indigenous People) with Kinh people was started through Vietnam war time. The socio-economic baseline survey does not show any other significant communicable diseases in the area. The most common forms of diseases are general influenza, upper respiratory systems, and outter skin diseases, which are mainly attributable to the weather conditions and local people behaviours. This indicates low vulnerability of the community.

Meanwhile during the operational phase, the expected number of workers is much smaller (i.e. 30 workers/ staff). It is expected that the non-local workforce will stay within the Project's Site Accommodation close to local community, the number is significantly less and it is expected that community would already familiar with the presence of non-locals in the area.

Impact Evaluation and Significance

The significance of impact to community health as a result of migrants presence are assessed as being *Minor* for construction phase and *Negligible* for operation phase (Table 12.6). The magnitude is *Small* due to potential interaction between migrant workers and local people is limited since non-local workers will stay in the accommodation during construction and operation, and other migrant people will be limited in number since this Project is small and there will not many business opportunities. The sensitivity of local people which are mostly Bru-Van Kieu People is assessed as *Medium*, in consideration of their own culture and behaviour which are distinct from other ethnic including Kinh people-the ethnic majority of Vietnam and their recent familiarity with the industrial activities developed in the area.

Table 12.6 Health Impacts Associated with the Presence of Migrant People

Impact Description	Impacts associated with migrant presence increasing the prevalence of communicable diseases.			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	**Minor**	Moderate	Major

Proposed Additional Measures

Though some of the mitigation measures have been provided in the local EIA of the Project such as strict management of workers/ staff and collaboration with local authorities for security status updates, the Project should implement the following additional measures to manage potential negative impacts associated with the presence of migrant:

- Compulsory medical examinations (i.e. annual health check-ups) for Project workers, including contractors, as required by national regulations, to ensure they are fit for work and to monitor the prevalence of communicable diseases detected through annual medical check-ups;
- Establish onsite health clinic for Project workers in construction and operation;

- Zero tolerance towards inappropriate behaviour from and amongst the workforce;
- Registration of temporary residence for non-local workers to local authorities to ensure the management of Project's related workforce;
- Develop a specific Project's Code of Conduct;
- The Project will implement Stakeholder Engagement Plan (SEP). Community Liaison Officers of the Project should be assigned. These persons will deliver induction training to provide guidance on requirements for culturally appropriate behaviours, and an overview of the risks to migrant staff and workers. The training will include key cultural sensitivity awareness topics/programs to ensure workers including security staff do not un-intentionally offend the local community, especially indigenous people;
- The Project's Code of Conduct should also be shared with workers of contractors and request their compliance;
- The workers' accommodation should be managed by developing and implementing regulations/policies on behaviour towards local communities and restricted hours for going out applied for non-local workers staying in camps in construction;
- Establish and disclose a grievance mechanism (i.e. as mentioned in *Section 13.3*) and accessible for all community groups to report concerns associated with potential Project health and safety impacts. Where complaints are submitted, the Project will undertake an immediate investigation;
- Regular engagement with local authorities relevant to crime (i.e. local police) or other social problems (e.g. village leaders) for prevention of issues and for mitigation when issues arise; and
- Conduct appropriate workers-community engagement such as sporting or cultural events to improve understanding and cohesions between non-local workers and the surrounding communities.

Residual Impacts

As a result of the implementation of the proposed management measures, the impact on the community health and safety associated with non-local presence will be maintained *Minor*.

12.4.2 *Disturbance to Local Public Road due to Increased Vehicle Movement during Construction*

Discussion of Impacts

According to the local EIA report, during construction activities, heavy equipment and construction material will be transported to the Project Sites through the following main transportation routes, as depicted in Figure 12.1

Main transportation routes used for transportation activities in the construction phase:

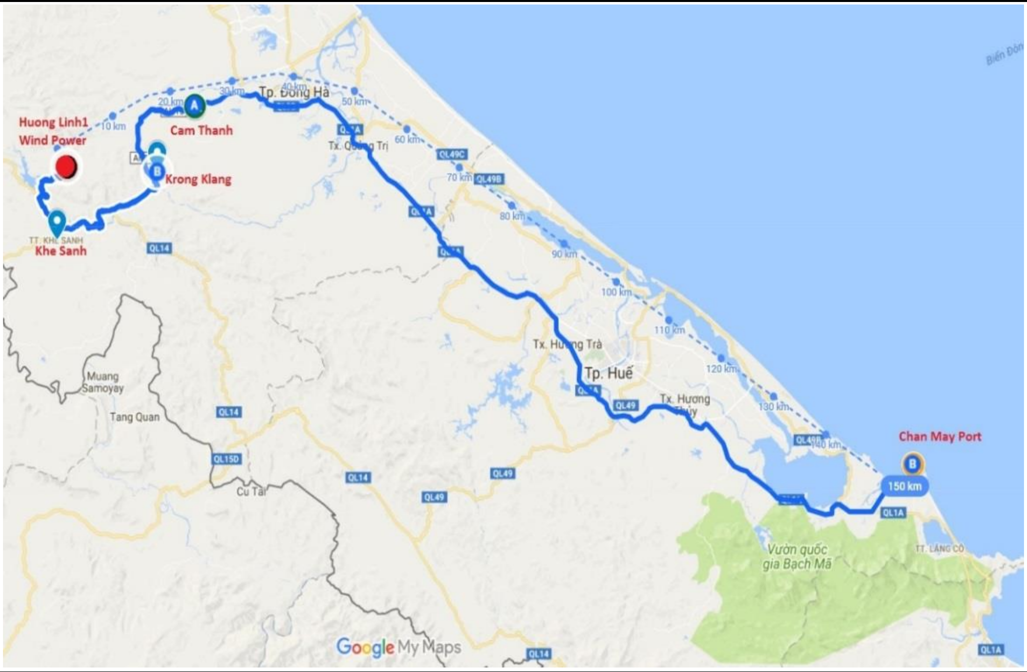
- Stone will be transported from Dau Mau quarry in Cam Thanh commune, Cam Lo District, running along National Road No. 9 and to the Project site through Khe Sanh with the total length of 45 km;

- Sand will be exploited from Ba Long river sand mining in Krong Klang to National Road No. 9, Khe Sanh to the Project site. The total transportation length is approximately 35 km;

- Cement and steel are purchased from local construction companies located in Khe Sanh Township and then mobilised to the Project site with the total distance of 15 km;

Machinery and equipment are imported from Chan May Port (Hue Province) to National Road 1A, following National Road No.9, then to the Project site through Khe Sanh. The total length is 150 km.

Figure 12.1 Main transportation routes used for transportation activities in the construction phase



Source: The map is created by ERM, 2018 based on information from local EIA report.

It is noted that there is no information on the number of trucks used for material transportation in the local EIA. However, the transportation rate used by local EIA report to calculate emission load from transportation activities during the construction phase is 10 vehicles per hour. This can be inferred that it is the peak transportation periods during the construction phase, mainly at the initial and at the end of the 18 months period. The information on transportation routes as well as inferred vehicle rate indicates that the road load within the Project area will increase during the construction phase, and expected to negatively impact the existing condition of roads within the Project area and potentially affect the traffic safety of the local area.

Based on the observation during ESIA Process, the Project area is connected with the National Road 9 and Ho Chi Minh Road which are completely asphalted. Approximately 15 kilometres of village road (i.e. asphalt/concrete road constructed by collaboration between governmental funding and local community labour contribution) are already damaged (i.e. by truck movement from other previous Projects) and quite narrow (within 6m width). In addition, the Project location is a mountainous area with constant foggy conditions, so traffic accidents might occur during the construction phase.

Impact Evaluation and Significance

Project impacts to local public roads as a result of increased vehicle movement during the construction were assessed as being *Minor* significance. Magnitude was assessed as being *Small* considering the scale of the Project and amount of materials used; although vehicle movements will use wide coverage of public roads to transport the Project equipment, electrical components Vulnerability was assessed as *Medium*; given some parts of the public road are damaged and in mountainous area, particularly the village road near the Project location, which cause difficulty for repairs.

Table 12.7 Disturbance to Local Public Road

Impact Description	Disturbance to Local Public Road due to Increased Vehicle Movement during Construction			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	**Minor**	Moderate	Major

Proposed Additional Measures

It is noted from the local EIA report, no mitigation measures have been provided to mitigate the negative impacts resulting from the vehicle mobilization on public roads within the Project location during the construction phase. Some commitments to the damages to local public transportation systems are provided for the operation phase such as no transportation of equipment with excess load, transportation of excavator with track-wheels must be using proper transportation vehicles; and provision of damage repairs to the road systems if this occurs. However, it is understood that the Project has performed an assessment on the condition of public roads prior to vehicle mobilization to ascertain the road load feasibility. Therefore, in addition to the mitigation measures as noted in the local EIA report as mentioned above, the Project should implement the following mitigation measures during the construction phase:

- In the area where unfeasible road conditions are identified, road improvement will be conducted to ensure the road conditions meet the standard conditions for construction vehicle mobilization;
- Should road damage occur associated with the Project mobilization, a road improvement/repair program will be implemented to ensure that the public road condition is adequate for the local community and other road users; and
- Establish a proper and accessible grievance mechanism to report concerns about public road conditions raised by local communities along the transportation route. The Project will carry out immediate investigation when the community submits related complaints.

Residual Impacts

As a result of implementation of proposed additional measures, the residual impact is considered *Negligible*.

12.4.3 Impact to Community Safety as a Result of Mobilization of Heavy Equipment and Material during the Project Construction

Discussion of Impacts

Based on the observation during the ESIA Process, the traffic volume along the main road is relatively low, particularly the section from Khe Sanh to the Project site (i.e. approximately 25 Km). However, community activities were observed along some road segments e.g. housing, schools, and local traffic, particularly around the Project location (i.e. within Hoong village, Cooc village and Miet village of Huong Linh commune). Meanwhile, unsafe driving practices were observed during the ESIA Process and reported by local authority, particularly in terms of helmet use for motor riders. In addition, the Project location is a mountainous area with constant foggy conditions and is the main walking route for children to local schools, so traffic accidents might occur during the construction phase. Livestock from local communities were also observed scattering around the local roads that further complicate the situation. This safety issue has been raised by local people as one of their main safety concerns as experienced from current and previous projects.

It is noted that the Project area is originally a forest and agriculture area of indigenous people which is uncrowded in terms of traffic, especially of heavy vehicle like trucks and crane trucks. As such with the frequency of the heavy vehicles of 10 trips every hour and carrying heavy equipment during the construction, the impacts on the community safety is assessed Moderate.

According to the socio-economic report of Huong Linh commune in 2016, the Commune recorded 42 cases of traffic violations and two traffic accidents that damaged three motorbikes and injured two people. Through the interview with the Village Heads and some of the community members during the ESIA Process, in the last two years there have been no traffic accidents within the village reported.

Impact Evaluation and Significance

As presented in Table 12.8 Community Safety Risk Associated with the Project Construction Mobilisation, the magnitude of impact is assessed as being *Medium* mainly since the high frequency of transportation trips during construction and the heavy equipment (i.e. turbine) will be carried to the Project site going through the residential area. Although the traffic volume is relatively low, considering the poor conditions of some road segments that will be traversed by the Project and unsafe behaviours, sensitivity is assessed as *Medium*. Therefore the significance of impact to safety risk on land is assessed as *Moderate*.

Table 12.8 Community Safety Risk Associated with the Project Construction Mobilisation

Impact Description	Potential transportation safety incident with community as a result of increase in Project traffic on a public road			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Magnitude	Negligible	Small	**Medium**	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	Minor	**Moderate**	Major

Proposed Additional Measures

It is noted that only limited information is provided in the local EIA report relating to the transportation safety mitigation measures will be in place such as limit the vehicle speed and load, and strictly follow of national transportation rules. In addition to such measures, the Project should implement the following additional mitigation measures:

- Disclosure and Consultation with the communities on key Project traffic routes, timing of peak movements, type of vehicles and heavy equipment and provision of road safety awareness to the surrounding community, through corporation with the local police to ensure local residents be aware of increase in the level of transportation activities during the Project Construction.

- Signs of traffic should be set up at village roads and using horn warning, especially at schools and children play grounds, as suggested by local authority representatives and residential households during interviews conducted from 24th -26th January 2018.

- A flagman shall be at the conjunction between the main roads and the access road to coordinate the trucks for entering and exiting the access road.

- Enforce speed limit regulations to all Project construction vehicles, along with an emergency response procedure for any incidents with other road users or pedestrians should be prepared; and

- The proposed grievance mechanism should be accessible for all villagers to report concerns associated with health and safety. Where complaints on accidents or near misses are submitted the Project will undertake an immediate investigation.

- Safety Transportation Management Plan, Traffic Management Plan shall be developed and implemented during construction phase by both the Project and the EPC Contractor.

- Local communities should be familiarised with traffic management such as warning signs, limited speed and notifications of the risks of traffic accidents. This measure will need to be incorporated into the SEP.

Residual Impacts

As a result of implementation of the proposed additional measures, the residual Project negative impact to community safety will be *Negligible*.

13 CUMULATIVE IMPACT ASSESSMENT

13.1 INTRODUCTION

Cumulative impacts are generally considered as those, which are additive or interactive in nature that arises as a result of an impact from the Project interacting with an impact from another activity to create an intensified impact.

"…result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted. Cumulative impacts are limited to those impacts generally recognised as important on the basis of scientific concerns and/or concerns from Affected Communities" (IFC World Bank Group Performance Standard 1).

IFC PS 1 requires that an environmental assessment should also address cumulative impacts. The objective of the cumulative impact assessment is to identify those environmental, social or health aspects that may not on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future Project activities or other projects/activities may result in a larger and more significance impact.

In order to gain an understanding of the Projects overall contribution to impacts within Huong Linh commune and the broader Huong Hoa district, a cumulative impact assessment (CIA) is required to be undertaken. Whilst total cumulative impacts due to multiple projects within a given area should be identified within government led spatial planning efforts (generally as part of a Strategic Environmental Assessment), the Sponsor needs to determine the degree to which it is contributing to these overall cumulative impacts on Valued Environmental and Social Components (VEC). In this regards, the objectives of the CIA are:

- Use the outcomes of the preceding chapters of this ESIA to determine spatial and temporal boundaries, identify VEC's and all development and external natural and social stressors affecting them;
- Recognise and identify how the project, along with other existing and future projects may contribute to cumulative impacts on the predicted future condition of the identified VEC's; and
- Develop measures to ensure these are avoided and/or minimised to the greatest extent possible.

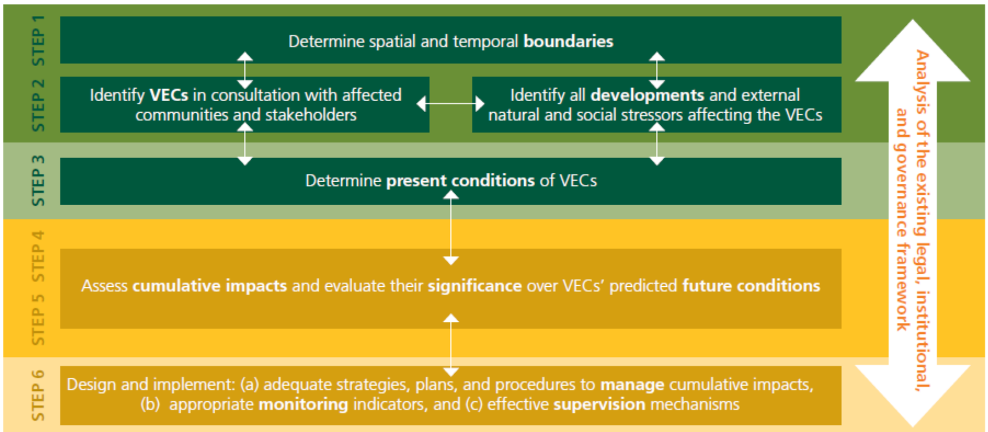
To achieve these objectives and gain an understanding of the complexities of cumulative impacts, this Chapter presents a Rapid Cumulative Impact Assessment (RCIA), which has been undertaken largely in accordance with the IFC's Good Practice Handbook: Cumulative Impact Assessment and Management Guidance for Private Sector in Emerging Markets (the "IFC Handbook").

13.2 METHODOLOGY

This chapter presents a rapid cumulative impact assessment (RCIA) in accordance with the IFC Handbook and therefore has been undertaken having regard for the six-step process outlined in *Figure 13.1.* As this RCIA forms part of the overall ESIA, the general conditions and trends of the VEC's are already known (established during environmental and social baseline condition assessments), as are the impacts from the Project (as part of the impact assessment) and the proposed mitigation, management and monitoring measures. Given this, VEC's and impacts have been quickly established, with an emphasis able to be placed on the steps pertaining to cumulative impact assessment and management.

Emphasis in developing the methodology for this CIA been placed upon following a largely qualitative approach, allowing for identification of general trends and developing appropriate management, mitigation and monitoring measures. This is primarily due to lack of clear data or information on surrounding projects. Given this approach, the majority of the methodology relies upon the use of professional judgements, complimented by ERM's understanding of the Project and impacts and experience with similar projects in similar settings.

Figure 13.1 Six-step process



Source: General RCIA Methodology (Source: IFC Handbook, 2013)

13.2.1 *Determining Spatial and Temporal Boundaries and VEC's*

The methodology used in the setting of the spatial and temporal boundaries is largely qualitative and based upon the general "rules of thumb" suggested within Box 7 of the IFC Handbook. The following factors have been set within the methodology:

- Temporal boundaries have been set based on desktop review of available information pertaining to other proposed Projects within the area (see below);
- ERM's understanding of Projects currently within and proposed to be developed within the local area; and

- Geographic boundaries are a composite of the location of the identified VEC's (see section 16.2.3 below), assessed impacts of the Project and the degree to which they may overlap with other external projects and stressors to impact upon an identified VEC.

13.2.2 *Identifying VEC's and their Present Conditions*

As this RCIA is part of an ESIA, the identification of VEC's is able to be largely drawn upon work already undertaken, supplemented by stakeholder engagement. VEC's are defined as follows:

- Those defined as sensitive receptors within the ESIA. An example of this is any village or house or identified as a sensitive receptor for the purposes of the noise assessment or biodiversity values identified at Chapter 7.3.1;

- Any particular resource or ecosystem service identified as being utilised by sensitive receptors. An example of this would be a groundwater resource used by the local community for domestic purposes.

- Those identified as part of stakeholder engagement, regardless of whether or not they meet either of the above definitions.

13.2.3 *Identifying Developments and External Social Stressors Affecting VEC's*

External developments, also known as reasonably foreseeable future actions, are identified utilising knowledge gained through the ESIA process (including field observations), stakeholder engagement and the interpretation of readily available external data. The outcomes of these considerations will be a simple binomial decision, i.e. yes the project is likely and therefore will be included within the CIA, or no, it is unlikely and therefore will not be included within the CIA.

The second step is to determine the extent of the various impacts of these projects. This allows for a decision to be made as to whether there is the potential for an overlap in Project impacts that could lead to a measurable cumulative impact. Key to this are the following elements:

- Identification of appropriate geographical/spatial boundaries. Where potentially interacting projects are not located close enough, or sufficiently linked through various ecological and social processes, for relevant impacts to overlap, cumulative impacts are less likely;

- Identification of temporal boundaries. Where the schedules of various components of projects do not overlap in time, particularly with regards to the construction phase of large projects, cumulative impacts are less likely. Additionally, where projects are going to be short term, cumulative impacts will generally be of limited duration;

- Consideration of impact type. Whilst there may be no direct geographical overlap in project boundaries, there is the possibility that their offsite impacts may directly overlap elsewhere and cause offsite cumulative impacts. Examples are sediment discharges into river systems, air pollutant emissions, and social impacts associated with overall migration influx;

- Determination of any "aggravating factors" that may be evident within a particular project identified for inclusion within the CIA. This includes elements such as the size of the project, environmental management performance, and the regulatory regime under which it operates; and

- Identification of potential externalities, that is a project ability to influence (either positively or negatively) the behaviours of other operations in the area.

The other element identified as part of this scope is external natural and social stressors which aren't related to a single project or source. As these are ongoing stressors it has been assumed that they have already been captured as part of the Project baseline conditions (refer to Chapter's Six and Seven) and the impact assessment. Specific additional identification and assessment of these is therefore not considered necessary as part of this RCIA.

13.2.4 Identification and Assessment of Impacts

Impact scoping and identification needs to be in alignment with those assessed throughout the main body of the ESIA, and needs to include those which are recognised as important on the basis of genuine scientific concerns and the views of affected communities and other stakeholders. This allows for impacts to be appropriately grouped and added to impacts identified as likely to occur from other projects.

A largely qualitative approach was taken for the RCIA. This is to enable a focus upon identification of trends across the various projects in the area, their temporal and spatial interactions and how these are likely to impact upon VEC's. Whilst impacts arising from the Project have been defined and assessed in isolation, it can be difficult to accurately quantify cumulative impacts as there can be a high degree of uncertainty in interactions with other projects and activities that may be occurring in the area as well as a lack of confirmed project information. Therefore, the impacts are to be assessed qualitatively based on the identified trends and grouped according to impact type, rather than VEC, in accordance with the overall methodology adopted for the ESIA. The RCIA is also based on the assumption that all assessed residual impact levels within the ESIA are achievable.

13.2.5 Development of Management, Mitigation and Monitoring Measures

Based upon identification of broad impact trends, broad scale mitigation measures will need to be developed. Generally, these are based upon:

- Effective application of, and adherence to, the mitigation hierarchy in environmental and social management of the specific contributions by the project expected cumulative impacts. This is generally achieved through stringent implementation of the measures developed specifically for the project; and

- Development of best efforts to engage in, enhance and/or contribute to a multi-stakeholder, collaborative approach to implementing management actions which are beyond the capacity of an individual project proponent.

Any measures developed to address concerns identified within this CIA will take into account these general concepts. There also needs to be scope to develop these measures further when detailed information regarding projects becomes available.

13.3 IDENTIFICATION OF VES'S AND THEIR PRESENT CONDITION

The ESIA identifies and describes the current condition of a range of Sensitive Receptors, defined as VEC's for the purposes of this RCIA. These are:

- Noise receptors in close proximity to the Project site;

- The inhabitants of the villages of Cooc village, Miet village and Hoong village which occur within the projects AoI; and

- Biodiversity values and particularly bird and bats which are at risk from blade strike, and to a lesser extent habitat loss.

No specific additional VEC's were identified during stakeholder engagement.

13.4 IDENTIFICATION OF RELEVANT DEVELOPMENTS AND EXTERNAL NATURAL AND SOCIAL STRESSORS

The project is situated in a relatively remote mountain location. Hydro-electric development has occurred in the past within the broader area of Quang Tri Province. Based upon a desktop review and information provided by the Sponsor the following Projects are either existing, under construction or planned within the immediate Project area:

- Huong Linh 2 with the capacity of 30 MW operating wind power project;

- Nearby Hydroelectric power projects

- Planned wind power developments; and

- The Khe Gio (Wind Spring) Eco-Tourism Site depicted at Figure 13.2 below which is being planned for the local area;;

Figure 13.2 Khe Gio (Wind Spring) Eco-Tourism Site

Source: Tan Hoan Cau Corporation Join Stock Company

13.5 SUMMARY OF TRENDS, VEC'S AND SCOPE REFINEMENT

Summary of Trends and Impacts to be considered

Some basic key trends and issues have been identified through investigating the nature of existing and proposed development within the area. These trends and issues, which will be used for qualitative cumulative impact assessment, are:

- Biodiversity impacts and particularly to known bird and bat biodiversity values within the area;
- Cumulative noise impacts on project communities;
- Changes to the visual setting as a result of several wind projects; and
- Impacts associated with influx and further development within the area on local communities.

Based on this, the scope of the cumulative impact assessment will be limited to the direct vicinity of HL 1 and 2 projects and the surrounding AoI.

Table 12 2 presents the outcomes of scoping, based upon identified VEC's, assessed project impacts, the identified external projects, and the summary of trends.

13.1 *Scoping of Impacts*

Impact Type	VEC's Likely to be Impacted	Existing Assessment in ESIA	RCIA Scope
Noise	Villages of Cooc, Miet and Hoong. Whilst the location of the Huong Hiep wind prower projects are still to be confirmed, it is at this stage understood that these villages are in the closest proximity to these sites.	Chapter 11.2 provides an assessment of noise impacts for both the HL 1 and HL 2 projects. These two projects are likely to be the primary source of noise impacts to the affected villages and mitigation measures have been proposed.	The assessment in Chapter 11.2 captures the likely impacts and no further cumulative impact assessment is proposed.
Bird and bat strike and habitat loss.	Conservation significant species known from the local area (Chapter 7.8)	A detailed assessment of biodiversity impacts is provided at Chapter 11.3 and captures impacts associated with the HL1 development only.	Cumlative assessment to be conducted using the findings of the HL 1 assessment as guidance on the extent and likely significance of impacts.
Visual Impacts	Villages of Cooc, Miet and Hoong.	A visual assessment is provided at Chapter 11.6 and captures impacts associated with HL 1 and HL 2.	The visual impact assessment captures the impacts and concerns associated with wind power developments on nearby visual recievers. This is likely to capture the primary concerns associated also with future wind power developments and as such no further assessment is proposed.
Waste	No VEC's are likely to be impacted by waste.	Waste has also not been considered in the CIA as the ESMP has proposed appropriate management and mitigation measures. It is expected that any future developments will comply with Vietnamese waste storage and management regulations (as a minimum).	No further assessment required

Impact Type	VEC's Likely to be Impacted	Existing Assessment in ESIA	RCIA Scope
Socio-Economics: Community Health and Safety	The VEC's likely to be impacted are those people residing in the villages of Cooc, Miet and Hoong.	**Chapter 12.4** presents a detailed assessment of impacts relating to community health and safety during construction and operations phase. None of these were considered cumulatively.	A qualitative assessment will be undertaken, focusing on identification of ways in which cumulative impacts may occur to VEC's, and develop appropriate mitigation strategies.
Socio-Economics: Employment and Business Opportunities	The VEC's likely to be impacted are those people residing in the villages of Cooc, Miet and Hoong.	Social impacts from the Project include impacts to employment and economy during both the construction and operation phases, were assessed as part of Chapter 12.1 and 12.2. None of these were considered cumulatively.	A qualitative assessment will be undertaken, focusing on identification of ways in which cumulative impacts may occur to VEC's, and develop appropriate mitigation strategies to ensure that positive impacts are maximised.
Impacts to Indigenous peoples	The VEC's likely to be impacted are indigenous peoples residing in the villages of Cooc, Miet and Hoong.	An assessment of impacts to indigenous peoples is provided at Chapter 12.3. Cumulative impacts were not considered.	A qualitative assessment will be undertaken, focusing on identification of ways in which cumulative impacts may occur to VEC's, and develop appropriate mitigation strategies.

13.6 *BIODIVERSITY ASSESSMENT*

13.6.1 *Project Impacts*

The Project was identified to have a number of potential impacts to biodiversity such as habitat loss, mortality or injury as a result of blade strike and also as a result of increased hunting. The project is located within an area of known conservation value and as a result, concerns have been identified with regards to likely impacts on these values. To mitigate impacts, during both construction and operation, a range of mitigation measures have been developed to manage potential impacts. This includes for example establishment of a BAP and also commencement of bird mand bat monitoring.

13.6.2 *Relevant Cumulative Impacts with Other Projects*

Additional projects such as new wind power developments and also the proposed Khe Gio eco tourism development will lead to additional land clearing and potentially habitat removal, particularly if this affects areas of natural habitat. The primary impact of concern is likely to be the development of additional wind farms near the HL 1 and 2 sites. These will increase the potential for bird and bat strike to occur and have the potential to affect local specues populations, particularly for species of significant conservation value.

13.6.3 *Specific Mitigation Measures for Cumulative Impacts*

The impact assessment has proposed the commencement of bird and bat monitoring. This will be important in understanding bird and bat presence within the project area and will help to inform a better understanding of strike risk to conservation significant species and also what, if any, additional mitigation measures are required.

13.7 *COMMUNITY AND LIVELIHOOD IMPACTS*

13.7.1 *Project Impacts*

Increasing development within and surrounding the project area, and specifically the vilages of Cooc, Miet and Hoong has the potential to result in both positive and negative social impacts. These are discussed in detail at *Chapter 12* and include the assessment of impacts to local indigenous peoples who comprise the majority of residents within these villages.

13.7.2 *Relevant Cumulative Impacts with Other Projects*

Additional projects within the area will exercabate the impacts identified within Chapter 13. Whist increased development may lead to improved access to jobs and improved infrastructure, they may also create increased community concerns associated with land acquisition and impacts to livelihoods and also general concerns associated with increased in migration and changes to local community structure. Residents of the villages of Cooc, Miet and Hoong are likely to be particularly susceptible due to their disadvatgaged status and reliance on agriculture.

13.7.3 *Specific Mitigation Measures for Cumulative Impacts*

A stakeholder engagement plan has been proposed for the project and this should be the primary means by which the project can guage and respond to community concerns. It is understood theat the project Sponsor is also developing the future Huong Hiep wind farm projects and it is recommended that they also establish appropriate engagement strategies once these projects are confirmed and prior to commencement or construction or land acquisition activities. If the project sponsor proceeds with the Huong Hiep projects, appropriate community development initiatives should be established to enable local communities to access jobs and training and to ensure thet they are not worse off as a result of guture development activities.

The ESIA process has identified the key environmental, social and health issues, impacts and risks associated with the Project requiring the implementation of a wide range of mitigation measures. The necessary actions required to manage these issues, impacts and risks are presented in this Environmental and Social Management Plan (ESMP); these include identification of all Project commitments (including legislative and IFC compliance requirements), mitigation measures that have been identified from the impact assessment, and other best practice measures designed to avoid, minimize or reduce negative impacts and enhance positive impacts. The objectives of the ESMP are to:

- Identify the set of responses to potentially adverse impacts;
- Define the responsibilities for implementation and monitoring;
- Determine requirements for ensuring that mitigation and management measures are implemented effectively and in a timely manner; and
- Describe the means for meeting those requirements.

The purpose of this Chapter is to demonstrate how the mitigation commitments made through the IA Process will be put into practice, monitored and upheld. The content of this chapter is crucial to bridge the findings of the IA with the implementation of the mitigation measures and to provide an early framework of management systems / monitoring regimes that will help to deliver these IA commitments.

Specifically, this Chapter provides information and instructions on how environmental, social, and health commitments of the Project will be managed from pre-construction through the construction and operation phases. The ESMP is a living document which:

- Incorporates the environment and social mitigation measures identified as a result of the ESIA process into a comprehensive framework to facilitate and ensure appropriate management throughout the Project cycle;
- Outlines the required regulatory monitoring detailed within the Project's EIA;
- Provides a framework to incorporate commitments into the Project plans and procedures for activities that have risks, as identified in the IA;
- Presents responsibilities for meeting ESMP requirements including the provision of training;
- Provides a framework for the implementation of specific management plans by the EPC; and
- Defines the monitoring/verification and reporting program (including corrective actions).

14.1 *ESMP PLANNING BACKGROUND*

The Project has not as yet signed an EPC contract and the Project Sponsor has not developed an environment management system and organisational structure for implementing the ESMP (managing the environment and social surrounds during construction and operation).

This document therefore outlines the ESIA expectations and provides guidance on how the actions might be implemented. It is expected that this would be formalized as the Project Sponsor prepares to commence construction.

14.2 *RESPONSIBILITY FOR IMPLEMENTING THE ESMF*

The key parties and their primary roles in implementing the ESMP are as follows:

- The Project Sponsor – responsible for the overall Project monitoring, ensuring compliance with environmental policy and obligations in the ESMP;
- EPC – responsible for complying with ESMP requirements set out by the Project Sponsor; and
- Other operational contractors – responsible for complying with the ESMP requirements set out by the Project Sponsor.

ERM has provided guidance on the types of roles and responsibilities that would be required for implementation of the ESMP during construction.

14.2.1 *Project Manager*

The Project Manager is responsible for all construction activities and accountable for overall EHSS (Environmental, Health, Safety and Social performance) of the Project. Expectations for the role in terms of implementing a management system would include:

- Actively promoting and participating in the Project EHSS Plan;
- Ensuring that the EHSS Management Plan, procedures and work practices are implemented across the Project;
- Ensuring that the EHSS Plan reflects the requirements of the Project in terms of resources and budget;
- Ensuring that all legislative and company requirements are complied with;
- Ensuring that all work scopes are conducted in accordance with the Project EHSS rules and regulations, work practices and procedures, as detailed in this ESMP and other associated documentation (e.g. the EIA);
- Ensuring that all contractors are made aware of their roles and responsibilities with regard to EHSS management;

- Ensuring that EHSS is regularly discussed and reported on i.e. in the weekly contractor progress meeting;

- Ensuring that all contractors are evaluated throughout the duration of the Project, as to their capabilities and performance; and

- Ensuring implementation of EHSS audit recommendations for non-compliances.

14.2.2 HSE Department

The Health, Safety and Environmental (HSE) Department would be expected to undertake the following roles:

- Manage, review and develop the HSE program to ensure that it fulfils Project requirements, including measures observed in this ESMP, and monitor the implementation including e.g. patrolling the job site daily to ensure construction works' compliance to Project HSE Procedures and safe working practices;

- Coordinate and evaluate the effectiveness of all program elements;

- Liaison with related government bodies as necessary;

- Manage the Project HSE team and supervise them to ensure that all areas of the project are given the required level of safety support and attention;

- Ensure proper housekeeping and waste disposal in accordance with company requirements and regulations;

- Ensure that the respective control areas are given in the required level of safety support and attention including e.g. only safety-approved material and equipment are allowed to be brought onto site;

- Ensure that all HSE reports/findings of any unsafe conditions/practices is brought to the attention of field management and those are immediately corrected, and coordinate accident/incident investigations and report to Project Manager; and

- Manage HSE Audits and report the results to the Project Manager.

14.2.3 Community Relations Department

The Community Relations Department would be expected to undertake the following roles:

- Manage, review and develop the Social Program to ensure that it fulfils Project requirements, including measures observed in this ESMP, and monitor the implementation;

- Coordinate and evaluate the effectiveness of all program elements;

- Manage the implementation of stakeholder relations and grievance management to ensure that all social-related requirements in this ESMP are implemented;

- Manage the implementation of community health program, including coordination with HSE team on OHS measures associated with management of impact to community health;
- Coordinating with HSE team on implementation of the Project vehicle safety measures associated with management of impact to community safety;
- Coordinating with HR (Human Resources) person to ensure implementation of labour-related measures required in this ESMP;
- Consultation with community and liaison with relevant stakeholders in implementing the required stakeholder and grievance management measures, including liaison with related government bodies as necessary;
- Leading collaboration to establish and implement the Project grievance mechanism during construction phase, and supervise contractor's social performance as required in this ESMP; and
- Managing social monitoring and reporting the results to the Project Manager.

14.2.4 EPC's Site Representatives/ HSE Department

The EPC and its contractors, depending on their work scopes, would be expected to have an HSE team. The contractors' site representatives or HSE Department should be assigned clear responsibilities and expectations with respect to implementing the Project's EHSS expectations and should be fully responsible for implementing any required expectations which fall under their work scopes. More specifically, they will:

- Actively promote and implement all Project HSE Plans related with the work they are preforming. The contractor will make sure that all activities under his/her responsibility shall follow all safety regulation/requirements, coordinating with the Project Manager; and
- Ensure that committed resources (personnel, material, and equipment) used are consistent with achieving the objectives and requirements of the Project EHSS Plan.

14.2.5 Employees

All employees involved in the Project will be qualified through training, experience, or knowledge. Non-supervisory personnel employed on the Project shall:

- Familiarize themselves with the concept of the Project EHSS rules and regulations;
- Work in accordance with Project EHSS Procedure, safe work practices, and method statements, risk assessments, permits to work and any other instructions that apply to their works;

- Use only tools/equipment and materials, which have been approved for use, and employ them only for the purpose for which they were designed;
- Take an active part in the protection of themselves, fellow workers, property and the environment from accidental losses;
- Immediately report to his respective supervisor or HSE officer/inspector if any potential hazards (relates to unsafe conditions and/or unsafe acts), which could lead to an accident, are found;
- Report promptly to immediate supervisor and HSE officer/inspector if any incidents/near misses as well as injuries, regardless how minor; and
- Shall attend project safety training and drills programs as required.

14.3 TRAINING, AWARENESS AND COMPETENCY

It is expected that the Project would implement a training and awareness program covering EHSS expectations of the Project. As a minimum, this should be implemented as an induction for all employees and contractors engaged on the project construction, with further training to be implemented depending on the level of responsibility for implementing HSE and social expectations and exposure to environmental and safety risks.

The Project should ensure that all personnel responsible for the implementation of this ESMP are competent on the basis of education, training and experience. All personnel shall be provided with environmental and social training appropriate to their scope of activity and level of responsibility.

14.4 MONITORING, REVIEW, AUDIT AND REPORTING

It would be expected that a monitoring, review and auditing program would be implemented during construction to monitor implementation of the Projects HSE requirements and environment and social commitments. Ultimately the Project Sponsor would normally be responsible for ensuring that the EPC and its contractors are complying with the applicable HSE and social requirements.

14.5 PROJECT ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The development of an ESMP is considered to be good management practice for any project or activity with the potential to impact upon the physical, chemical, biological, social and health environment. It provides guidance and a framework for ensuring that the commitments of the Project Sponsor, made both within this ESIA and within the Project’s EIA, are upheld and that the HSE impacts of the Project are managed to an acceptable level and in accordance with the requirements of the Project ESIA.

Specifically this ESMP pulls together the mitigation and management measures identified within this ESIA (and EIA) as being necessary for the construction and operational phase of the Project.

The mitigation and management measures take place throughout the Project lifetime, from pre-construction through construction, operation and decommissioning. In addition, there are common mitigation and monitoring requirements that apply to all phases of the Project, e.g. vehicle use/operation.

The mitigation and monitoring measures specific to the impact assessment conducted for this Project ESIA are detailed in the *Section 14.8* and *Section **14.9*** together with information on:

- Phase and activity;
- Impact summary and receptor impacted;
- Mitigation measures, responsibility and timing;
- Monitoring requirement, responsibility and timing; and
- Reporting.

Where specific mitigation measures could not be adequately defined due to lack of Project information or uncertainty regarding the environmental or social baseline, recommendations for the development of specific management plans or procedures or follow-up actions have been made.

14.6 ESMP Link to Other HSE Management System Plans

Other types of plans are required to facilitate practical implementation of the ESMP commitments, for example, Operational Environmental Management Plan, Social Management Plans or specific Safety Plans. These plans or studies are not substitutes for the overall ESMP, but serves to describe how the commitments will be implemented in greater detail (and likely at a later stage in Project development) than in the ESMP.

This ESMP will be part of the future construction and operational activities, and as the future construction and operational plans are prepared, these are expected to confirm how these commitments will be incorporated into the relevant EHSS management systems. This implementation will be under the responsibility of the Project Sponsor. This ESMP is a live document and will be updated periodically, for example, depending on Project execution and performance.

14.7 Plans, Policies and Procedures

The following plans and follow-up actions were identified as being necessary within this ESIA to manage identified risks or further understand potential environmental and social impacts (see Table 14.1). These plans will be developed by the Project Sponsor to manage specific risks or issues and also align the Project with the expectations of the IFC PS and EHS Guidelines.

Table 14.1 Specific Management Plans and Policies

Management Plan	Description
Stakeholder Engagement Plan	A stakeholder engagement plan is recommended to develop, to include: • Guidelines and recommendations to conduct future engagement, including consultation with relevant community groups e.g. farmer, local health institution, and relevant government institution in managing impact from the Project construction and operation. This should include planning a workers-community engagement events such as sporting or cultural events to improve understanding and cohesions between non-local workers and the surrounding communities; • Provides a framework to manage grievances which can be accessed by all groups of community; and • Recommendation for regular monitoring of stakeholder engagement and grievance resolution. A framework SEP had been prepared by ERM and is provided at Annex A.
Extended Community Development Plan (CDP)	The extended Community Development Plan (CDP) that incorporates the following components: • the Livelihood Restoration Programs/ Initiatives specifically designed for households having agricultural land acquired; and • the Indigenous People Development Programs/ Initiatives specifically designed for affected Indigenous People.
Occupational health and safety (OHS) Management Plan	Some of the mitigation measures that are proposed in this ESMP to manage impact to occupational health and safety (OHS) for workers. An OHS Management Plan should be developed to include these measures e.g. compulsory medical examinations for Project workers.
Biodiversity Action Plan	IFC PS6 requires that a Biodiversity Action Plan be prepared for projects within Critical Habitats. The BAP is designed outline measures to mitigate and manage Critical Habitat values to achieve a net-gain outcome. The BAP in this instance would look to manage key threats to species within the vicinity of the project. This would be primarily be assisting the protected area manager of the Bac Huong Hoa Nature Reserve to reduce illegal logging, hunting and poaching and undertake monitoring. From experience, these programs in Vietnam involve financial and in-kind support to undertake education programs, regular patrols, and facilitation of government regulation. Monitoring would involve physical seasonal surveys and the purchase of capital equipment such as camera traps. Annual monitoring and reporting would also be required. Generally the BAP would last for the lifetime of the concession agreement or loan agreement (which ever was longer).

14.8 CONSTRUCTION AND OPERATIONAL ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This Section outlines the construction and operational ESMP which will be developed for the project. Specific standalone tables are provided for the following requirements:

- Air quality management;
- Noise management;
- Terrestrial biodiversity;
- Surface water and sedimentation management;
- Social management; and
- Occupational health and safety.

These are provided as a working table (see Table 14.2 to Table 14.9) to support future implementation and preparation of the Project's specific EHSS plans.

These tables detail minimum requirements for mitigation measures that will be implemented during construction to avoid, or mitigate environmental or social impacts as a result of the Project.

Table 14.2 Air Quality Management– Construction and Operation

Source Document	Chapter	Phase	Activity/Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
EIA	4.1.2.1 ; 5.2.1.2	Construction	Mobilisation of equipment and material	• Increase dust and air emission	• Arrange working time and distance properly. • All trucks transporting material (i.e. cement, sand, rock) must be covered by tarpaulin. • Vehicle inspection should be conducted periodically • In dry season, water spays should be applied at least 03 times per day in village roads, in particular roads in Miet and Cooc Villages, Huong Linh People's Committee, Health Care Center, Huong Linh Highschool. • Avoid transporting material construction at peak hours or at night. • Provide PPE to workers.	• The Project Sponsor • EPC Contractor	Construction	Temperature, humidity, wind speed, wind direction, dust, noise, CO, SOx, NOx	• The Project Sponsor • EPC Contractor	02 times/year	Environmental monitoring report
EIA	4.1.3.1	Operation	Transportation	Air emission	Do not use old vehicles	• The Project Sponsor	Operation	Temperature, humidity, wind speed, wind direction, dust, noise, CO, SOx, NOx	• The Project Sponsor	02 times/year	Environmental monitoring report

Table 14.3 Waste Management – Construction and Operation

Source Document	Chapter	Phase	Activity/ Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
EIA	4.1.2.2	Construction	Construction	• Increase wastewater • Impacts on local water irrigation system	• Build septic tank with the capacity of 20 m3 (as calculated in the EIA report) for workers using during the construction phase. • Collect solid waste, oil wastewater generated from vehicles, machines or equipment properly to avoid water irrigation system blocked.	• The Project Sponsor • EPC Contractor	Construction	The level of generated waste at source;	• The Project Sponsor • EPC Contractor	02 times/year	Environmental Monitoring Report
EIA	4.1.2.3	Construction	Construction	Increase solid waste	• Set up garbage bins at the construction sites. • Collect, classify, reuse and treat solid waste properly	• The Project Sponsor • EPC Contractor	Construction	The level of generated waste at source;	• The Project Sponsor • EPC Contractor	02 times/year	Environmental Monitoring Report
EIA	4.1.3.2	Operation	Using water for daily activities	• Increase wastewater	• Build septic tank with the capacity of 20 m3 • Collect rainwater at transformer station and powerhouse and release into the environment through water drain pipes with the slope of 0.5%.	• The Project Sponsor	Operation	The level of generated waste at source;	• The Project Sponsor	02 times/year	Environmental Monitoring Report

Source Document	Chapter	Phase	Activity/ Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
EIA	4.1.3.3.	Operation	Daily activities	Solid waste	• Collect, classify and store solid waste properly in bins with covers. • Sign a contract with the Centre of Environment and Urban Work in Huong Hoa District for waste collection.	• The Project Sponsor	Operation	The amount of generated waste at source;	• The Project Sponsor	02 times/year	Environmental Monitoring Report
EIA	4.1.3.3	Operation	Operation	Hazardous waste	• Hazardous must be collected, classified and stored appropriately in accordance with Vietnamese regulation. • Sign a contract with a competent company (Song Thu – Da Nang Company) for the waste treatment. The waste collection will be treated at ADB landfill in Dong Ha City in the operation phase. • Establish and register hazardous waste generators in according to the Decree No.36/2015/TT-BTNMT	• The Project Sponsor	Operation	The amount of generated waste at source;	• The Project Sponsor	02 times/year	Environmental Monitoring Report

Table 14.4 Soil and Erosion Management – Construction

Source Document	Chapter	Phase	Activity/ Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
EIA	4.1.2.4 (b)	Construction	Ground levelling, foundation digging	Disturb soil structure	• Avoid expanding the project area to prohibited forest areas or conserved areas • Monitor waste released into solid environment; regulate waste collection areas and treat waste properly to avoid contaminated soil. • Avoid oil/contaminated substance spilled to soil environment. • Main works and foundation should be constructed in the dry season to avoid erosion.	• The Project Sponsor • EPC Contractor	Construction	NA	NA	NA	NA
EIA	4.2.2.3	Construction	Digging foundation	Soil erosion	• Digging foundation must be undertaken in dry season. • Under raining condition, foundation construction must be covered by tarpaulin to avoid stagnant rainwater. In addition, the Project Sponsor should build irrigation system to let the rainwater run out the project site. • When a turbine is installed at high places (hills), the ground should be made even to reduce its height in order to mitigate erosion issues.	• The Project Sponsor • EPC Contractor	Construction	NA	NA	NA	NA

Table 14.5 Noise Management – Construction

Source Document	Chapter	Phase	Activity/ Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
EIA	4.1.2.4 (a)	Construction	Construction, mobilisation of equipment and material	Noise impact	Avoid operating several equipment/ machines/vehicles simultaneously or at night Inspect equipment Periodically (at least 02 times/year) and use them in accordance with its technical instruction; Ensure equipment stand on solid foundation.	• The Project Sponsor • EPC Contractor	Construction	Noise volume (dB)	• The Project Sponsor • EPC Contractor	02 times/ year	Environmental Monitoring Report
ESIA	11.2	Construction	Site clearing, site establishment and civil works, and turbine installation and construction	Noise disturbance above ambient background levels	High noise activities will be undertaken over short periods and where possible scheduled to avoid simultaneous operation of high noise generating plant	• The Project Sponsor • EPC Contractor	During construction	Noise level measurement Community grievances	• The Project Sponsor • EPC Contractor	Weekly	Weekly HSE report
ESIA	11.2	Construction	Site clearing, site establishment and civil works, and turbine installation and construction	Noise disturbance above ambient background levels	Complaints tracking and grievance log	• The Project Sponsor • EPC Contractor	During construction	Noise level measurement Community grievances	• The Project Sponsor • EPC Contractor	Weekly	Weekly HSE report

Table 14.6 Terrestrial Biodiversity Impact – Pre-construction and Construction Phase

Source Document	Chapter	Phase	Activity/Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
EIA	4.1.2.4 (b)	Pre-Construction	Land clearance	Loss in forest resource	• Commit to use the land area regulated in land use certification or transferred from the government; do not transgress the territory of surrounding areas; do not exploit forest resources through hunting or deforestation. • Land clearance activities and forest biomass removal should be undertaken in separate periods to give time for animal find new natural habitats. • Develop protection plans for surrounding conserved forest areas as well as endangered species. • Provide trainings to enhance environmental protection awareness for workers and have measures	• The Project Sponsor • EPC Contractor	During land preparation	NA	NA	NA	NA

					to prevent fire incidents in forest areas.						
EIA	4.1.1.2	Pre-construction	Land clearance	• Increase biomass waste • Fire explosion	• Collect and sell high-value wood for local wood manufacturing company or residents. • Collect and incinerate biomass properly to avoid fire incidents. • Conduct UXO detection prior to land clearance or ground disturbance.	• The Project Sponsor • EPC Contractor • The Military Command of Huong Hoa District, or relevant government officers.	During land preparation	NA	NA	NA	NA
ESIA	11.3.3	Construction	Land clearing	• Vegetation& fauna habitat loss	• Vegetation clearing only in designated areas for the project footprint	• The Project Sponsor • EPC Contractor	During construction	The number and types of trees and vegetation found on the project site	• The Project Sponsor EPC Contractor	Weekly	
ESIA	11.3.3	Construction	Land clearing	• Vegetation & fauna habitat loss	• Restricting work to designated/cleared boundaries	• The Project Sponsor • EPC Contractor	During construction	The number and types of trees and vegetation found on the project site	• The Project Sponsor EPC Contractor	Weekly	
ESIA	11.3.3	Construction	Land clearing	• Vegetation & fauna habitat loss	• No disturbance to vegetation outside marked areas	• The Project Sponsor • EPC Contractor	During construction	The number and types of trees and vegetation found on the project site	• The Project Sponsor EPC Contractor	Weekly	
ESIA	11.3.3	Construction	Land clearing	• Vegetation & fauna habitat loss	• Undertaking site revegetation to assist with soil stabilisation, where possible	• The Project Sponsor • EPC Contractor	During construction	The number and types of trees and vegetation found on the project site	• The Project Sponsor EPC Contractor	Weekly	
ESIA	11.3.3	Construction	Land clearing	• Vegetation & fauna habitat loss	• Establishment and implementation of a clearance protocol to manage encounters with fauna;	• The Project Sponsor • EPC Contractor	During construction	The number and types of trees and vegetation found on the project site	• The Project Sponsor EPC Contractor	Weekly	

Table 14.7 Surface Water and Sedimentation Management – Construction

Source Document	Chapter	Phase	Activity/ Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
EIA	5.2.2.1	Operation	Operation		Monitoring ground water quality at the well of power house	The Project Owner	Operation	pH, turbidity, TS, hardness, TS, COD, Fe, SO4, E.coli and Coliform.	The Project Owner	02 times/year	NA
ESIA	12.2.2	Construction	Land clearing	Sedimentation of water bodies of farming areas	Solid stabilisation to be implemented during construction, this may include establishment of grass cover or other forms of ground cover across the site	Contractor Construction HSE Manager	During land clearing activities	Land clearing and ground cover area	• The Project Sponsor EPC Contractor	Weekly	Weekly HSE report
ESIA	12.2.2	Construction	Land clearing	Sedimentation of water bodies of farming areas	Solid stabilisation to be implemented during construction, this may include establishment of grass cover or other forms of ground cover across the site	Contractor Construction HSE Manager	During land clearing activities	Land clearing and ground cover area	• The Project Sponsor EPC Contractor.	Weekly	Weekly HSE report
ESIA	12.2.2	Construction	Land clearing	Sedimentation of water bodies of farming areas	Storm water management structures such as storm water ponds will be designed to collect the surface runoff and allow the	Contractor Construction HSE Manager	During land clearing activities	Storm water pond design	• The Project Sponsor EPC Contractor.	Weekly	Weekly HSE report

					removal of sediment by natural settlement, which in turn should reduce sediment loading prior to discharge into receiving environment						
ESIA	9.3	Construction	Land clearing	Sedimentation of water bodies of farming areas	Minimizing the land clearance area where possible, providing surface protection such as sheet cover	Contractor Construction HSE Manager	During land clearing activities	Land clearing and sheet cover area	• The Project Sponsor EPC Contractor.	Weekly	Weekly HSE report
ESIA	9.3	Construction	Land clearing	Sedimentation of water bodies of farming areas	Appropriate surface drainage will be designed and provided	Contractor Construction HSE Manager	During land clearing activities	surface drainage design	• The Project Sponsor EPC Contractor	Weekly	Weekly HSE report
ESIA	9.3	Construction	Land clearing	Increased of suspended sediment and spilled oil contaminants in receiving waters	Provide containment for storage areas of oil, fuel and chemicals to control contaminated surface runoff	Contractor Construction HSE Manager	During land clearing activities	Containment devices	• The Project Sponsor EPC Contractor	Weekly	Weekly HSE report
ESIA	9.3	Construction	Land clearing	Increased of suspended sediment and spilled oil contaminants receiving waters	Temporary traffic areas and access roads, if any, formed during construction will be protected by coarse stone ballast or equivalent. These measures shall prevent soil erosion caused by rainstorms	Contractor Construction HSE Manager	During land clearing activities	Temporary traffic areas and access roads protected	• The Project Sponsor EPC Contractor.	Weekly	Weekly HSE report
ESIA	9.3	Construction	Land clearing	Increased of suspended sediment and spilled oil contaminants in receiving waters	Open stockpiles of construction materials (for example, aggregates, sand and fill material) in places which are identified to have a possibility of significant runoff will have measures in place to prevent the washing away of construction materials, soil, silt or debris into any drainage system	Contractor Construction HSE Manager	During land clearing activities	Stockpiles material construction	• The Project Sponsor EPC Contractor	Weekly	Weekly HSE report

Table 14.8 Social Management – Construction

Source Document	Chapter	Phase	Activity/Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
EIA	4.1.2.5	Operation	Working at site	Disrupt public order	Establish a regulation at workplace Coordinate with local government in manage public order and security at the local area.						
EIA	4.1.2.5	Operation	Transportation	Increase traffic accidents. Landslide and damage the road.	Do not transport heavy equipment that exceeded the regulation applied each vehicle. Do not allow excavators, crawler bulldozers moving on the road. They must be transported by specialised vehicles to the Project site. Have measures to response landslide issues or repair roads at a right time.	• The Project Sponsor • EPC Contractor	NA	NA	NA	NA	NA
EIA	4.2.2.1	Operation	Electricity	Fire explosion incident	Electricity points must be connected properly by qualified electricians.	• The Project Sponsor • EPC Contractor	NA	NA	NA	NA	NA

Source Document	Chapter	Phase	Activity/Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
					No smoking is required at the Power House. Avoid using overload of electricity capacity that might cause short circuit incidents. When electric fire explosion occurs, work must inform immediately to project managers.						
ESIA	12.1	Pre-construction	Land procurement	Economic benefit from land compensation to the land owner	Where practicable align with IFC PS5 expectation, including: - Proper documentation for all consultation and negotiation discussions; - Ensure documentation to demonstrate fair compensation rates; Develop and implement grievance mechanism for concerns related to the land acquisition to be channelled. The system will be informed to the affected communities and made easily accessible. Relevant grievances will be addressed immediately.	• Project Sponsor	Pre-construction phase/ during land acquisition process	- Land acquisition procedure has been updated to meet the IFC PS - Grievance mechanism procedure has been in place - Available documentation of consultation and grievance records	Project Sponsor	During land acquisition process	Land acquisition completion report
ESIA	12.1	Pre-construction	Land procurement	Impact to Loss of Access and Income for Land Users	The following additional measures will be implemented: - Should any significant loss of income be identified the Project will provide a development support program to ensure the livelihood of the affected land users could be restored or improved; Develop and implement grievance mechanism for the land users to channel their concern. The system will be informed to the affected communities and made easily accessible. Relevant grievances will be addressed immediately.	• Project Sponsor	Pre-construction phase/ during land acquisition process up to the initial stage of construction phase	- Land acquisition procedure has been updated to meet the IFC PS - Grievance mechanism procedure has been in place - Available documentation of consultation and grievance records	Project Sponsor	During land acquisition process and once during the initial phase of construction	Livelihood restoration plan and monitoring report
ESIA	12.2	Construction	Workforce Mobilisation/Presence	Economic benefit to locals as a result of the Project employment and business opportunities	To have a clear stipulation of using local labour in the EPC contract and instruct the EPC contractor to prioritise qualified local people as construction workers in accordance with the needs of the Project	• Project Sponsor	Prior to commissioning of construction phase and during construction phase	Clear stipulation in the contract with EPC and Documentation/ record of employment announcement at regional and local (village) level	Project Sponsor	Once prior to commissioning of construction phase and quarterly monitoring during construction phase	Quarterly report regarding workforce number
ESIA	12.2	Construction	Workforce Mobilisation/Presence	Economic benefit to locals as a result of the Project employment and business opportunities	Provide and communicate clear information about the Project's requirement related to employment and business opportunities and priorities locals where feasible	• Project Sponsor	Prior to and during construction phase	Documentation/ record of employment and business opportunities announcement at regional and local (village) level, as part of stakeholder engagement/ consultation report	Project Sponsor	Quarterly during construction phase	Quarterly report regarding workforce number and composition and consultation report
ESIA	12.2	Construction	Construction activities	Disturbance to Farming Activities as a Result of Project	The Project is still expected to implement the following mitigation measures during construction:	• Project Sponsor; • EPC Contractor	Prior to commissioning of construction phase	- Record of consultation - Available documentation of	• Project Sponsor; EPC Contractor	Quarterly monitoring on grievance resolution	Consultation report and quarterly grievance report

Source Document	Chapter	Phase	Activity/Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
				Construction Activities	- Provide and communicate the detail information about the Project's plan and schedule particularly related to land clearing and construction to the community with a special attention to farmers and households nearby the project location. - Agree with local farmers suitable access routes to their lands Establishment of a grievance mechanism that is understood by and accessible for all villagers. The mechanism will be simple, efficient and timely and fully consultative.		and during construction phase	consultation and grievance records			
ESIA	12.2	Construction	Workforce Mobilisation/Presence	Impacts associated with non-local workforce and/or in-migrant presence increasing the prevalence of communicable diseases particularly during construction phase	- Compulsory medical examinations for the Project workers, including contractors to ensure they are fit for working and to monitor the prevalence of communicable diseases detected through annual medical check-up - Zero tolerance towards inappropriate behaviour from and amongst the workforce Conduct inductions and training refreshers on the Project's Code of Conduct regarding do's and don'ts in relation with interaction with locals	• Project Sponsor; • EPC Contractor	Prior to the commencement of work, and during construction phase	- Record of employee medical check-up result - Record of breach to the code of conduct Record of worker induction and training refresher	• Project Sponsor; EPC Contractor	Quarterly during construction phase	- Report of workforce health condition - Report of employee induction and training Report of code of conduct implementation
ESIA	12.2	Construction	Vehicle use/transportation (workforce, supply and support)	Community health impacts associated with dust generation during Project construction from the movement of Project heavy equipment	- Consultation with communities on Project's traffic routes and peak traffic times Establish a grievance mechanism and accessible for all villages to report dust concerns. Where complaints are submitted the Project will undertake an immediate investigation	• Project Sponsor; • EPC Contractor	During the construction phase	- Documentation/ record of consultation Grievance mechanism procedure Documentation/ record of grievance mechanism socialisation at local (village) level	• Project Sponsor; EPC Contractor	Quarterly during construction phase	- Environmental monitoring report - Stakeholder engagement report Quarterly grievance report
ESIA	12.2	Construction	Vehicle use/transportation (workforce, supply and support)	Potential incident with community as a result of increase in Project traffic on a public road	It is understood that the Project has performed an assessment about the condition of public roads prior to vehicle mobilization to ascertain the road load feasibility. In addition, the Project will implement the following additional mitigation measures: - In the area where unfeasible road conditions are identified, a road improvement will be conducted to ensure the road condition could meet the standard condition for construction vehicle mobilization. - Should road damage occur associated with the Project mobilization, a road improvement program will be implemented to ensure that the public road condition is adequate for the	• Project Sponsor; • EPC Contractor	During construction phase	- Road improvement and/ or repairs Grievance is resolved in timely manner	• Project Sponsor; EPC Contractor	Quarterly during construction phase	- Report of road improvement, if any - Report of road repairs Grievance record

Source Document	Chapter	Phase	Activity/Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
					local community and other road users; and Establish a proper and accessible grievance mechanism to report concerns about public road condition. The Project will carry out immediate investigation when the community submits related complaints.						
ESIA	12.2	Construction	Vehicle use/transportation (workforce, supply and support)	Potential incident with community as a result of increase in Project traffic on a public road	- Enforce speed limit regulations to all Project construction vehicles, along with an emergency response procedure - Consultation with the communities on key Project traffic routes, timings of peak movements, type of vehicles and heavy equipment and provision of road safety awareness to the surrounding communities, through corporation with local police The proposed grievance mechanism should be accessible for all villages to report concerns associated with health and safety. Where complaints on accidents or near misses are submitted the Project will undertake an immediate investigation	• Project Sponsor; • EPC Contractor	Prior to and during construction phase	- Documentation/ record of consultation Safety awareness program planning and report - Safety management plan/ procedure and emergency response plan/ procedure (ERP) in place, along with record of any breach of the plan/ procedure Grievance mechanism procedure Documentation/ record of grievance mechanism socialisation at local (village) level	• Project Sponsor; EPC Contractor	Quarterly during construction phase	- HSE Report - Stakeholder engagement report Quarterly grievance report

Table 14.9 Occupational Health and Sanitation Management – Construction

Source Document	Chapter	Phase	Activity/Aspect	Potential Impacts	Mitigation	Responsibility	Timing	Monitoring Parameter	Monitoring Responsibility	Monitoring Frequency	Reporting
EIA	4.2.2.2	Construction and operation	Working at site	Electric shock Accidents at work	Recruit qualified electricians Fully provide PPE for works and training course about electrical safety. Hire competent companies and use specific lifting equipment to install turbines.	• The Project Sponsor • EPC Contractor	Construction and operation	NA	NA	NA	NA
ESIA	14.2	Pre-construction and Construction	All pre-construction/ land works and construction activities	Potential impacts to workers' health and safety during construction phase	Proper OHS procedure is expected to be in place, align with Indonesian Regulation, as well as IFC PS. The procedure will include, at minimum, the following measures: • Contractor will be committed to ensure all health and safety measures are in place to prevent accidents and reduce the consequences of non-conformance events; • Contractor will provide training, awareness and supervising to	• The Project Sponsor • EPC Contractor	During pre-construction and construction phase	• OHS procedure in place • Training material on OHS and number of workers participated in the training • HS awareness program for workers are implemented e.g. through posters and regular toolbox meeting	• The Project Sponsor • EPC Contractor	Weekly inspection and monthly implementation report	Inspection form and monthly report

	ensure all of its construction workers comply with the OHS procedure; • Contractor shall provide all appropriate resources i.e. personal protective equipment (PPE) onsite; and Emergency response procedure and infrastructure will be available to all workers	• The use of PPE on all workers • ERP in place and socialized to workers e.g. through posters and regular toolbox meeting	

14.9 SPECIFIC OPERATIONAL / POST OPERATIONS ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS

In addition to the construction and operational management measures tabulated at Chapter 14.8, the ESIA process has identified the following operational requirements be adopted for the project.

These relate specifically to the following operational impacts of the wind farm;

Noise impacts associated with wind farm operation;

- Impacts associated with shadow flicker;
- Impacts associated with blade throw;
- Landscape and Visual impacts; and
- Biodiversity impacts and impacts associated with bird and bat strike..

14.9.1 Operational Noise Management and Mitigation

14.9.2 It is recommended that a baseline noise monitoring campaign be considered and designed to address the existing HL2 project noise emissions. Following this baseline noise monitoring campaign, and where levels are still predicted to exceed criteria, noise reducing mitigation measures should be considered to minimise impacts and reduce emissions to compliant levels.Shadow Flicker Mitigation

WTG's 1o and 11 were identified as causing what is considered to be excessive shadow flickering to some residences. The maximum shadow flicker occurs at receptor '112', located close to the wind turbines *T11* and *T10*, with a maximum of 82:47 hr/year followed by receptor '49', located close to wind turbine *T09*, with a maximum of 75:07 hr/ year, followed '114' (located close to *T11 and T10*) with 67:31 hr.

- In case the locations have been finalised by the project proponent and earmarked for construction, there needs to be close monitoring through engagement with residents during the operational phase where there are predicted impacts from shadow flicker. This specifically related to WTG's 10 and 11.
- The likelihood of direct line of sight to the location of proposed turbine locations can be assessed visually and the potential for using screening like higher fencing and planting trees can be explored at problem locations. The use of curtains can also be explored.
- If these prove effective and the impacts mitigated, the shutting down of turbines during certain environmental conditions, which meet the physical requirements for theoretical shadow flicker to occur, will not be required.

Should the impact of shadow flicker be identified, and the mitigation measures proposed above prove ineffective, further analysis can be carried out to identify the exact timings and conditions under which shadow flicker occurs, and a technical solution sought. This is likely to involve pre-programming the turbine with dates and times when shadow flicker would cause a nuisance for nearby receptors. A photosensitive cell can be used to monitor sunlight, and the turbine could potentially then be shut down, when the strength of the sun, wind speed and the angle and position of the sun combines to cause a flicker nuisance.

14.9.3 *Blade Throw Mitigation*

Mitigation measures, in this case, would be possibly to relocate the proposed WTG locations, specifically for WTG's T-11 which has maximum number of receptors in the Section 7.4.1. Although the IFC suggests a setback distance for avoiding blade throw impact in the EHS guidelines for wind power projects, a more holistic approach would be to establish a setback distance of about 300 m or more to encompass the findings in the shadow flicker and noise modelling studies.

If relocation of either turbines or receptors are not feasible options the potential risk reduction options to consider include:

- 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.
- Carry out periodic blade inspections and repair any defects that could affect blade integrity.
- Ensure that lightning protection systems are properly installed and maintained.
- Equipping wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.
- Create awareness amongst the community about any potential impacts and bringing to immediate notice of the client any abnormal sound/changes noticed by the residents regarding operations of the turbines.
- The disaster management cell of the local administrative unit/ district administration and the nearest fire-service station should be involved in preparedness for emergency situation;

14.9.4 *Landscape and Visual Mitigation*

- Use of materials that will minimize light reflection should be used for all project components.
- Bright patterns and obvious logos should be avoided.
- The replacement of wind turbines with visually different wind turbines can result in visual clutter, so replacing wind turbines with the same or a visually similar model over the lifetime of the project may be an important requirement.
- Existing vegetation should be retained to the greatest extent possible. Vegetation should be retained along roads and around turbine pads, substations, and other project infrastructure.

14.9.5 *Biodiversity Management and Mitigation*

Mitigation measures will be confirmed following completion of an updated impact assessment following the completion of bird surveys. Expected management and mitigation measures during operations may include:

- All tower structures are to be free of holes that can be used for nesting. Roosting habitats (wires and ledges) are to be kept to a minimum.
- Shut down-on-demand shall be enabled for all wind turbines.
- Contrasting colours are to be trialled on wind turbines in order to make turning blades visible to avifauna.
- Turbine cut in speed is to be made slower in order to increase the opportunity for avifauna avoidance during start up.
- Seasonal bird and bat studies during the first two years of operation;
- A carcass monitoring program is to be conducted on a weekly basis at the base of all turbines. All carcasses are to be identified and a database kept of the number and taxa of the species.

- A review of the data collected from monitoring and carcasses is to be undertaken every 6 months for 2 years to identify particular species susceptible to strike risk by a suitably qualified person. Wind farm operations may be altered based on the lifecycle characteristics of any species identified that are susceptible to strike. Assessment of data is to occur yearly from the 3rd year of operation.

Annex A

Stakeholder Engagement Plan

1.1 *STAKEHOLDER ENGAGEMENT PLAN*

Stakeholders are those persons or organisations interested in, capable of influencing or affected by, the proposed development, involved in highlighting opportunities, risks and issues of concern. Stakeholder engagement includes proactive communication with the public and other stakeholders through effective consultation and disclosure that is an integral part of project development. Engagement, therefore, assists the Project team in taking into account locally relevant conditions and opinions rather than imposing incompatible designs onto an environment that is potentially socially and environmentally sensitive.

Both the International Finance Corporation (IFC) Performance Standards and the Equator Principles III(1), listed in Section ***Error! Reference source not found.***, highlight the need for on-going and appropriate communication between the Project developer and any interested or affected parties which can be defined as stakeholders through all stages of a Project's lifecycle.

1.2 *OBJECTIVE*

The objectives of stakeholder engagement are to:

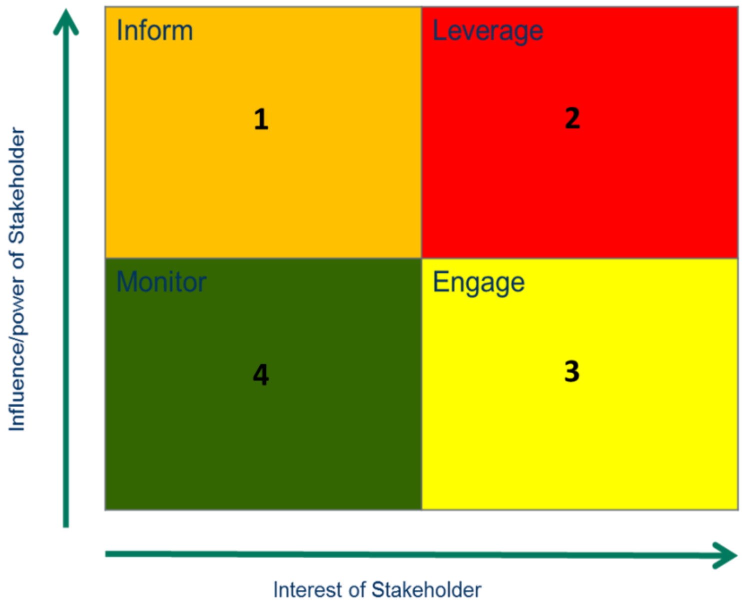
- Identify all the interested and affected parties (IAPs) of the Project;
- Distribute accurately the Project information;
- Identify the interests, concerns and needs of IAPs;
- Seek input from IAPs in the project planning process;
- Manage IAPs' expectations;
- Provide feedback to IAPs on how their concerns and needs have been addressed in the ESIA process;
- Form partnerships to promote constructive interaction amongst all parties; and
- Fulfil national and international requirements for consultation.

1.3 *STAKEHOLDER IDENTIFICATION AND CATEGORISATION*

During the course of the ESIA and its recent update, stakeholders were identified based on their interest in and influence on the Project to classify into: Inform, Leverage, Engage, and Monitor groups. The identification of stakeholder is based on the stakeholder mapping matrix ***Figure*** *Error! No text of specified style in document.****.1***.

[1] http://www.equator-principles.com/index.php/ep3 (accessed 18 August 2017)

Figure Error! No text of specified style in document..1 ***Stakeholder Mapping Matrix***



The stakeholder mapping matrix is the tool assisting identification of where stakeholders stand depending on their influence and interest. The influence and interest of stakeholders can be classed as low, low-medium, medium, high-medium or high.

After stakeholders are identified, the stakeholders will be categorised based on their interest and influence areas. These include:

- **Environmental –** this includes alteration and potential degradation of the current environmental baseline conditions, such as ecological nature, elevated noise/ disturbance levels (during construction phase), waste generation and disposal of wastes, especially in construction and any reduction in aesthetic value of the environment.

- **Social –** includes livelihood, changes in land use and occupation, community health and safety, employment of temporary/ migrant workers, traffic and transportation, etc.

- **Economic –** includes local versus non-local procurement of labour, income and economic development opportunities, infrastructure and utility requirements, etc.

- **Technical –** includes wind energy technology, management plans and mitigation measures.

The results of stakeholder identification and categorisation are summarised in **Error! Reference source not found.**

Table *Error! No text of specified style in document.*.**1** ***Stakeholder Identification and Categorisation***

Category	Stakeholder	Concerns: Environment	Concerns: Social	Concerns: Economic	Concerns: Technical	Level of Influence	Level of Interest	Level of Influence and Interest	Engagement strategies
Local communities									
	Bru - Van Kieu Indigenous People	✓	✓	✓		High	High	2-Leverage	▪ Inform and consult in interest areas by formal communications such as meetings or letters, written documents; ▪ Seek to obtain their support and technical guidance; ▪ Aim to increase level of interest.
	Communities whose land is and will be acquired by the Project (i.e. approximately 15 households who are have land acquired)	✓	✓	✓		High	High	2-Leverage	
	Communities surrounding the Project site	✓	✓	✓		Medium	High	3-Engaged	▪ Keep involved in governance and decision making process; ▪ Keep engaged and consult regularly, particularly regarding environmental, community health and safety concerns.
Authorities									
Central level	Ministry of Natural Resources and Environment (MoNRE)	✓			✓	High	Medium	2-Leverage	▪ Inform and consult in interest areas by formal communications such as meetings or official letters, written documents; ▪ Seek to obtain their support and technical guidance; ▪ Aim to increase level of interest.
	Ministry of Labour, Invalid and Social Affairs (MoLISA)		✓	✓					
	Ministry of Industry and Trade (MoIT)			✓	✓				

Category	Stakeholder	Concerns: Environment	Concerns: Social	Concerns: Economic	Concerns: Technical	Level of Influence	Level of Interest	Level of Influence and Interest	Engagement strategies
Quang Tri Province	Department of Natural Resources and Environment (DoNRE)	✓			✓	High	Medium	2-Leverage	▪ Inform and consult in interest areas by formal communications such as meetings or official letters, written documents; ▪ Seek to obtain their support and technical guidance; Aim to increase level of interest.
	Department of Labour, Invalid and Social Affairs (DoLISA)		✓	✓					
	Department of Agriculture and Rural Development (DARD)		✓	✓					
Huong Hoa District	People's Committee	✓	✓	✓	✓	Medium	High	3-Engage	▪ Involve in governance and decision making; ▪ Engage and consult regularly.
	Fatherland Front	✓	✓	✓					
	DoNRE at District level	✓			✓				
	DoLISA at District level		✓	✓					
	DARD at District Level		✓	✓					
	Committee of Ethnic Minority Affairs at District Level		✓	✓					
Huong Linh Commune	People's Committee	✓	✓	✓	✓	Medium	High	3-Engage	▪ Involve in governance and decision making; ▪ Engage and consult regularly.
	Fatherland Front	✓	✓						
	Farmers' Union	✓	✓	✓					
	Women's Union	✓	✓	✓					
	Youth Union	✓	✓	✓					
Others									
Contractors	Contractors	✓	✓	✓	✓	Low	High	3-Engage	▪ Involve in governance and decision making, particularly those relating to environment, occupational health and safety concerns; ▪ Engage and consult regularly.
Economically Interested Parties	Potential local suppliers and service providers		✓	✓		Low	High	3-Engage	
	Vietnam Electricity (EVN)	✓	✓	✓	✓	High	High	2-Leverage	

Category	Stakeholder	Concerns: Environment	Concerns: Social	Concerns: Economic	Concerns: Technical	Level of Influence	Level of Interest	Level of Influence and Interest	Engagement strategies
	Lenders	✓	✓	✓	✓	High	High		▪ Inform and consult in interest areas by formal communications such as meetings or official letters, written documents; ▪ Seek to obtain their support and technical guidance; ▪ Aim to increase level of interest.
NGOs	Vietnam World Vision International (i.e. active in the area)	✓	✓	✓		Medium	Medium	3-Engage	▪ Engage and consult for potential collaboration in community development programs.
	Other NGOs	✓	✓	✓	✓	Medium	Low	4-Monitor	▪ Inform via public communications such as newsletter, website etc. ▪ Engage if they ask to be consulted. ▪ Monitor for their feedback.
Media	Provincial media	✓	✓	✓	✓	Medium	Low	4-Monitor	▪ Inform via public communications such as newsletter, website, etc. ▪ Monitor for their feedback.
	National media	✓	✓	✓	✓				
Neighbour Private Sector Bodies	Huong Linh 2 Wind Power Plant (under the same investor)	✓	✓	✓	✓	Medium	Medium	3-Engage	▪ Engage and consult for potential collaboration in community development programs; ▪ Inform via public communications such as newsletter, website, etc. ▪ Monitor for their feedback.
	Economic – Defence Group 337	✓	✓	✓					
	Rao Quan Hydropower Plant	✓	✓						

1.4 *GRIEVANCE PROCEDURE*

1.4.1 *The Existing Grievance Procedure of Local Authority*

The *Law on Grievances* and *Law on Administrative Procedures* provide regulations/requirements/procedures for issues regarding grievances and lawsuit against the administrative decision or administrative act, respectively.

In particular, when a person has grounds to believe that an administrative decision or administrative act is unlawful or directly infringes upon their rights and lawful interests, that person may make a first-time complaint with the person who has issued such administrative decision or the agency that manages the person who has committed such administrative act, or institute an administrative lawsuit at court in accordance with the *Law on Administrative Procedures*.

In case the grievant disagrees with the first-time grievance resolution decision or the grievance remains unsettled although the prescribed time has been over, he/she may make a second-time grievance with the direct superior of the person competent to settle the first-time grievance or institute an administrative lawsuit at court in accordance with the *Law on Administrative Procedures*.

In case the grievant disagrees with the second-time grievance resolution decision or the grievance remains unsettled though the prescribed time has been over, he/she has right to institute an administrative lawsuit at court in accordance with the *Law on Administrative Procedures*.

1.4.2 *Grievance Procedure Suggested for the Project*

Within the scope of the ESIA, ERM has suggested a high level grievance procedure for the Project, based upon internationally recognised best practice. The grievance procedure is detailed below and designed specifically for redressing the external Project development activity-related grievances.

The Need for a Grievance Procedure

An effective stakeholder engagement process, which includes providing access to information on a regular basis and conducting consultation to listen to the stakeholder concerns/feedbacks, can substantially help to prevent grievances from arising in the first place. However, sometimes for a project with high potential of environmental and social impacts, grievances of some form or level generally arise. Therefore, a grievance procedure needs to be developed and implemented to ensure that project related grievances can be identified, documented, solved and monitored.

The grievance procedure should be in place from the beginning of the social and environmental assessment process and exist throughout construction and operation phases to the end of project life. As with the broader process of stakeholder engagement, it is important that management stays informed and involved so that decisive action can be taken when needed to avoid escalation of disputes.

Grievance Procedure Overview

To ensure grievances are incorporated into project decision-making and to ensure key messages are accurately communicated, all grievances will be recorded in the issues/ grievances register. This will ensure that follow-up is achieved and that the process is transparent.

An affective Grievance Procedure is phased in a set of steps and activities which are easy to follow and understand. A typical Grievance Procedure is characterized by five basic steps illustrated and further detailed in **Error! Reference source not found.** and **Error! Reference source not found.**.

***Figure** Error! No text of specified style in document..**2** Basic Steps of Grievance Tracking and Redress Process*

Submission, reporting or indirect capture of grievance	Grievance recorded; assigned case number; and delegated to resolution agent	Investigation of complaint – including gathering inputs and perspectives from parties involved	Implement remedial actions. Claim remains open for potential appeals	Obtain feedback from aggrieved. Claim can be closed upon satisfactory outcome

***Figure** Error! No text of specified style in document..**3** Typical Steps of a Grievance Mechanism*

Steps	**Typical Time Frame**	**Descriptions**
Step 1		<u>Identification of Grievance:</u> Through personal communication with appropriately trained and advertised Project workers (e.g. Grievance Officer - GO). This could be in person, by dedicated grievance form, phone, letter, or email using specific contact details.
Step 2	Within 1 (One) day of Identification	<u>Grievance is recorded in the "Grievance Log":</u> Grievances will be logged (paper and electronic) within one day of identification. The grievance log will be held at the Project offices and managed by the Grievance Officer. The significance of the grievance will then be assessed within five to seven days.
Step 3	10 – 14 working days after submission	<u>Grievance is acknowledged</u> through a personal meeting, phone call, or letter as appropriate, within a target of 10 – 14 working days after submission. If the grievance is not well understood or if additional information is required, clarification will be sought from the complainant during this step.
Step 4	Within 5 – 7 working days after submission	<u>The Grievance Officer delegates the Grievance</u> within five to seven days via email to relevant department(s) / personnel to ensure an effective response is developed (e.g. Human Resource).
Step 5	Within 14 working days after submission	<u>A Response is developed</u> by the delegated team and Grievance Officer within 14 days, with input from senior management and others, as necessary
		<u>The Response is signed-off</u> by senior manager and or the Grievance Officer within 14 days. The sign-off

Step 6	Within 14 working days after submission	may be a signature on the grievance log or an email which indicates agreement, which should be filed by the Grievance Officer and referred to in the grievance log.
Step 7		Communication of the response should be carefully coordinated. The Grievance Officer ensures that an approach to communicating the response is agreed and implemented.
Step 8		Record the response of the complainant to help assess whether the grievance is closed or whether further action is needed. The Grievance Officer should use appropriate communication channels, most likely telephone or a face to face meetings, to confirm whether the complainant has understood and is satisfied with the response. The complainant's response should be recorded in the grievance log.
Step 9		Close the grievance with sign-off from the Grievance Officer. The Grievance Officer assesses whether a grievance can be closed or whether further attention is required. If further attention is required the Grievance Officer should return to step 2 to re-assess the grievance. Once the Grievance Officer has assessed whether the grievance can be closed, he/she will sign off or seek agreement from the senior management / project manager to approve closure of the grievance. The agreement may be a signature on the grievance log or an equivalent email, which will be filed by the Grievance Officer and referred to in the grievance log. In additional, a "Grievance Closeout Form" will be used.

The external grievances can be submitted to the Project through different channels such as grievance boxes which can be allocated in the offices of the affected commune People's Committee, and at the site office of the Project Company; directly via hotline of the grievance team of the Project or directly submit to the dedicated Grievance Officer of the Project.

The grievance procedure is generally designed for different levels of redress, corresponding to the scale and seriousness of the complaint. Therefore, classification of the complaint is an important step.

The Project should appropriately recruit and allocate human resources to manage the procedure. A team of Community Relations Staff should be established which includes dedicated Grievance Officer. Ideally, persons with social/community development and management background should be recruited and assigned as a Community Relation Staff. Furthermore, members of the local community who have the requisite skill sets should be preferably selected. Also, the Project should assign resources to set up a Grievance Committee. Members of this Committee include senior managers of the Project; and during the construction phase, senior managers of the EPC Contractor shall be involved to discuss and resolve the issues relating to their activities.

1.5 *FUTURE ENGAGEMENT PLAN*

Apart from the key stakeholder engagement activities conducted within the scope of the ESIA development and those carried out by the Project as discussed above, other identified stakeholders shall be engaged by the Project.

A summary of engagement activities suggested for the Project to be conducted during the Project life is presented in **Error! Reference source not found.**.

Table** Error! No text of specified style in document.**.2 Summary of Key Future Engagement Activities

Activity		Timeframe
Information disclosure and consultation	Any community-related, particularly Indigenous People-related, environmental and social management plans that will be developed in future (e.g. Emergency Response Plan, Grievance Management Plan, Community Development Plan, Local Recruitment Plan)	Disclosure and Consultation: During the development of the management plans, and Disclosure: when the management plan is considered final.
	Any major changes of the project development that may affect stakeholders, especially local communities (e.g. development schedule or project design) or potential impacts/ issues/ opportunities of project milestones (e.g. recruitment for construction, worker peak times, demobilisation period, recruitment for operation, project commissioning, etc.)	Disclosure and Consultation: One-off as any changes made.
Information disclosure	Non-technical summary of the ESIA	When the ESIA are considered final and prior to commencing construction activities
	Project status update	During the construction and operation
	Grievance procedure/ Grievance Management Plan	As soon as the grievance procedure gets approved or When there is any update/change on the grievance procedure.
	Environmental and Social Management Plan (ESMP) included in the ESIA	For Construction ESMP: Prior to commencing construction activities. For Operation ESMP: Prior to commencing operation activities.

Activity		Timeframe
	Environmental and Social Monitoring Report (ESMR) The extended Community Development Plan (CDP) that incorporates the following components: • the Livelihood Restoration Programs/ Initiatives specifically designed for households having agricultural land acquired; and • the Indigenous People Development Programs/ Initiatives specifically designed for affected Indigenous People.	During the construction and During the operation As soon as the CDP gets approved or When there is any update/change on the CDP.
Monitoring	Stakeholder perception survey	Ongoing engagement during the project life time
Other Engagement	Consultation with different stakeholder groups, including local authority, social groups of local communities, EPC contractors, interested NGOs, governmental agencies, and private entities within the area for the collaboration in development and implementation of mitigation measures (i.e. including livelihood related programs, where appropriate) of the Project.	Consultation: During the development of the mitigation measures.

1.5.1 *Information Disclosure and Consultation*

In common practice, the Project should contact the stakeholders two weeks prior to any engagement activities to ensure that the target groups will be informed and receive information prior to the engagement activities. It also allows for adequate time for preparation work by all parties. Additional support from the local authorities (i.e. head of villages) may be necessary to ensure that notification can be provided to remote communities.

It is noted that prior to any engagement activities with local communities, the Project needs to get permission from the local authorities. If possible, local authorities at the commune level should be engaged in implementation of engagement activities with local communities.

1.5.2 *Documentation*

Record keeping following throughout the process of the stakeholder engagement plays a key role in the efficiency of stakeholder engagement activities implementation. In line with IFC guidelines, documenting consultation activities and their outcomes is critical to effectively managing the stakeholder engagement process.

During the construction phase, the Community Relations Staff will take responsibility for documentation and reporting in collaboration with the community relations staff of EPC Contractor. During the operation phase, Community Relations Staff will be in charge of documentation and reporting stakeholder engagement activities to the Community Relations Officer and EHS Manager. Moreover, a log of external stakeholder communications including complaints and responses to them need to be maintained by Community Relations Officer/ Grievance Officer. The key information to be covered includes 1) when and where the engagement activities took place; 2) list of attendees; 3) discussed topics; 4) results from discussion; and 5) commitments, if any.

It is noted that once engagement occurs, local community and other interested parties may also want to receive feedback from the Project to know how their concerns will be addressed. Therefore, the results of the periodic monitoring on the implementation of the stakeholder engagement activities shall be disclosed and considered as feedback to local communities.

In addition, it is necessary to report back periodically to communities and other stakeholder groups as to how the Project has been responding to the grievances received. The grievance monitoring is considered as a good approach to provide such information to stakeholders including communities. In particular, the report should contain the name of the individual or organisation; the date and nature of the complaint/ concern; any follow-up actions taken; the final result; and how and when this decision was communicated to the grievant.

Annex B

Preliminary Noise Assessment

Tan Hoang Cau Join Stock Company

Huong Linh 1 Wind Farm

Wind Farm Noise Assessment
– Preliminary Noise Screening

January 2018

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ERM Document Control Record 0440013AU01 - Huong Linh 1 - Noise Screening Assessment						
				ERM Approval to Issue		
Version	**Revision**	**Author**	**Reviewed by**	**Name**	**Date**	**Comments**
DRAFT	D01	NL	-	-	-	Draft report prepared by ERM for client review

Huong Linh 1 Wind Farm

Wind Farm Noise Assessment – Preliminary Noise Screening

Tan Hoang Cau Join Stock Company

January 2018

ERM Reference: 0440013

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DRAFT REPORT

Tan Hoang Cau Join Stock Company

Huong Linh 1 – Wind Farm

Wind Farm Noise Assessment – Preliminary Noise Screening

January 2018

Reference: 0440013AU01

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EXECUTIVE SUMMARY

This report has been prepared by Environmental Resources Management Australia Pty Ltd (ERM) on behalf of Tan Hoang Cau Join Stock Company. It presents the methodology, results and findings of the preliminary noise screening assessment (the assessment) conducted for the Huong Linh 1 wind farm project (the HL1 project).

Overview

Nuisance, or an unacceptable level of noise amenity, may arise from operational (or construction) activities associated with new or existing wind farm sites. This potential for operational noise issues to arise is associated with emissions from significant noise generating sources/assets such as wind turbines but in some cases may include other items such as transformers often situated within or near to a wind farm.

The preliminary noise screening assessment has been conducted for the Huong Linh 1 wind farm to address these features. The purpose of this assessment, to predict and assess operational noise levels (with regard to applicable screening thresholds) from the wind farm at nearby noise sensitive receptors has been completed. A qualitative construction noise assessment has also been provided.

The assessment was completed to identify potential receptors situated in the vicinity of site emission sources and identify significant noise equipment, the focus of which was emissions associated with wind turbine generators. The scope of this assessment is limited to the preferred project design, preliminary noise modelling, assessment and associated reporting to document the methodology, findings and any agreed recommendations for the wind farm site/design.

Screening noise criteria were established and are in accordance with recognised International Finance Corporation (IFC) guidelines. The key document adopted for the terms of reference from which noise screening criteria were established is the World Bank Group: International Finance Corporation (IFC) - Environmental, Health and Safety Guidelines for Wind Energy, dated August 2015 (IFC: Wind Energy Guideline, 2015). In particular the requirements of Section 1.1.2 of the IFC: Wind Energy Guideline, 2015 were referenced for the purpose of this assessment. Other international noise guidelines and standards were applied where relevant to the assessment and potential impacts. Noise levels were predicted, compared to criteria and discussion provided regarding the wind farm's compliance with the IFC: Wind Energy Guideline, 2015 as relevant to noise.

Construction Findings

The construction noise assessment concluded that some noise from construction sites is inevitable, such that good construction management practices focus on minimising noise impacts, rather than only on achieving numeric noise levels. Good-practice construction noise management and noise mitigation techniques may be required during the HL1 project to reduce noise levels as far as practicable. These will need to be considered and then implemented, where necessary.

Based on these findings suitable recommendations which can be considered and potentially implemented on site are provided in Chapter 7 of this report.

No further recommendations for construction noise mitigation and management measures to those established by the findings of this assessment, and documented in this report, are provided or warranted. Tan Hoang Cau Join Stock Company should however remain aware of the potential for nuisance, or an unacceptable level of amenity, to occur due to construction noise, continue to plan for and then manage construction works accordingly.

Operational Findings

As summarised in Section 5.1 of this report the predicted noise levels for HL1 and HL2 projects would (under normal circumstances) be expected to generate moderate to high impacts. However, due to the economic (e.g. employment) opportunities provided by the HL1 and HL2 projects and the assumed local community acceptance of noise emissions associated with the wind farms, noise reducing mitigation, management measures and/or monitoring options have not been provided as recommendations in this report. It is beyond the scope of this assessment to comment any further, or to provide recommendations associated with, the community and stakeholder consultation for the project.

Should an agreement or documented acceptance of the projects noise emission not be reached it is recommended that a baseline noise monitoring campaign be considered and designed to address the existing HL2 project noise emissions. Following this baseline noise monitoring campaign, and where levels are still predicted to exceed criteria, noise reducing mitigation measures should be considered to minimise impacts and reduce emissions to compliant levels.

Based on these findings suitable recommendations which can be considered and potentially implemented on site are provided in Chapter 7 of this report.

No further recommendations for additional operational assessment and/or operational noise mitigation and management measures to those established by the findings of this assessment, and documented in this report, are provided or warranted. Tan Hoang Cau Join Stock Company should however remain aware of the potential for nuisance, or an unacceptable level of amenity, to occur due to operational noise, continue to plan for and then adapt the wind farm design accordingly.

Residual Impacts and Closing

Construction and operational noise levels will be reduced and impacts minimised with the successful implementation of the recommendations presented in Chapter 7 of this report. Impacts may not be reduced to negligible or fully compliant levels for all receptors during all construction and operational activities, however the recommendations are designed to ensure that any residual impacts are minimised as far as is practically achievable.

1 INTRODUCTION

This report has been prepared by Environmental Resources Management Australia Pty Ltd (ERM) on behalf of Tan Hoang Cau Join Stock Company. It presents the methodology, results and findings of the preliminary noise screening assessment (the assessment) conducted for the Huong Linh 1 wind farm project (the HL1 project).

Nuisance, or an unacceptable level of noise amenity, may arise from operational activities associated with new or existing wind farm sites.

This potential for noise issues to arise is associated with emissions from significant noise generating sources/assets such as wind turbines but in some cases may include other items such as transformers often situated within or near to a wind farm.

The purpose of this assessment is to address these potential noise issues by predicting and assessing operational noise levels from the wind farm at nearby noise sensitive receptors. A qualitative assessment of potential short-term construction noise emissions has also been provided.

This report has been prepared to document the findings of the assessment, provide an evaluation of potential impacts, identify potential mitigation measures that may be required to achieve compliance and then highlight any potential residual noise issues.

1.1 PROJECT OVERVIEW

The HL1 project is located in the Huong Linh and Dakrong communes, Huong Hoa and Dakrong Districts, in Quang Tri Province of central Vietnam. It comprises 15 wind turbines, as follows:

- 11 x Vestas V110 wind turbines with a hub height of 80 metres.
- 4 x Vestas V90 wind turbines with a hub height of 80 metres.

The Huong Linh 2 wind farm project (the HL2 project) is located in the same area as the HL1 project and comprises 15 wind turbines, each of which is understood to be a Vestas V100.

The HL2 project is already operational, and as such has been considered in this assessment when addressing potential cumulative noise emissions and impacts at nearby noise sensitive receptors.

1.1.1 *Site Description*

The HL1 project is located within a mountain valley with steep forested hillsides occurring on each side. A relatively remote village area is located in and around the footprint of HL1 and HL2. Residential dwellings as well as community infrastructure such as schools and kindergartens are located within the projects footprint.

The HL1 and HL2 projects, surrounding area and other items of importance to this assessment are identified in *Figure 1.1* and *Figure 1.2* below.

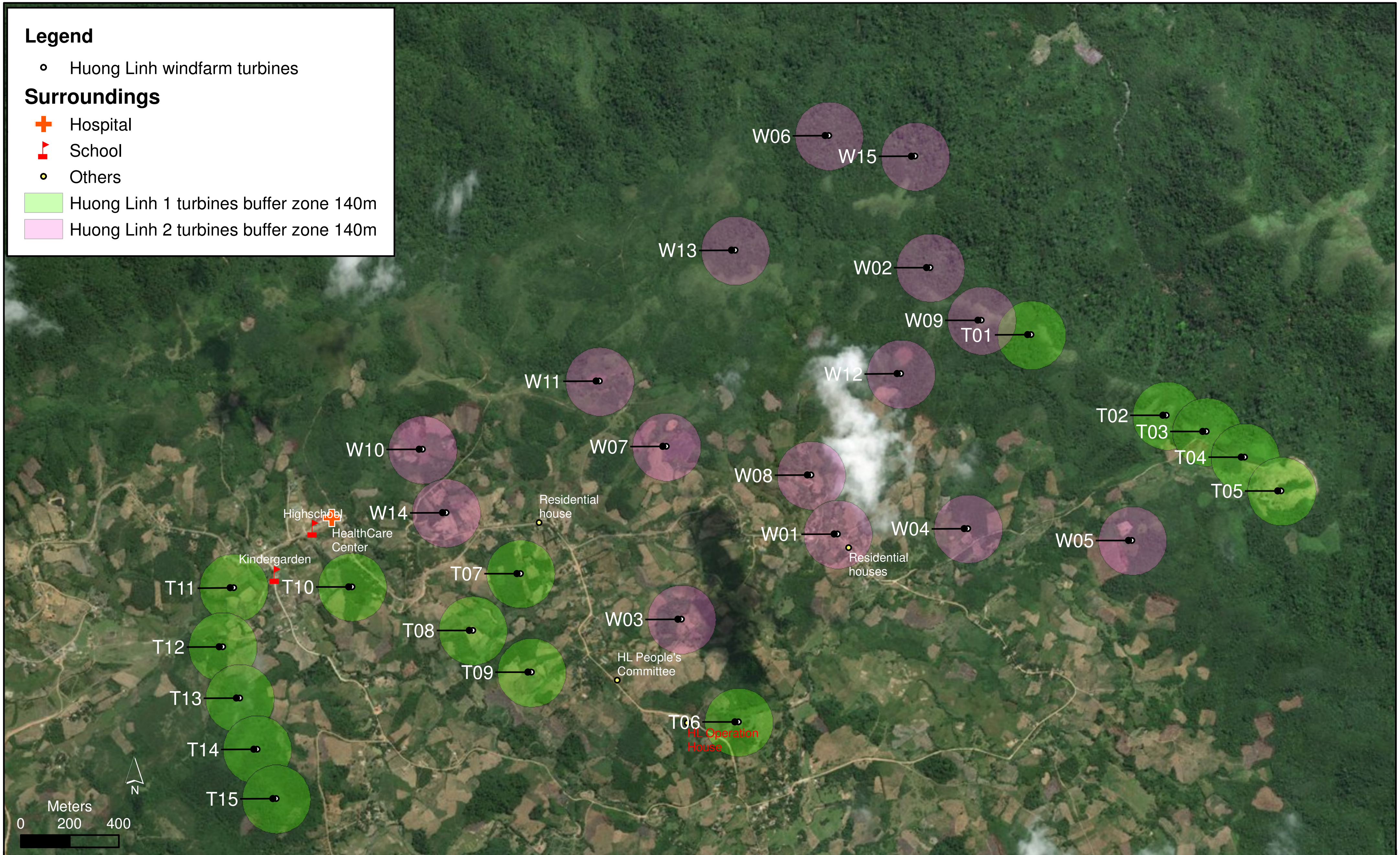

Figure 1

Huong Linh 1 Wind farm project

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Date: 4/1/2018

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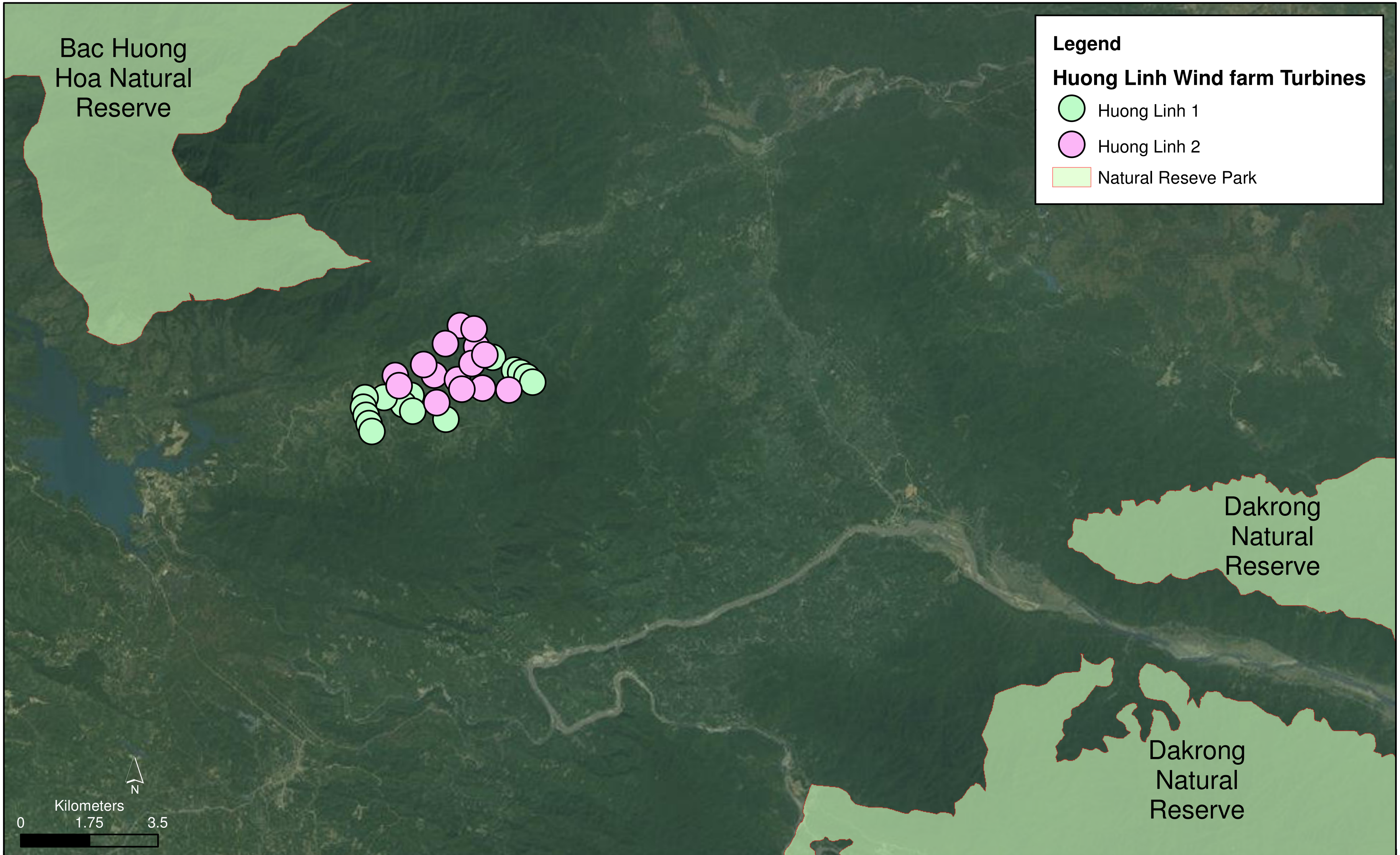

Figure 1

Huong Linh Wind farm project

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Date: 3/1/2018

Environmental Resources Management

ERM

2 *ASSESSMENT METHODOLOGY*

This chapter summarises the assessment methodology. A glossary of relevant acoustical concepts and terminology is provided in *Annex A* of this report.

2.1 *SCOPE OF THIS ASSESSMENT*

The scope of this assessment is limited to the supplied HL1 (proposed) and HL2 (operational) project designs as identified in *Figure 1.1*, preliminary noise modelling, assessment and associated reporting to document the methodology, findings and any agreed recommendations for the wind farm site/design. The assessment scope of works included:

- Reviewing existing project information and operational activities to identify noise equipment that are being used as part of the wind farm's general operation.
- Identify the closest and/or potentially most affected receptors situated within the potential area of influence of the wind farm and discuss the existing conditions near these receptors
- Establishing project-specific operational noise screening criteria.
- Establishing a noise model to predict operational noise levels associated with the wind farm/s.
- Providing a comparison of predicted noise levels to the project-specific operational noise screening criteria and identifying any levels that exceed criteria.
- Developing noise reducing mitigation options designed to reduce levels to achieve compliance and modelling these options to determine their effect, and any residual impacts.
- Evaluating the magnitude and extent of potential residual impacts associated with the wind farm's operation and providing recommendations for potentially effective noise mitigation, where the impacts warrant. These recommendations are designed for Tan Hoang Cau Join Stock Company consideration and potential implementation, where considered feasible and reasonable.
- A qualitative assessment of short-term construction noise levels is also provided. Recommendations for conceptual noise mitigation management and measures, and monitoring options are provided for consideration by Tan Hoang Cau Join Stock Company, refer *Chapter 6*.

2.2 *RELEVANT DOCUMENTS, POLICY AND STANDARDS*

This assessment has been conducted with due regard to and in accordance with the following documents, policy and standards:

- International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) - *Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation*.

- World Bank Group: International Finance Corporation (IFC) - *Environmental, Health and Safety Guidelines for Wind Energy*, dated August 2015 (IFC: Wind Energy Guideline, 2015) – noise only.

- World Bank Group: International Finance Corporation (IFC) - *Environmental, Health and Safety (EHS) Guidelines - General EHS Guidelines: Environmental Noise Management*, Section 1.7 Noise (IFC 1.7 Noise), dated 30 April 2007.

- Relevant project data and information provided to ERM by Tan Hoang Cau Join Stock Company at the time of this assessment.

2.3 *KEY FEATURES, INPUTS AND ASSUMPTIONS*

Key features, inputs and assumptions that have informed the current noise modelling and assessment are reproduced or outlined in *Table 2.1* below.

Table 2.1 Assessment Features, Inputs and Assumptions

ID	Feature	Description
1	General Acoustics	All sound pressure levels presented in this report (eg noise levels predicted at a receptor) are in decibels referenced to 2 x 10^{-5} Pa, with A-weighting applied. All sound power levels presented in this report (eg noise levels assigned to specific sources) are decibels referenced to 10^{-12}W, with A-weighting applied.
2a	Noise Modelling	Brüel & Kjær's Predictor 7810 (Version 11.1) noise modelling software package was utilised to calculate noise levels using the ISO9613:2 noise propagation algorithms (international method for general purpose, 1/1 octaves). For sound calculated using ISO9613:2, the indicated accuracy is ±3dBA at source to receiver distances of up to 1000 metres (m) and unknown at distances above 1000 m.
2b		The Predictor software package allows 3D elevation data to be combined with ground regions, water, foliage, barriers, significant building structures etc and receptor locations, to create a detailed and accurate representation of the wind farm and surrounding area. The noise model allows for the quantification of noise levels from multiple sources, based on sound power or pressure levels emitted from each source. It computes the noise propagation in the assessment area of influence to specifically quantify A-weighted decibels, L_{eq} in dBA at identified noise sensitive receptors. For the HL1 project-specific noise model 3D elevation data or a digital terrain model (DTM) was not available at the time the assessment was conducted, hence flat ground has been modelled.
2c		A ground factor of 0.0 was adopted for the entire modelling area: 0.0 is hard and 1.0 is soft.
3	Noise Source Data	Sound Power Level (L_W, dBA) data (overall L_W values and spectral data) incorporated into the project-specific noise model was provided for use in the assessment or derived by ERM, as summarised here: • The predicted noise levels are based on the representative worst-case 107.7 dBA overall LW value for the V110 (winds speeds 10 metres per second (m/s) and above) and 104.9 dBA overall LW value for the V90 (also winds speeds 10 m/s). Based on the data provided it is understood that these values accurately represent the source noise emissions from the preferred HL1 project wind turbines, each operating in standard Mode 0 (no wind turbines are proposed to be run in any noise mitigation modes) and with standard blades i.e. no STE. • Noise modelling has taken into account the potential cumulative noise from the HL2 project as it has the potential to increase noise levels at nearby noise sensitive receptors. HL2 project wind turbine L_W specifications were not available or provided at the time the assessment was conducted, as such a Vestas V100 has been assumed for HL2 project. The predicted noise levels are therefore based on a 105.0 dBA overall L_W value for the V100 which was identified via a web search for this turbines noise specification. On this basis it is understood that this value accurately represents the source noise emissions from the operational HL2 project wind turbines, each operating in standard Mode 0 (no noise mitigation modes) and with standard blades i.e. no STE.

ID	Feature	Description
		• Spectral data (dBA per frequency band in 1/3 octaves) was provided for the V110 and V90 wind turbines and has been utilised for this assessment. The spectral data provided for the V90 wind turbine identified a worst-case overall LW value of 103.8 which differed from the client supplied V90 noise specification of 104.9 dBA. Hence the V90 1/3 octave data was modified to the 104.9 dBA specification. • Spectral data (dBA per frequency band in 1/3 octaves) was not provided for the V100 wind turbine. Hence the V110 1/3 octave data was modified to the assumed 105.0 dBA V110 noise specification. • A hub height of 80 metres has been adopted for all HL1 and HL2 wind turbines. • Wind distribution data was not available or provided at the time the assessment was conducted, hence Leq, 24 hour noise levels (which would consider this wind distribution throughout an average day) have not been predicted. Furthermore, and to provide a concise assessment addressing the requirements of the IFC: Wind Energy Guideline, 2015 Leq noise levels are predicted for the representative worst-case noise scenario only i.e. all predicted noise levels are based on the highest overall LW values for the V90, V100 and V110 (winds speeds ≥10 m/s) as stated above.
4	Receptors	A total of seven locations were identified as per *Figure 1.1* and noise levels were calculated at 1.5 and 10 metres above ground level, in accordance with IFC 1.7 Noise and the IFC: Wind Energy Guideline, 2015 assessment height requirements. A receptor height of 1.5 metres is representative of a human in a seated position and is commonly adopted as a general assessment height. A receptor height of 10 metres is commonly adopted for wind farms as it is a typical height for meteorological masts.

2.4 *NOISE EMISSION SOURCES*

The overall Sound Power Level (LW) values (L_{eq} in dBA) and spectral data adopted for this assessment is identified in *Table 2.2* below. This includes the eleven Vestas V110 and four Vestas V90 wind turbines associated with the HL1 project and the 15 Vestas V100 wind turbines assumed for the HL2 project, each with a hub height of 80 metres.

Guidance Note

L_W is a measure of the total power radiated by a source. The "sound power" of a source is a fundamental property of the source and is independent of the surrounding environment. This differs from the Sound Pressure Level (L_P) which is the level of "sound pressure" as measured at distance by a standard sound level meter with a microphone. L_P is the received sound as opposed to L_W that is the sound 'intensity' at the source itself.

Table 2.2 Sound Power Level Data – Vestas V90, V100 and V110

Project	Wind Turbine ID	Wind Turbine Model	Spectral Data – dBA in 1/1 Octave Bands: 31.5 to 8kHz									Total Lw in dBA
			31.5	63	125	250	500	1000	2000	4000	8000	
	T01		80.4	89.6	94.7	95.2	95.1	100.3	98.8	92.7	83.2	104.9
	T02	Vestas V90	80.4	89.6	94.7	95.2	95.1	100.3	98.8	92.7	83.2	104.9
	T03		80.4	89.6	94.7	95.2	95.1	100.3	98.8	92.7	83.2	104.9
	T04		80.4	89.6	94.7	95.2	95.1	100.3	98.8	92.7	83.2	104.9
	T05		79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
	T06		79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
	T07		79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
HL1	T08		79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
	T09		79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
	T10	Vestas V110	79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
	T11		79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
	T12		79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
	T13		79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
	T14		79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
	T15		79.8	87.6	92.2	93.2	97.8	103.0	103.5	97.7	79.1	107.7
	W01		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W02		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W03		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W04		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W05		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W06		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W07		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
HL2	W08	Vestas V100	77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W09		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W10		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W11		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W12		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W13		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W14		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0
	W15		77.1	84.9	89.5	90.5	95.1	100.3	100.8	95.0	76.5	105.0

3 EXISTING ENVIRONMENT

A key element in assessing environmental noise impacts is an understanding of the existing ambient and background noise levels in the vicinity of the closest and/or potentially most affected receptors situated within the potential area of influence of a project.

3.1 POTENTIALLY SENSITIVE RECEPTORS

The potentially sensitive noise receptors where compliance has been assessed were identified in *Figure 1.1* above and are tabulated in *Table 3.1* below. These locations were provided for use in the assessment and include two dwellings, a healthcare centre, two commercial properties (village offices), a school and a kindergarten.

Table 3.1 Potentially Sensitive Noise Receptor Locations

Noise ID	**Desc.**	**GPS Co-ordinates (X and Y)**	
R1	Residential (Dwelling) Receptor	689858	1848969
R2	Residential (Dwelling) Receptor	688592	1849071
R3	Health Care Centre (Other) Receptor	687744	1849091
R4	HL People's Committee (Commercial) Receptor	688911	1848427
R5	HL High School (School) Receptor	687668	1849047
R6	Kindergarten (School) Receptor	687512	1848858
R7	HL Operation House (Commercial) Receptor	689198	1848252

Guidance Note

These locations do not represent all receptors located in the vicinity of the HL1 (or HL2) project but have been provided for the purposes of this noise assessment; they are considered to be representative of locations that will experience the highest impacts associated with the ongoing operation of both HL1 and HL2 projects.

Furthermore, where additional receptors are identified (beyond those presented in *Figure 1.1* and *Table 3.1*) the predicted noise levels at the nearest assessed receptor (R1 to R7) provides an indication of potential wind farm emissions and impacts that could be experienced at other receptors not identified in this assessment.

3.2 *EXISTING NOISE LEVELS*

Existing ambient and background noise levels were not measured for this assessment but an understanding of the existing acoustics environment is summarised below.

Given the topography surrounding the HL1 project (steep forested hillsides occurring on each side) and the relatively remote village area in and around the footprint of HL1 and HL2, it would be expected that existing ambient and background noise levels would be low and representative of a generally rural environment. However, given the community infrastructure and local roads in the area, and the potential for small commercial or agricultural activities to occur, existing ambient and background noise levels above that representative of a rural environment may be experienced. This evaluation and understanding of the existing noise environment excludes emissions from the now operational HL2 wind farm.

The Environmental Impact Assessment (EIA) presented some noise baseline information, however the measurement methodology is unknown. This information is reproduced below but has not been adopted to inform this assessment as the quality of the data cannot be relied upon. It does however indicate that average or maximum noise levels up to approximately 65 dBA may be experienced by receptors within and near to the HL1 project.

The EIS identified that noise sampling occurred between 6 AM and 9 PM on Thursday, 13 August 2015. Noise samples were recorded at three locations described as Air Sampling 1, Air Sampling 1, and Air Sampling 3 as identified in *Figure 3.1* below. The recorded noise levels were:

- 66.7 dBA at "Air Sampling 1".
- 63.1 dBA at "Air Sampling 2".
- 62.2 dBA at "Air Sampling 3".

Figure 3.1 ***EIA Noise ("Air") Sampling Locations***

4 *PROJECT-SPECIFIC NOISE CRITERIA*

The key document adopted for the terms of reference from which noise screening criteria were established is the *World Bank Group: International Finance Corporation (IFC) - Environmental, Health and Safety Guidelines for Wind Energy*, dated August 2015 (IFC: Wind Energy Guideline, 2015). In particular the requirements of Section 1.1.2 of the IFC: Wind Energy Guideline, 2015 were referenced for the purpose of this assessment.

In addition, the IFC - *Environmental, Health and Safety (EHS) Guidelines - General EHS Guidelines: Environmental Noise Management*, Section 1.7 Noise (IFC 1.7 Noise), dated 30 April 2007 was adopted as required by the IFC: Wind Energy Guideline, 2015.

This chapter summarises these guidelines and presents the project-specific noise screening criteria adopted for this assessment.

4.1 *IFC: WIND ENERGY GUIDELINE, 2015 (CONSTRUCTION NOISE)*

Section 1.2.2-17 of the IFC: Wind Energy Guideline, 2015 states that "*onshore construction noise should be limited to protect people living nearby. Noise-producing activities include blasting, piling, construction of roads and turbine foundations, and the erection of the turbines themselves. Guidance on acceptable levels can be found in the General EHS Guidelines*". These acceptable levels are identified in IFC 1.7 Noise as presented in *Section 4.3* of this report, and form the basis of the qualitative assessment presented in *Chapter 6* of this report. **Section 1.1.2-18** of IFC: Wind Energy Guideline, 2015 provides underwater noise and vibration requirements however they do not apply to this project.

4.2 *IFC: WIND ENERGY GUIDELINE, 2015 (OPERATIONAL NOISE)*

4.2.1 *Section 1.2.2-19: Potential Wind Farm Emissions*

Section 1.2.2-19 of the IFC: Wind Energy Guideline, 2015 states that "*wind turbines produce noise through a number of different mechanisms, which can be roughly grouped into mechanical and aerodynamic sources. The major mechanical components include the gearbox, generator, and yaw motors, each of which produce their own characteristic sounds. Other mechanical systems, such as fans and hydraulic motors, can also contribute to the overall acoustic emissions. Mechanical noise is radiated by the surface of the turbine and by openings in the nacelle housing. The interaction of air and the turbine blades produces aerodynamic noise through a variety of processes as air passes over and past the blades.*

This information is relevant to this assessment and is reproduced here for documentative purposes, and so an understanding of wind farm emissions is provided.

4.2.2 *Section 1.2.2-20: Noise Screening Criteria and Other Requirements*

Section 1.2.2-20 identifies the principles that wind farm noise impacts should be assessed. These are reproduced below and form the basis of this noise screening assessment:

- *Receptors should be chosen according to their environmental sensitivity (human, livestock, or wildlife).*
- *Preliminary modelling should be carried out to determine whether more detailed investigation is warranted. The preliminary modeling can be as simple as assuming hemispherical propagation (i.e., the radiation of sound, in all directions, from a source point). Preliminary modeling should focus on sensitive receptors within 2,000 meters (m) of any of the turbines in a wind energy facility.*
- *If the preliminary model suggests that turbine noise at all sensitive receptors is likely to be below an L_{A90} of 35 decibels (dBA) at a wind speed of 10 meters/second (m/s) at 10 m height during day and night times, then this preliminary modeling is likely to be sufficient to assess noise impact; otherwise it is recommended that more detailed modeling be carried out, which may include background ambient noise measurements.*
- *All modeling should take account of the cumulative noise from all wind energy facilities in the vicinity having the potential to increase noise levels.*
- *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. Often the critical receptors will be those closest to the wind energy facility, but if the nearest receptor is also close to other significant noise sources, an alternative receptor may need to be chosen.*
- *The background noise should be measured at 10 m height over a series of 10-minute intervals, using appropriate wind screens. At least five of these 10-minute measurements should be taken for each integer wind speed from cut-in speed to 12 m/s.*

Project-Specific Noise Screening Criteria: in accordance with **Section 1.2.2-20** reproduced above, a noise screening criteria of <35 dBA at 10 m/s and at 10 m height has been adopted, for both daytime and night time assessment periods. This has been adopted at all receptors identified in *Figure 1.1* of this report.

As stated in *Table 2.1* of this report, all modeling has taken into account the cumulative noise from the Huong Linh 2 wind energy facility situated in the vicinity of the project which has the potential to increase noise levels at receptors.

4.2.3 *Section 1.2.2-21 to 1.2.2-23: Noise Mitigation Measures*

Section 1.2.2-21 to **Section 1.2.2-23** of the IFC: Wind Energy Guideline, 2015 provides information regarding noise mitigation measures which are addressed in *Chapter 7* of this report.

4.2.4 *Section 2.1.2-78 to 2.1.2-80: Noise Monitoring*

Section 2.1.2-78 of the IFC: Wind Energy Guideline, 2015 states that "*noise impacts should not exceed the levels presented in the General EHS Guidelines*".

Supplementary Noise Screening Criteria: Although this **Section 2.1.2-78** requirement relates to noise monitoring it is adopted here as a secondary noise screening criteria by which the potential for noise impacts to occur may be assessed. These acceptable levels are identified in IFC 1.7 Noise as presented in *Section 4.3* below.

Section 2.1.2-79 states that "*Noise generated from wind energy facilities tends to increase with the speed of the wind, as does overall background noise due to the friction of air over existing landscape features. Increased wind speeds may also mask the noise emitted by the wind energy facility itself, and wind speed and direction may affect the direction and extent of noise propagation. The application of noise guideline values and the assessment of background levels should therefore take these factors into consideration. It is considered good practice to undertake noise compliance testing when the project becomes operational to verify the modeled noise levels at nearby properties and confirm the appropriateness of any mitigation applied*".

In addition **Section 2.1.2-80** states that "*additional consideration may be required to address the nuisance factor associated with impulsive or tonal (sound of a specific frequency) characteristics of noise emitted from some wind energy facilities' configurations*".

Section 2.1.2-79 and **Section 2.1.2-80** apply to noise monitoring but are reproduced here as they provide insight and further relevant information regarding the **Section 1.2.2-19** principles reproduced above in relation to background noise measurements.

The features discussed in **Section 2.1.2-79** and **Section 2.1.2-80** relating to an increase in background levels with wind speed identifies the conservative nature of the project-specific noise screening criteria defined by IFC and identified in *Section 4.2.2* of this report.

Furthermore, **Section 2.1.2-79** and **Section 2.1.2-80** highlight the value of the secondary noise screening criteria adopted here, as the adjacent Huong Linh 2 wind farm project may prevent the measurement of background noise levels "*in the absence of any wind turbines*" stated in **Section 1.2.2-20** above.

4.3 *IFC General EHS Guidelines: IFC 1.7 Noise*

The IFC 1.7 Noise guideline addresses "*impacts of noise beyond the property boundary of the facilities*" and outlines prevention and control measures. It is tailored to suit "industrial" noise generating facilities and is commonly adopted to assess, for example, power and mining developments, it does not however directly relate to wind farm developments.

Therefore, the fixed-value acceptable noise levels presented in *Table 1.7.1* of the IFC 1.7 Noise guideline are adopted here a) for the assessment and management of potential construction noise impacts, and b) as a secondary criterion by which the potential for operational noise impacts may be assessed.

No consideration of the IFC 1.7 Noise guideline "increase in background noise" requirement is provided for in this assessment as this feature is most appropriately assessed in accordance with the specific wind farm requirements presented in the IFC: Wind Energy Guideline, 2015.

The IFC 1.7 Noise (fixed-value) acceptable noise levels are reproduced in *Table 4.1* below.

Table 4.1 IFC 1.7 Noise (fixed-value) acceptable noise levels

Receptor	Leq, 1 hour in dBA	
	Daytime	**Night time**
Residential; institutional; educational	55	45
Industrial; commercial	70	70

4.4 *Consolidated Noise Screening Criteria*

Based on the terms of reference discussed above the following noise screening criteria have been adopted as identified in *Table 4.2*.

Table 4.2 Project Noise Screening Criteria

Receptor	Project-specific Noise Screening Criteria – Leq in dBA		Secondary Noise Screening Criteria – Leq in dBA	
	Daytime	**Night time**	**Daytime**	**Night time**
Dwelling, School or Other	35	35	55	45
Commercial	35	35	70	70

1. A one hour time period has been adopted for this assessment.

5 *OPERATIONAL NOISE ASSESSMENT*

Based on the methodology, inputs and assumptions described in *Chapter 2* of this report L_{eq} noise levels have been predicted for both the HL1 and HL2 projects.

The resultant noise levels and comparison to the IFC operational noise screening criteria (L_{eq} < 35) and the limiting night time secondary screening criteria (L_{eq} < 45) are presented in *Table 5.1* below. All noise levels have been rounded to one decimal place.

Any noise levels that exceed criteria by >0.5 dBA are highlighted in **bold** typeset. Differences in noise levels of less than approximately 2 dBA are generally imperceptible in practice hence an increase of 2 dBA is hardly perceivable; such that a level which exceeds criteria by less than 0.5 dBA is insignificant.

Table 5.1 Predicted Noise Levels (Unmitigated) – HL1, HL2 and Cumulative (HL1 + HL2) Noise

Receptor	Description	Assessment Height, m	Predicted Noise Level – Leq in dBA			Project- Specific Screening Criteria	Secondary Screening Criteria[2]	Comparison to Criteria (HL1 + HL2 – Criteria)	
			HL1	HL2	HL1 + HL2			Project- Specific Screening Criteria	Secondary Screening Criteria
R1	Residential (Dwelling) Receptor	1.5	**40.5**	**56.2**	**56.3**	35	45	**21.3**	**11.3**
R1	Residential (Dwelling) Receptor	10	**40.5**	**56.7**	**56.8**	35	45	**21.8**	**11.8**
R2	Residential (Dwelling) Receptor	1.5	**51.8**	**46.3**	**52.9**	35	45	**17.9**	**7.9**
R2	Residential (Dwelling) Receptor	10	**51.9**	**46.3**	**53**	35	45	**18.0**	**8.0**
R3	Health Care Centre (Other) Receptor	1.5	**50.4**	**43.9**	**51.3**	35	45	**16.3**	**6.3**
R3	Health Care Centre (Other) Receptor	10	**50.4**	**44**	**51.3**	35	45	**16.3**	**6.3**
R4	HL People's Committee (Commercial) Receptor	1.5	49.2	44.5	50.5	35	45	**15.5**	-19.5
R4	HL People's Committee (Commercial) Receptor	10	49.2	44.6	50.5	35	45	**15.5**	-19.5
R5	HL High School (School) Receptor	1.5	**51.1**	**42.2**	**51.6**	35	45	**16.6**	**6.6**
R5	HL High School (School) Receptor	10	**51.1**	**42.2**	**51.6**	35	45	**16.6**	**6.6**
R6	Kindergarten (School) Receptor	1.5	**54.8**	**38.7**	**54.9**	35	45	**19.9**	**9.9**
R6	Kindergarten (School) Receptor	10	**55**	**38.7**	**55.1**	35	45	**20.1**	**10.1**
R7	HL Operation House (Commercial) Receptor	1.5	51.7	43.1	52.2	35	45	**17.2**	-17.8
R7	HL Operation House (Commercial) Receptor	10	51.8	43.1	52.3	35	45	**17.3**	-17.7

1. All noise levels are expressed in decibels, dBA using the Leq parameter.
2. The limiting night time criterion (45 dBA) is adopted.

5.1 *DISCUSSION*

The predicted noise levels in *Table 5.1* identify that **unmitigated** wind farm noise emissions **exceed** the most stringent IFC operational noise screening criteria (L_{eq} < 35 dB) for the representative worst-case scenario assessed.

The extent by which the predicted levels exceed the operational noise screening criteria varies depending on the receptors location and distance offset to nearby wind turbines. In general wind farm noise levels are between 15 and 22 dBA above the screening criteria, 18 dBA on average.

The predicted noise levels in *Table 5.1* identify that **unmitigated** wind farm noise emissions also **exceed** (except at the commercial receptors) the secondary operational noise screening criteria (L_{eq} < 45 dB) for the representative worst-case scenario assessed.

The extent by which the predicted levels exceed the secondary operational noise screening criteria again varies depending on the receptors location and distance offset to nearby wind turbines. In general noise levels are between 6 and 12 dBA above the screening criteria, 9 dBA on average. At the **commercial receptors** predicted noise levels are **below** the commercial screening criteria, L_{eq} < 70 dB by between 17 and 20 dBA.

It is also important to consider the influence of the HL1 project and any increase in cumulative wind farm noise levels, above that predicted for the HL2 project. An evaluation of the predicted noise levels in table 5.1 identifies that noise levels will increase at the majority of receptors with the introduction of the HL1 wind turbines. The extent by which the predicted values increase varies depending on the receptors location and proximity to each wind farm development. In general noise levels are expected to increase by between 6 and 16 dBA at the most affected receptors, up to 9 dBA on average.

Under normal circumstances these noise levels would be expected to generate moderate to high impacts, based on which a baseline noise monitoring campaign would be designed and/or noise reducing mitigation would be considered to minimise impacts and emissions to compliant levels. However, it is understood that due to the economic (e.g. employment) opportunities provided by the HL1 and HL2 projects, that all potentially affected noise sensitive receptors are accepting of these levels being above criteria, and the associated impacts that could be experienced. It is beyond the scope of this noise assessment to provide any further discussion in regards to the social and stakeholder consultation conducted for the project/s but this feature i.e. the local communities acceptance of noise emissions associated with the wind farms, has influenced the recommendations provided in this report.

Based on the findings discussed above suitable recommendations which can be considered and potentially implemented on site are provided in *Chapter 7* of this report.

6 *CONSTRUCTION NOISE ASSESSMENT*

To construct the HL1 project a range of works and activities may be required at various locations within the area. Those with the potential to generate significant noise emissions include:

- Site preparation, construction and installation works associated with each of the proposed wind turbines.
- Site preparation and building construction works associated any permanent facilities.
- Construction and installation of the internal electrical network (between turbines) and any associated transmission lines.
- Construction works associated with internal access roads which provide access between the WTGs.
- Use of specialised (e.g. concrete batching plants) or unforeseen wind farm construction equipment, or activities that are to be undertaken.

A quantitative noise modelling assessment has not been conducted however these works and activities (or similar activities) are expected to generate noise levels that will exceed the IFC 1.7 Noise criteria. This is typical of most construction works associated with major developments and these elevated levels do not represent a constant or long-term emission that would be experienced by the community on a daily basis throughout the projects construction schedule, or for the operational life of the wind farm. Construction noise levels will only be experienced for limited periods of time when works are occurring at select locations; they will not be experienced for full daytime, evening or night time periods. Any impacts associated with these works will be temporary and do not represent a permanent impact on the community and surrounding environment.

Some noise from construction sites is inevitable, such that good construction management practices focus on minimising noise impacts, rather than only on achieving numeric noise levels. Good-practice construction noise management and noise mitigation techniques may be required during the HL1 project to reduce noise levels as far as practicable. These will need to be considered and then implemented, where necessary.

Based on the findings discussed above suitable recommendations which can be considered and potentially implemented on site are provided in *Chapter 7* of this report. Construction noise levels will be reduced and impacts minimised with the successful implementation of these recommendations. Impacts may not be reduced to negligible levels for all receptors during all construction activities; however the recommendations are designed to ensure that any residual impacts are minimised as far as is practically achievable.

7 RECOMMENDATIONS

7.1 CONSTRUCTION NOISE

Based on the findings of the qualitative construction noise assessment presented in *Chapter 7* of this report it is recommended that:

- During construction of the HL1 project good-practice construction noise mitigation and management measures should be implemented to reduce noise levels and minimise any impacts as far as practicable. A range of mitigation and management measures are available and those that are considered feasible, reasonable and practical to implement the specific tasks should be considered for example:
  - avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient;
  - ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the site; and/or
  - ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse.
- During the construction design, choose appropriate machines for each task and adopt efficient work practices to minimise the total construction period and the number of noise sources on the site. Select the quietest item of plant available where options that suit the design permit.
- High noise generating construction works and activities should be limited to the IFC daytime period (7AM to 10PM), and work should be avoided on Sundays or public holidays if possible.
- Any works that are required during the IFC night time period (10PM to 7AM) should be justified and task-specific noise mitigation and management measures should be implemented to reduce noise impacts to acceptable levels. These additional measures should consider the potential for sleep disturbance impacts that could occur during the night time period due to “peak” or “maximum” noise level events e.g. metal on metal contact, or general clangs and bangs.
- Works associated with transmission line and access road construction often require activities in closer proximity to receptors that are not affected by construction works at wind turbines, or permanent facilities. In these circumstances task-specific noise mitigation and management measures should be implemented (when works are close to receptors) to reduce noise impacts to acceptable levels.

- Construction road traffic and heavy vehicle movements have the potential to generate "peak" or "maximum" noise level events and these should be limited during the night time period, and avoided if possible. Where possible, significant noise generating vehicle movements should be limited to the daytime period if possible. Where it is not possible for this to occur drivers should be instructed to arrive and depart as quietly as possible. Whilst on-site and in close proximity to receptors the drivers should be instructed to implement good-practice noise management measures to reduce peak noise levels and minimise any impacts as far as practicable. During the works, instruct drivers to travel directly to site and avoid any extended periods of engine idling at or near residential areas, especially at night.

- If any validated noise complaints are received, the problem source and any potential noise reducing measures should be identified and evaluated for implementation during the works. If the noise complaint cannot be validated, no further mitigation or management measures are required.

No further recommendations for construction noise mitigation and management measures to those established by the findings of this assessment, and documented in this report, are provided or warranted. Tan Hoang Cau Join Stock Company should however remain aware of the potential for nuisance, or an unacceptable level of amenity, to occur due to construction noise, continue to plan for and then manage construction works accordingly.

7.2 *OPERATIONAL NOISE*

As summarised in *Section 5.1* of this report the predicted noise levels for HL1 and HL2 projects would (under normal circumstances) be expected to generate moderate to high impacts. However, due to the economic (e.g. employment) opportunities provided by the HL1 and HL2 projects and the assumed local community acceptance of noise emissions associated with the wind farms, noise reducing mitigation, management measures and/or monitoring options have not been provided as recommendations in this report. It is beyond the scope of this assessment to comment any further, or to provide recommendations associated with, the community and stakeholder consultation for the project.

Should an agreement or documented acceptance of the projects noise emission not be reached it is recommended that a baseline noise monitoring campaign be considered and designed to address the existing HL2 project noise emissions. Following this baseline noise monitoring campaign, and where levels are still predicted to exceed criteria, noise reducing mitigation measures should be considered to minimise impacts and reduce emissions to compliant levels.

7.2.1 *IFC: Wind Energy Guideline, 2015*

Section 1.2.2-21 of the IFC: Wind Energy Guideline, 2015 states that "*Measures to prevent and control noise are mainly related to engineering design standards and turbine siting. With modern turbines, mechanical noise is usually significantly lower than aerodynamic noise, and continuous improvement in airfoil design is reducing the latter*".

Section 1.2.2-22 of the IFC: Wind Energy Guideline, 2015 states that "*Additional recommended noise management measures might include:*

- *Operating turbines in reduced noise mode.*
- *Building walls/appropriate noise barriers around potentially affected buildings (only an option in hilly terrain, due to the height of turbines).*
- *Curtailing turbine operations above the wind speed at which turbine noise becomes unacceptable in the project-specific circumstances*".

Section 1.2.2-23 of the IFC: Wind Energy Guideline, 2015 provides noise-related mitigation options with respect to offshore ecological receptors and does not apply to this assessment.

These features as presented in **Section 1.2.2-21** to **Section 1.2.2-23** of the IFC: Wind Energy Guideline, 2015 should be considered and implemented as part of the wind farms design where considered feasible, reasonable and practical to do so.

No further recommendations for additional operational assessment and/or operational noise mitigation and management measures to those established by the findings of this assessment, and documented in this report, are provided or warranted. Tan Hoang Cau Join Stock Company should however remain aware of the potential for nuisance, or an unacceptable level of amenity, to occur due to operational noise, continue to plan for and then adapt the wind farm design accordingly.

8 CONCLUSION

This report has been prepared by ERM on behalf of Tan Hoang Cau Join Stock Company. It presents the methodology, results and findings of the preliminary noise screening assessment (the assessment) conducted for the Huong Linh 1 wind farm project (the HL1 project).

The purpose of this assessment, to predict and assess operational noise levels (with regard to applicable screening thresholds) from the wind farm at nearby noise sensitive receptors has been completed. A qualitative construction noise assessment has also been provided.

The assessment was completed to identify potential receptors situated in the vicinity of site emission sources and identify significant noise equipment, the focus of which was emissions associated with wind turbine generators. The scope of this assessment is limited to the preferred project design, preliminary noise modelling, assessment and associated reporting to document the methodology, findings and any agreed recommendations for the wind farm site/design.

Screening noise criteria were established and are in accordance with recognised International Finance Corporation (IFC) guidelines. The key document adopted for the terms of reference from which noise screening criteria were established is the *World Bank Group: International Finance Corporation (IFC) - Environmental, Health and Safety Guidelines for Wind Energy*, dated August 2015 (IFC: Wind Energy Guideline, 2015). In particular the requirements of Section 1.1.2 of the IFC: Wind Energy Guideline, 2015 were referenced for the purpose of this assessment. Other international noise guidelines and standards were applied where relevant to the assessment and potential impacts. Noise levels were predicted, compared to criteria and discussion provided regarding the wind farm's compliance with the IFC: Wind Energy Guideline, 2015 as relevant to noise.

8.1.1 Construction Findings

The construction noise assessment concluded that some noise from construction sites is inevitable, such that good construction management practices focus on minimising noise impacts, rather than only on achieving numeric noise levels. Good-practice construction noise management and noise mitigation techniques may be required during the HL1 project to reduce noise levels as far as practicable. These will need to be considered and then implemented, where necessary.

Based on these findings suitable recommendations which can be considered and potentially implemented on site are provided in Chapter 7 of this report.

No further recommendations for construction noise mitigation and management measures to those established by the findings of this assessment, and documented in this report, are provided or warranted. Tan Hoang Cau

Join Stock Company should however remain aware of the potential for nuisance, or an unacceptable level of amenity, to occur due to construction noise, continue to plan for and then manage construction works accordingly.

8.1.2 Operational Findings

As summarised in Section 5.1 of this report the predicted noise levels for HL1 and HL2 projects would (under normal circumstances) be expected to generate moderate to high impacts. However, due to the economic (e.g. employment) opportunities provided by the HL1 and HL2 projects and the assumed local community acceptance of noise emissions associated with the wind farms, noise reducing mitigation, management measures and/or monitoring options have not been provided as recommendations in this report. It is beyond the scope of this assessment to comment any further, or to provide recommendations associated with, the community and stakeholder consultation for the project.

Should an agreement or documented acceptance of the projects noise emission not be reached it is recommended that a baseline noise monitoring campaign be considered and designed to address the existing HL2 project noise emissions. Following this baseline noise monitoring campaign, and where levels are still predicted to exceed criteria, noise reducing mitigation measures should be considered to minimise impacts and reduce emissions to compliant levels.

Based on these findings suitable recommendations which can be considered and potentially implemented on site are provided in *Chapter 7* of this report.

No further recommendations for additional operational assessment and/or operational noise mitigation and management measures to those established by the findings of this assessment, and documented in this report, are provided or warranted. Tan Hoang Cau Join Stock Company should however remain aware of the potential for nuisance, or an unacceptable level of amenity, to occur due to operational noise, continue to plan for and then adapt the wind farm design accordingly.

8.1.3 Residual Impacts and Closing

Construction and operational noise levels will be reduced and impacts minimised with the successful implementation of the recommendations presented in *Chapter 7* of this report. Impacts may not be reduced to negligible or fully compliant levels for all receptors during all construction and operational activities, however the recommendations are designed to ensure that any residual impacts are minimised as far as is practically achievable.

REFERENCES

International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) - **Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation**

World Bank Group: International Finance Corporation (IFC) - **Environmental, Health and Safety Guidelines for Wind Energy**, dated August 2015 (IFC: Wind Energy Guideline, 2015) – noise only

World Bank Group: International Finance Corporation (IFC) - **Environmental, Health and Safety (EHS) Guidelines - General EHS Guidelines: Environmental Noise Management**, Section 1.7 Noise (IFC 1.7 Noise), dated 30 April 2007

Relevant project data and information provided to ERM by TransGrid at the time of this assessment

Annex A

Acoustics Glossary

A.1 ACOUSTICS - GLOSSARY OF TERMS, DEFINITIONS AND METHODOLOGY

A.1.1 *What Is Noise And Vibration?*

Noise

Noise is often defined as a sound, especially one that is loud or unpleasant or that causes disturbance[1] or simply as unwanted sound, but technically, noise is the perception of a series of compressions and rarefactions above and below normal atmospheric pressure.

Vibration

Vibration refers to the oscillating movement of any object. In a sense noise is the movement of air particles and is essentially vibration, though in regards to an environmental assessment vibration is typically taken to refer to the oscillation of a solid object(s). The impact of noise on objects can lead to vibration of the object, or vibration can be experienced by direct transmission through the ground, this is known as ground-borne vibration.

Essentially, noise can be described as what a person hears, and vibration as what they feel.

A.1.2 *What Factors Contribute To Environmental Noise?*

The noise from an activity, like construction works, at any location can be affected by a number of factors, the most significant being:

- how loud the activity is;
- how far away the activity is from the receiver;
- what type of ground is between the activity and the receiver location eg concrete, grass, water or sand;
- how the ground topography varies between the activity and the receiver (is it flat, hilly, mountainous) as blocking the line of sight to a noise source will generally reduce the level of noise; and
- any other obstacles that block the line of sight between the sources to receiver eg buildings or purpose built noise walls.

[1] Copyright © 2011 Oxford University Press

A.1.3 *How To Measure And Describe Noise?*

Noise is measured using a specially designed 'sound level' meter which must meet internationally recognised performance standards. Audible sound pressure levels vary across a range of 10^7 Pascals (Pa), from the threshold of hearing at 20µPa to the threshold of pain at 200Pa. Scientists have defined a statistically described logarithmic scale called Decibels (dB) to more manageably describe noise.

To demonstrate how this scale works, the following points give an indication of how the noise levels and differences are perceived by an average person:

- 0 dB - represents the threshold of human hearing (for a young person with ears in good condition);
- 50 dB – represents average conversation;
- 70 dB – represents average street noise, local traffic etc;
- 90 dB – represents the noise inside an industrial premises or factory; and
- 140 dB - represents the threshold of pain – the point at which permanent hearing damage may occur.

A.1.4 *Human Response to Changes in Noise Levels*

The following concepts offer qualitative guidance in respect of the average response to changes in noise levels:

- differences in noise levels of less than approximately 2 dBA are generally imperceptible in practice, an increase of 2 dB is hardly perceivable;
- differences in noise levels of around 5 dBA are considered to be significant;
- differences in noise levels of around 10 dBA are generally perceived to be a doubling (or halving) of the perceived loudness of the noise. An increase of 10 dB is perceived as twice as loud. Therefore an increase of 20 dB is four times as loud and an increase of 30 dB is eight times as loud etc;
- the addition of two identical noise levels will increase the dB level by about 3 dB. For example, if one car is idling at 40 dB and then another identical car starts idling next to it, the total dB level will be about 43 dB;
- the addition of a second noise level of similar character which is at least 8 dB lower than the existing noise level will not add significantly to the overall dB level; and

- a doubling of the distance between a noise source and a receiver results approximately in a 3 dB decrease for a line source (for example, vehicles travelling on a road); and a 6 dB decrease for a point source (for example, the idling car discussed above). A doubling of traffic volume for a line source results approximately in a 3 dB increase in noise, halving the traffic volume for a line source results approximately in a 3 dB decrease in noise.

A.1.5 Terms to Describe the Perception of Noise

The following terms offer quantitative and qualitative guidance in respect of the audibility of a noise source:

- **Inaudible / Not Audible** - the noise source and/or event could not be heard by the operator, masked by extraneous noise sources not associated with the source. If a noise source is 'inaudible' its noise level may be quantified as being less than the measured L90 background noise level, potentially by 10 dB or greater;

- **Barely Audible** – the noise source and/or event are difficult to define by the operator, typically masked by extraneous noise sources not associated with the source. If a source is 'barely audible' its noise level may be quantified as being 5 - 7 dB below the measured L90 or Leq noise level, depending on the nature of the source eg constant or intermittent;

- **Just Audible** – the noise source and/or event may be defined by the operator. However there are a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator;

- **Audible** - the noise source and/or event may be easily defined by the operator. There may be a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator; and

- **Dominant** – the noise source and/or event are noted by the operator to be significantly 'louder' than all other noise sources. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator.

The following terms offer qualitative guidance in respect of acoustic terms used to describe the frequency of occurrence of a noise source during an operator attended environmental noise measurements:

- **Constant** – this indicates that the operator has noted the noise source(s) and/or event to be constantly audible for the duration of the noise measurement eg an air-conditioner that runs constantly during the measurement;

- **Intermittent** – this indicates that the operator has noted the noise source(s) and/or event to be audible, stopping and starting intervals for the duration of the noise measurement eg car pass-bys; and

- **Infrequent** – this indicates that the operator has noted the noise source(s) and/or event to be constantly audible, however; not occurring regularly or at intervals for the duration of the noise measurement eg a small number of aircraft are noted during the measurement.

A.1.6 How to Calculate or Model Noise Levels?

There are two recognised methods which are commonly adopted to determine the noise at particular location from a proposed activity. The first is to undertake noise measurements whilst the activity is in progress and measure the noise, the second is to calculate the noise based on known noise emission data for the activity in question.

The second option is preferred as the first option is largely impractical in terms of cost and time constraints, notwithstanding the meteorological factors that may also influence its quantification. Furthermore, it is also generally considered unacceptable to create an environmental impact simply to measure it. In addition, the most effective mitigation measures are determined and implemented during the design phase and often cannot be readily applied during or after the implementation phase of a project.

Because a number of factors can affect how 'loud' a noise is at a certain location, the calculations can be very complex. The influence of other ambient sources and the contribution from a particular source in question can be difficult to ascertain. To avoid these issues, and to quantify the direct noise contribution from a source/site in question, the noise level is often calculated using noise modelling software packages. The noise emission data used in each noise model of this assessment has been obtained from ERM's database of measured noise emissions.

A.1.7 Acoustic Terminology & Statistical Noise Descriptors

Environmental noise levels such as noise generated by industry, construction and road traffic are commonly expressed in dBA. The A-weighting scale follows the average human hearing response and enables comparison of the intensity of noise with different frequency characteristics. Time varying noise sources are often described in terms of statistical noise descriptors. The following descriptors are commonly used when assessing noise and are referred to throughout this acoustic assessment:

- **Decibel (dB is the adopted abbreviation for the decibel)** – The unit used to describe sound levels and noise exposure. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure;

- **dBA** - unit used to measure ‘A-weighted’ sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear;

- **dBC** – unit used to measure ‘A-weighted’ sound pressure levels. C-weighting is an adjustment made to sound-level measurements which takes account of low-frequency components of noise within the audibility range of humans;

- **dBZ or dBL** – unit used to measure ‘Z-weighted’ sound pressure levels with no weighting applied, linear;

- **Hertz (Hz)** - the measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz;

- **Octave –** a division of the frequency range into bands, the upper frequency limit;

- **1/3 Octave** – single octave bands divided into three parts;

- **L_{eq}** - this level represents the equivalent or average noise energy during a measurement period. The $L_{eq, 15min}$ noise descriptor simply refers to the L_{eq} noise level calculated over a 15 minute period. Indeed, any of the below noise descriptors may be defined in this way, with an accompanying time period (eg L_{10}) as required;

- **L_{max}** - the absolute maximum noise level in a noise sample;

- **L_N -** the percentile sound pressure level exceeded for N% of the measurement period calculated by statistical analysis;

- **L_{10} -** the noise level exceeded for 10 per cent of the time and is approximately the average of the maximum noise levels;

- **L_{90}** - the noise level exceeded for 90 per cent of the time and is approximately the average of the minimum noise levels. The L_{90} level is often referred to as the “background” noise level and is commonly used as a basis for determining noise criteria for assessment purposes;

- **Sound Power Level (L_W)** - this is a measure of the total power radiated by a source. The Sound Power of a source is a fundamental property of the source and is independent of the surrounding environment;

- **Sound Pressure Level (L_P)** - the level of sound pressure; as measured at a distance by a standard sound level meter with a microphone. This differs from L_W in that this is the received sound as opposed to the sound ‘intensity’ at the source;

- **Background noise** – the underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L90 descriptor;

- **Ambient noise** – the all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far;

- **Cognitive noise** – noise in which the source is recognised as being annoying; and

- **Masking** – the phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.

Industrial Noise Policy Terminology

- **Assessment Background Level (ABL)** - is defined in the INP as a single figure background level representing each assessment period (day, evening and night). Its determination is by the tenth percentile method (of the measured L90 statistical noise levels) described in *Appendix B* on the INP;

- **Rating Background Level (RBL)** - is defined in the INP as the overall single figure background level representing each assessment period (day, evening and night) over the whole monitoring period (as opposed to over each 24hr period used for the ABL). This is the level used for assessment purposes. It is defined as the median value of:

  - all the day assessment background levels over the monitoring period for the day;

  - all the evening assessment background levels over the monitoring period for the evening; and

  - all the night assessment background levels over the monitoring period for the night;

- **Extraneous noise** – noise resulting from activities that are not typical of the area. Atypical INP activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous;

- **Most affected location(s)** – locations that experience (or will experience) the greatest noise impact from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source location(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver;

- **Noise criteria** – the general set of non-mandatory noise level targets for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (for example, noise levels for various land uses);

- **Noise limits** – enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action;

- **Project Specific Noise Levels** – target noise levels for a particular noise generating facility. They are based on the most stringent of the intrusive criteria or amenity criteria. Which of the two criteria is the most stringent is determined by measuring the level and nature of existing noise in the area surrounding the actual or propose noise generating facility;

- **Compliance** – the process of checking that source noise levels meet with the noise limits in a statutory context;

- **Non-compliance** – development is deemed to be in non-compliance with its noise consent/ licence conditions if the monitored noise levels exceed its statutory noise limit by more than 2 dB;

- **Feasible and Reasonable measures** – feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors:

  - noise mitigation benefits (amount of noise reduction provided, number of people protected);

  - cost of mitigation (cost of mitigation versus benefit provided);

  - community views (aesthetic impacts and community wishes); and

  - noise levels for affected land uses (existing and future levels, and changes in noise levels);

- **Meteorological Conditions** – wind and temperature inversion conditions;

- **Temperature Inversion** – an atmospheric condition in which temperature increases with height above the ground; and

- **Adverse Weather** – weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time.

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Annex C

Invasive Species and Summary of Bird and Volant Mammal (Bat) Screening Assessment

Annex X Invasive Species identified within Vietnam

S/N	Species	Kingdom	Family	System
1.	*Abrus precatorius*	Plantae	Fabaceae	Terrestrial
2.	*Acacia farnesiana*	Plantae	Fabaceae	Terrestrial
3.	*Acacia mangium*	Plantae	Fabaceae	Terrestrial
4.	*Acanthogobius flavimanus*	Animalia	Gobiidae	Freshwater
5.	*Achatina fulica*	Animalia	Achatinidae	Terrestrial
6.	*Acridotheres tristis*	Animalia	Sturnidae	Terrestrial
7.	*Adenanthera pavonina*	Plantae	Fabaceae	Terrestrial
8.	*Aedes aegypti*	Animalia	Culicidae	Terrestrial
9.	*Ageratum conyzoides*	Plantae	Asteraceae	Terrestrial
10.	*Alpinia zerumbet*	Plantae	Zingiberaceae	Terrestrial
11.	*Alternanthera sessilis*	Plantae	Amaranthaceae	Terrestrial
12.	*Anas platyrhynchos*	Animalia	Anatidae	Freshwater terrestrial
13.	*Annona glabra*	Plantae	Annonaceae	Terrestrial
14.	*Anoplolepis gracilipes*	Animalia	Formicidae	Terrestrial
15.	*Anoplophora chinensis*	Animalia	Cerambycidae	Terrestrial
16.	*Anser anser*	Animalia	Anatidae	Freshwater terrestrial
17.	*Ardisia crenata*	Plantae	Myrsinaceae	Terrestrial
18.	*Azolla pinnata*	Plantae	Azollaceae	Terrestrial
19.	*Bacopa monnieri*	Plantae	Scrophulariaceae	Terrestrial
20.	*Bidens pilosa*	Plantae	Asteraceae	Terrestrial
21.	*Bothriochloa pertusa*	Plantae	Poaceae	Terrestrial
22.	*Brontispa longissima*	Animalia	Chrysomelidae	Terrestrial
23.	*Caesalpinia decapetala*	Plantae	Fabaceae	Terrestrial
24.	*Carassius auratus*	Animalia	Cyprinidae	Freshwater
25.	*Cardamine flexuosa*	Plantae	Brassicaceae	Terrestrial
26.	*Casuarina equisetifolia*	Plantae	Casuarinaceae	Terrestrial
27.	*Cenchrus echinatus*	Plantae	Poaceae	Terrestrial
28.	*Ceratophyllum demersum*	Plantae	Ceratophyllaceae	Terrestrial
29.	*Cervus nippon*	Animalia	Cervidae	Terrestrial
30.	*Channa argus*	Animalia	Channidae	Freshwater
31.	*Channa marulius*	Animalia	Channidae	Freshwater
32.	*Chromolaena odorata*	Plantae	Asteraceae	Terrestrial
33.	*Cinnamomum camphora*	Plantae	Lauraceae	Terrestrial
34.	*Cipangopaludina chinensis*	Animalia	Viviparidae	Freshwater
35.	*Clarias batrachus*	Animalia	Clariidae	Freshwater
36.	*Coccinia grandis*	Plantae	Cucurbitaceae	Terrestrial
37.	*Colubrina asiatica*	Plantae	Rhamnaceae	Terrestrial
38.	*Columba livia*	Animalia	Columbidae	Terrestrial
39.	*Commelina benghalensis*	Plantae	Commelinaceae	Terrestrial
40.	*Ctenopharyngodon idella*	Animalia	Cyprinidae	Freshwater
41.	*Cynodon dactylon*	Plantae	Poaceae	Terrestrial
42.	*Cyperus rotundus*	Plantae	Cyperaceae	Terrestrial
43.	*Cyprinus carpio*	Animalia	Cyprinidae	Freshwater
44.	*Diaphorina citri*	Animalia	Psyllidae	Terrestrial
45.	*Dioscorea bulbifera*	Plantae	Dioscoreaceae	Terrestrial
46.	*Eichhornia crassipes*	Plantae	Pontederiaceae	Terrestrial
47.	*Epipremnum pinnatum*	Plantae	Araceae	Terrestrial
48.	*Ficus microcarpus*	Plantae	Moraceae	Terrestrial
49.	*Gallus gallus*	Animalia	Phasianidae	Terrestrial

S/N	Species	Kingdom	Family	System
50.	*Gambusia affinis*	Animalia	Poeciliidae	Freshwater
51.	*Hemidactylus frenatus*	Animalia	Gekkonidae	Terrestrial
52.	*Herpestes javanicus*	Animalia	Herpestidae	Terrestrial
53.	*Hygrophila polysperma*	Plantae	Acanthaceae	Terrestrial
54.	*Hypophthalmichthys molitrix*	Animalia	Cyprinidae	Freshwater
55.	*Hypophthalmichthys nobilis*	Animalia	Cyprinidae	Freshwater
56.	*Leucaena leucocephala*	Plantae	Fabaceae	Terrestrial
57.	*Ligustrum sinense*	Plantae	Oleaceae	Terrestrial
58.	*Limnophila sessiliflora*	Plantae	Scrophulariaceae	Terrestrial
59.	*Lygodium japonicum*	Plantae	Lygodiaceae	Terrestrial
60.	*Lygodium microphyllum*	Plantae	Lygodiaceae	Terrestrial
61.	*Macaca mulatta*	Animalia	Cercopithecidae	Terrestrial
62.	*Maconellicoccus hirsutus*	Animalia	Pseudococcidae	Terrestrial
63.	*Melastoma candidum*	Plantae	Melastomataceae	Terrestrial
64.	*Mimosa diplotricha*	Plantae	Fabaceae	Terrestrial
65.	*Mimosa pigra*	Plantae	Fabaceae	Terrestrial
66.	*Mimosa pudica*	Plantae	Fabaceae	Terrestrial
67.	*Misgurnus anguillicaudatus*	Animalia	Cobitidae	Freshwater
68.	*Monomorium floricola*	Animalia	Formicidae	Terrestrial
69.	*Monopterus albus*	Animalia	Synbranchidae	Freshwater
70.	*Neyraudia reynaudiana*	Plantae	Poaceae	Terrestrial
71.	*Nypa fruticans*	Plantae	Asteraceae	Terrestrial
72.	*Oreochromis*	Animalia	Cichlidae	Freshwater
73.	*Oreochromis mossambicus*	Animalia	Cichlidae	Freshwater
74.	*Oryctes rhinoceros*	Animalia	Scarabaeidae	Terrestrial
75.	*Oxalis corniculata*	Plantae	Oxalidaceae	Terrestrial
76.	*Paederia foetida*	Plantae	Rubiaceae	Terrestrial
77.	*Panicum repens*	Plantae	Poaceae	Terrestrial
78.	*Paratrechina longicornis*	Animalia	Formicidae	Terrestrial
79.	*Paspalum vaginatum*	Plantae	Poaceae	Terrestrial
80.	*Passiflora foetida*	Plantae	Passifloraceae	Terrestrial
81.	*Pheidole megacephala*	Animalia	Formicidae	Terrestrial
82.	*Pistia stratiotes*	Plantae	Araceae	Terrestrial
83.	*Poecilia reticulata*	Animalia	Poeciliidae	Freshwater
84.	*Pomacea canaliculata*	Animalia	Ampullariidae	Freshwater
85.	*Pomacea insularum*	Animalia	Ampullariidae	Freshwater
86.	*Porphyrio porphyrio*	Animalia	Rallidae	Freshwater terrestrial
87.	*Prosopis*	Plantae	Fabaceae	Terrestrial
88.	*Prunus campanulata*	Plantae	Rosaceae	Terrestrial
89.	*Psidium guajava*	Plantae	Myrtaceae	Terrestrial
90.	*Psittacula krameri*	Animalia	Psittacidae	Terrestrial
91.	*Pterygoplichthys multiradiatus*	Animalia	Loricariidae	Freshwater
92.	*Pterygoplichthys pardalis*	Animalia	Loricariidae	Freshwater
93.	*Pterygoplichthys spp.*	Animalia	Loricariidae	Freshwater
94.	*Pueraria montana var. lobata*	Plantae	Fabaceae	Terrestrial
95.	*Pycnonotus cafer*	Animalia	Pycnonotidae	Terrestrial
96.	*Pycnonotus jocosus*	Animalia	Pycnonotidae	Terrestrial
97.	*Pyrus calleryana*	Plantae	Rosaceae	Terrestrial
98.	*Python bivittatus*	Animalia	Pythonidae	Terrestrial
99.	*Quadrastichus erythrinae*	Animalia	Eulophidae	Terrestrial
100.	*Rhodomyrtus tomentosa*	Plantae	Myrtaceae	Terrestrial

S/N	Species	Kingdom	Family	System
101.	*Rottboellia cochinchinensis*	Plantae	Poaceae	Terrestrial
102.	*Rubus moluccanus*	Plantae	Rosaceae	Terrestrial
103.	*Rubus niveus*	Plantae	Rosaceae	Terrestrial
104.	*Rusa unicolor*	Animalia	Cervidae	Terrestrial
105.	*Sagittaria sagittifolia*	Plantae	Alismataceae	Terrestrial
106.	*Solenopsis geminata*	Animalia	Formicidae	Terrestrial
107.	*Striga asiatica*	Plantae	Scrophulariaceae	Terrestrial
108.	*Syzygium cumini*	Plantae	Myrtaceae	Terrestrial
109.	*Tapinoma melanocephalum*	Animalia	Formicidae	Terrestrial
110.	*Terminalia catappa*	Plantae	Combretaceae	Terrestrial
111.	*Trachemys scripta elegans*	Animalia	Emydidae	Freshwater terrestrial
112.	*Trapa natans*	Plantae	Trapaceae	Terrestrial
113.	*Urochloa maxima*	Plantae	Poaceae	Terrestrial
114.	*Urochloa mutica*	Plantae	Poaceae	Terrestrial
115.	*Viverricula indica*	Animalia	Viverridae	Terrestrial
116.	*Xylosandrus compactus*	Animalia	Scolytidae	Terrestrial
117.	*Zizania latifolia*	Plantae	Poaceae	Terrestrial
118.	*Zostera japonica*	Plantae	Zosteraceae	Terrestrial
119.	*Zosterops japonicus*	Animalia	Zosteropidae	Terrestrial

Annex X Results of the Bird and Volant Mammal (Bat) Screening Assessment

Birds

S/N	Scientific Name	Common Name	Potential Critical Habitat	Potential Collision Risk
1.	*Abroscopus albogularis*	Rufous-faced Warbler		Yes
2.	*Abroscopus superciliaris*	Yellow-bellied Warbler		Yes
3.	*Accipiter badius*	Shikra		Yes
4.	*Accipiter gularis*	Japanese Sparrowhawk	CH3	Yes
5.	*Acridotheres cristatellus*	Crested Myna		Yes
6.	*Acridotheres grandis*	Great Myna		Yes
7.	*Acridotheres leucocephalus*	Vinous-breasted Myna		Yes
8.	*Acridotheres tristis*	Common Myna		Yes
9.	*Acrocephalus arundinaceus*	Great Reed-warbler	CH3	Yes
10.	*Acrocephalus bistrigiceps*	Black-browed Reed-warbler	CH3	Yes
11.	*Aegithina tiphia*	Common Iora		Yes
12.	*Aerodramus fuciphagus*	Edible-nest Swiftlet		Yes
13.	*Agropsar sturninus*	Purple-backed Starling	CH3	Yes
14.	*Alauda gulgula*	Oriental Skylark	CH3	Yes
15.	*Alcedo hercules*	Blyth's Kingfisher		Yes
16.	*Alcedo meninting*	Blue-eared Kingfisher		Yes
17.	*Ampeliceps coronatus*	Golden-crested Myna		Yes
18.	*Anas acuta*	Northern Pintail	CH3	Yes
19.	*Anthracoceros albirostris*	Oriental Pied Hornbill		Yes
20.	*Anthreptes malacensis*	Brown-throated Sunbird		Yes
21.	*Anthus cervinus*	Red-throated Pipit	CH3	Yes
22.	*Anthus hodgsoni*	Olive-backed Pipit	CH3	Yes
23.	*Anthus richardi*	Richard's Pipit	CH3	Yes
24.	*Anthus rufulus*	Paddyfield Pipit		Yes
25.	*Apus pacificus*	Pacific Swift	CH3	Yes
26.	*Arachnothera hypogrammica*	Purple-naped Spiderhunter		Yes
27.	*Arachnothera longirostra*	Little Spiderhunter		Yes
28.	*Arachnothera magna*	Streaked Spiderhunter		Yes
29.	*Arborophila merlini*	Annam Hill-Patridge	CH3	
30.	*Artamus fuscus*	Ashy Woodswallow	CH3	Yes
31.	*Arundinax aedon*	Thick-billed Warbler	CH3	Yes
32.	*Asio flammeus*	Short-eared Owl	CH3	Yes
33.	*Brachypodius atriceps*	Black-headed Bulbul		Yes
34.	*Bubo nipalensis*	Spot-bellied Eagle-owl	CH3	Yes
35.	*Bubulcus ibis*	Cattle Egret	CH3	Yes
36.	*Buceros bicornis*	Great Hornbill		Yes
37.	*Burhinus indicus*	Indian Thick-knee	CH3	Yes
38.	*Butastur indicus*	Grey-faced Buzzard	CH3	Yes
39.	*Buteo japonicus*	Japanese Buzzard	CH3	Yes
40.	*Butorides striata*	Green-backed Heron	CH3	Yes
41.	*Cacomantis merulinus*	Plaintive Cuckoo	CH3	Yes
42.	*Calliope calliope*	Siberian Rubythroat	CH3	Yes
43.	*Caprimulgus jotaka*	Grey Nightjar	CH3	Yes
44.	*Centropus sinensis*	Greater Coucal		Yes
45.	*Ceryle rudis*	Pied Kingfisher		Yes
46.	*Chalcophaps indica*	Grey-capped Emerald Dove		Yes
47.	*Charadrius dealbatus*	White-faced Plover	CH3	Yes
48.	*Charadrius mongolus*	Lesser Sandplover	CH3	Yes

S/N	Scientific Name	Common Name	Potential Critical Habitat	Potential Collision Risk
49.	*Charadrius placidus*	Long-billed Plover	CH3	Yes
50.	*Chloropsis aurifrons*	Golden-fronted Leafbird		Yes
51.	*Chloropsis lazulina*	Greyish-crowned Leafbird		Yes
52.	*Chrysococcyx xanthorhynchus*	Violet Cuckoo	CH3	Yes
53.	*Chrysomma sinense*	Yellow-eyed Babbler		Yes
54.	*Cinnyris asiaticus*	Purple Sunbird		Yes
55.	*Cinnyris jugularis*	Olive-backed Sunbird		Yes
56.	*Circus melanoleucos*	Pied Harrier	CH3	Yes
57.	*Circus spilonotus*	Eastern Marsh-harrier	CH3	Yes
58.	*Cissa chinensis*	Common Green Magpie		Yes
59.	*Cisticola juncidis*	Zitting Cisticola		Yes
60.	*Clamator coromandus*	Chestnut-winged Cuckoo	CH3	Yes
61.	*Copsychus saularis*	Oriental Magpie-robin		Yes
62.	*Coracias affinis*	Indochinese Roller		Yes
63.	*Corvus macrorhynchos*	Large-billed Crow		Yes
64.	*Crypsirina temia*	Racquet-tailed Treepie		Yes
65.	*Cuculus canorus*	Common Cuckoo	CH3	Yes
66.	*Cuculus micropterus*	Indian Cuckoo	CH3	Yes
67.	*Culicicapa ceylonensis*	Grey-headed Canary-flycatcher		Yes
68.	*Cutia legalleni*	Vietnamese Cutia	CH2	
69.	*Cyanecula svecica*	Bluethroat	CH3	Yes
70.	*Cyanoptila cyanomelana*	Blue-and-white Flycatcher	CH3	Yes
71.	*Cyornis sumatrensis*	Indochinese Blue-flycatcher		Yes
72.	*Cypsiurus balasiensis*	Asian Palm-swift		Yes
73.	*Delichon dasypus*	Asian House Martin	CH3	Yes
74.	*Delichon lagopodum*	Eastern House Martin	CH3	Yes
75.	*Dendrocitta vagabunda*	Rufous Treepie		Yes
76.	*Dendrocopos analis*	Freckle-breasted Woodpecker		Yes
77.	*Dendronanthus indicus*	Forest Wagtail	CH3	Yes
78.	*Dicaeum agile*	Thick-billed Flowerpecker		Yes
79.	*Dicaeum chrysorrheum*	Yellow-vented Flowerpecker		Yes
80.	*Dicaeum cruentatum*	Scarlet-backed Flowerpecker		Yes
81.	*Dicaeum ignipectus*	Fire-breasted Flowerpecker		Yes
82.	*Dicaeum minullum*	Plain Flowerpecker		Yes
83.	*Dicrurus annectens*	Crow-billed Drongo	CH3	Yes
84.	*Dicrurus hottentottus*	Hair-crested Drongo	CH3	Yes
85.	*Dicrurus macrocercus*	Black Drongo	CH3	Yes
86.	*Dicrurus remifer*	Lesser Racquet-tailed Drongo		Yes
87.	*Dinopium javanense*	Common Flameback		Yes
88.	*Elanus caeruleus*	Black-winged Kite		Yes
89.	*Emberiza aureola*	Yellow-breasted Bunting	CH1	Yes
90.	*Emberiza rutila*	Chestnut Bunting	CH3	Yes
91.	*Eudynamys scolopaceus*	Western Koel	CH3	Yes
92.	*Eumyias thalassinus*	Verditer Flycatcher	CH3	Yes
93.	*Eurylaimus harterti*	Banded Broadbill		Yes
94.	*Eurystomus orientalis*	Oriental Dollarbird	CH3	Yes
95.	*Falco peregrinus*	Peregrine Falcon	CH3	Yes
96.	*Falco severus*	Oriental Hobby	CH3	Yes
97.	*Falco tinnunculus*	Common Kestrel	CH3	Yes
98.	*Ficedula albicilla*	Red-throated Flycatcher	CH3	Yes

S/N	Scientific Name	Common Name	Potential Critical Habitat	Potential Collision Risk
99.	*Ficedula hyperythra*	Snowy-browed Flycatcher		Yes
100.	*Ficedula tricolor*	Slaty-blue Flycatcher		Yes
101.	*Francolinus pintadeanus*	Chinese Francolin		Yes
102.	*Garrulax canorus*	Chinese Hwamei		Yes
103.	*Garrulax leucolophus*	White-crested Laughingthrush		Yes
104.	*Garrulax perspicillatus*	Masked Laughingthrush		Yes
105.	*Garrulax vassali*	White-cheeked Laughingthrush	CH2	
106.	*Geokichla citrina*	Orange-headed Thrush	CH3	Yes
107.	*Geokichla sibirica*	Siberian Thrush	CH3	Yes
108.	*Glareola maldivarum*	Oriental Pratincole		Yes
109.	*Glaucidium cuculoides*	Asian Barred Owlet		Yes
110.	*Gracula robusta*	Nias Hill Myna	CH1	
111.	*Gracupica nigricollis*	Black-collared Starling		Yes
112.	*Gyps tenuirostris*	Slender-billed Vulture	CH1	Yes
113.	*Halcyon coromanda*	Ruddy Kingfisher	CH3	Yes
114.	*Halcyon pileata*	Black-capped Kingfisher	CH3	Yes
115.	*Haliastur indus*	Brahminy Kite		Yes
116.	*Hemipus picatus*	Bar-winged Flycatcher-shrike		Yes
117.	*Hierococcyx hyperythrus*	Northern Hawk-cuckoo	CH3	
118.	*Hierococcyx nisicolor*	Whistling Hawk-cuckoo	CH3	Yes
119.	*Hierococcyx sparverioides*	Large Hawk-cuckoo	CH3	Yes
120.	*Hirundo rustica*	Barn Swallow	CH3	Yes
121.	*Horornis canturians*	Korean Bush-warbler	CH3	
122.	*Hypsipetes leucocephalus*	Black Bulbul	CH3	
123.	*Icthyophaga humilis*	Lesser Fish-eagle		Yes
124.	*Icthyophaga ichthyaetus*	Grey-headed Fish-eagle		Yes
125.	*Ictinaetus malaiensis*	Black Eagle		Yes
126.	*Irena puella*	Asian Fairy-bluebird		Yes
127.	*Ketupa flavipes*	Tawny Fish-owl		Yes
128.	*Ketupa ketupu*	Buffy Fish-owl		Yes
129.	*Lacedo pulchella*	Banded Kingfisher		Yes
130.	*Lanius collurioides*	Burmese Shrike	CH3	Yes
131.	*Lanius cristatus*	Brown Shrike	CH3	Yes
132.	*Lanius tephronotus*	Grey-backed Shrike	CH3	Yes
133.	*Locustella lanceolata*	Lanceolated Warbler	CH3	
134.	*Locustella tacsanowskia*	Chinese Grasshopper-warbler	CH3	Yes
135.	*Lonchura malacca*	Tricoloured Munia		Yes
136.	*Lonchura punctulata*	Scaly-breasted Munia		Yes
137.	*Lonchura striata*	White-rumped Munia		Yes
138.	*Lophotriorchis kienerii*	Rufous-bellied Eagle		Yes
139.	*Loriculus vernalis*	Vernal Hanging-parrot	CH3	Yes
140.	*Lyncornis macrotis*	Great Eared-nightjar		Yes
141.	*Macropygia unchall*	Barred Cuckoo-dove	CH3	Yes
142.	*Megalurus palustris*	Striated Grassbird		Yes
143.	*Merops leschenaulti*	Chestnut-headed Bee-eater	CH3	Yes
144.	*Merops philippinus*	Blue-tailed Bee-eater	CH3	Yes
145.	*Merops viridis*	Blue-throated Bee-eater	CH3	Yes
146.	*Microhierax melanoleucos*	Pied Falconet		Yes
147.	*Micropternus brachyurus*	Rufous Woodpecker		Yes
148.	*Milvus migrans*	Black Kite	CH3	Yes

S/N	Scientific Name	Common Name	Potential Critical Habitat	Potential Collision Risk
149.	*Mirafra erythrocephala*	Indochinese Bushlark		Yes
150.	*Motacilla alba*	White Wagtail	CH3	Yes
151.	*Motacilla cinerea*	Grey Wagtail	CH3	Yes
152.	*Motacilla tschutschensis*	Eastern Yellow Wagtail	CH3	Yes
153.	*Muscicapa sibirica*	Dark-sided Flycatcher	CH3	Yes
154.	*Niltava davidi*	Fujian Niltava		Yes
155.	*Ninox scutulata*	Brown Boobook		Yes
156.	*Nisaetus cirrhatus*	Changeable Hawk-eagle		Yes
157.	*Nycticorax nycticorax*	Black-Crowned Night Heron	CH3	Yes
158.	*Nyctyornis athertoni*	Blue-bearded Bee-eater		Yes
159.	*Oriolus chinensis*	Black-naped Oriole	CH3	Yes
160.	*Oriolus tenuirostris*	Slender-billed Oriole	CH3	Yes
161.	*Oriolus traillii*	Maroon Oriole	CH3	
162.	*Orthotomus sutorius*	Common Tailorbird		Yes
163.	*Otus sunia*	Oriental Scops-owl	CH3	Yes
164.	*Pandion haliaetus*	Osprey	CH3	Yes
165.	*Parus major*	Great Tit		Yes
166.	*Pericrocotus divaricatus*	Ashy Minivet	CH3	Yes
167.	*Pericrocotus roseus*	Rosy Minivet	CH3	Yes
168.	*Pericrocotus solaris*	Grey-chinned Minivet	CH3	
169.	*Pernis ptilorhynchus*	Oriental Honey-buzzard	CH3	Yes
170.	*Phaenicophaeus tristis*	Green-billed Malkoha		Yes
171.	*Phodilus badius*	Oriental Bay-owl		Yes
172.	*Phylloscopus armandii*	Yellow-streaked Warbler	CH3	
173.	*Phylloscopus coronatus*	Eastern Crowned Warbler	CH3	
174.	*Phylloscopus fuscatus*	Dusky Warbler	CH3	
175.	*Phylloscopus inornatus*	Yellow-browed Warbler	CH3	
176.	*Phylloscopus schwarzi*	Radde's Warbler	CH3	
177.	*Ploceus philippinus*	Baya Weaver		Yes
178.	*Prinia hodgsonii*	Grey-breasted Prinia		Yes
179.	*Prinia inornata*	Plain Prinia		Yes
180.	*Prinia polychroa*	Brown Prinia		Yes
181.	*Prinia rufescens*	Rufescent Prinia		Yes
182.	*Prinia superciliaris*	Hill Prinia		Yes
183.	*Psilopogon annamensis*	Annam Barbet		Yes
184.	*Psilopogon cyanotis*	Blue-eared Barbet		Yes
185.	*Psilopogon franklinii*	Golden-throated Barbet		Yes
186.	*Psilopogon lagrandieri*	Red-vented Barbet		Yes
187.	*Psilopogon lineatus*	Lineated Barbet		Yes
188.	*Psittacula alexandri*	Red-breasted Parakeet		Yes
189.	*Pycnonotus aurigaster*	Sooty-headed Bulbul		Yes
190.	*Pycnonotus finlaysoni*	Stripe-throated Bulbul		Yes
191.	*Pycnonotus flaviventris*	Black-crested Bulbul		Yes
192.	*Pycnonotus hualon*	Bare-faced Bulbul	CH2	
193.	*Rallina eurizonoides*	Slaty-legged Crake		Yes
194.	*Rhipidura albicollis*	White-throated Fantail		Yes
195.	*Rhipidura aureola*	White-browed Fantail		Yes
196.	*Sarcogyps calvus*	Red-headed Vulture	CH1	Yes
197.	*Spilornis cheela*	Crested Serpent-eagle		Yes
198.	*Stachyris herberti*	Sooty Babbler	CH2	Yes
199.	*Surniculus dicruroides*	Fork-tailed Drongo-cuckoo		Yes
200.	*Tephrodornis pondicerianus*	Common Wood-shrike		Yes
201.	*Terpsiphone incei*	Chinese Paradise-flycatcher		Yes
202.	*Timalia pileata*	Chestnut-capped Babbler		Yes

S/N	Scientific Name	Common Name	Potential Critical Habitat	Potential Collision Risk
203.	*Tringa erythropus*	Spotted Redshank	CH3	Yes
204.	*Tringa glareola*	Wood Sandpiper	CH3	Yes
205.	*Tringa nebularia*	Common Greenshank	CH3	Yes
206.	*Turdus obscurus*	Eyebrowed Thrush	CH3	Yes
207.	*Upupa epops*	Common Hoopoe	CH3	Yes
208.	*Urocissa erythroryncha*	Red-billed Blue Magpie		Yes
209.	*Vanellus duvaucelii*	River Lapwing	CH3	Yes
210.	*Vanellus indicus*	Red-wattled Lapwing	CH3	Yes
211.	*Yuhina torqueola*	Indochinese Yuhina	CH3	Yes
212.	*Zapornia fusca*	Ruddy-breasted Crake	CH3	Yes
213.	*Zapornia pusilla*	Baillon's Crake	CH3	Yes
214.	*Zosterops japonicus*	Japanese White-eye		Yes
215.	*Zosterops palpebrosus*	Oriental White-eye		Yes

Volant Mammals (Bats)

S/N	Species	Common name	Potential Critical Habitat	High Risk of Turbine Strike	Medium Risk of Turbine Strike
1.	*Taphozous melanopogon*	Blackbearded Tomb Bat	CH3	Yes	
2.	*Miniopterus magnater*	Large Bentwinged Bat	CH3	Yes	
3.	*Miniopterus pusillus*	Small Long-fingered Bat	CH3	Yes	
4.	*Eonycteris spelaea*	Dawn Bat	CH3	Yes	
5.	*Rousettus amplexicaudatus*	Geoffroy's Rousette	CH3	Yes	
6.	*Rousettus leschenaultii*	Leschenault's Rousette	CH3	Yes	
7.	*Glischropus bucephalus*	Common Thickthumbed Bat	CH3	Yes	
8.	*Ia io*	Great Evening Bat	CH3	Yes	
9.	*Pipistrellus abramus*	Japanese Pipistrelle	CH3	Yes	
10.	*Pipistrellus coromandra*	Coromandel Pipistrelle	CH3	Yes	
11.	*Pipistrellus javanicus*	Javan Pipistrelle	CH3	Yes	
12.	*Pipistrellus paterculus*	Mount Popa Pipistrelle	CH3	Yes	
13.	*Pipistrellus tenuis*	Least Pipistrelle	CH3	Yes	
14.	*Scotophilus heathii*	Greater Asiatic Yellow House Bat	CH3	Yes	
15.	*Scotophilus kuhlii*	Lesser Asiatic Yellow House Bat	CH3	Yes	
16.	*Hipposideros scutinares*	Shieldnosed Leafnosed Bat	CH2		
17.	*Murina beelzebub*	Beelzebub's Tubenosed Bat	CH2		
18.	*Myotis annamiticus*	Annamite Myotis	CH2		
19.	*Eonycteris spelaea*	Dawn Bat	CH3		
20.	*Rousettus amplexicaudatus*	Geoffroy's Rousette	CH3		
21.	*Rousettus leschenaultii*	Leschenault's Rousette	CH3		
22.	*Aselliscus stoliczkanus*	Stoliczka's Asian Trident Bat			Yes
23.	*Hipposideros armiger*	Great Himalayan Leaf-nosed Bat			Yes
24.	*Hipposideros diadema*	Diadem Leaf-nosed Bat			Yes
25.	*Hipposideros larvatus*	Horsfield's Leaf-nosed Bat			Yes
26.	*Hipposideros scutinares*	Shield-nosed Leaf-nosed Bat			Yes
27.	*Megaderma lyra*	Greater False Vampire Bat			Yes
28.	*Megaderma spasma*	Lesser False Vampire Bat			Yes
29.	*Cynopterus brachyotis*	Lesser Dog-faced Fruit Bat			Yes
30.	*Cynopterus sphinx*	Greater Shortnosed Fruit Bat			Yes
31.	*Macroglossus sobrinus*	Hill Long-tongued Fruit Bat			Yes
32.	*Megaerops niphanae*	Ratanaworabhan's Fruit Bat			Yes
33.	*Sphaerias blanfordi*	Blandford's Fruit Bat			Yes
34.	*Rhinolophus affinis*	Intermediate Horseshoe Bat			Yes
35.	*Rhinolophus luctus*	Great Woolly Horsehoe Bat			Yes
36.	*Rhinolophus pearsonii*	Pearson's Horseshoe Bat			Yes
37.	*Harpiocephalus harpia*	Lesser Hairy-winged Bat			Yes
38.	*Hesperoptenus tickelli*	Tickell's Bat			Yes
39.	*Kerivoula picta*	Painted Woolly Bat			Yes
40.	*Myotis annectans*	Hairy-faced Bat			Yes
41.	*Myotis horsfieldii*	Horsfield's Myotis			Yes
42.	*Myotis muricola*	Nepalese Whiskered Myotis			Yes

S/N	Species	Common name	Potential Critical Habitat	High Risk of Turbine Strike	Medium Risk of Turbine Strike
43.	*Myotis siligorensis*	Himalayan Whiskered Myotis			Yes
44.	*Phoniscus jagorii*	Peters's Trumpet-eared Bat			Yes
45.	*Pipistrellus cadornae*	Cadorna's Pipistrelle			Yes
46.	*Scotomanes ornatus*	Harlequin Bat			Yes
47.	*Tylonycteris fulvida*	Lesser Bamboo Bat			Yes
48.	*Tylonycteris malayana*	Greater Flat-headed Bat			Yes

Annex D

Key Information Questionnaire

Hướng dẫn phỏng vấn sâu

DỰ ÁN NHÀ MÁY ĐIỆN GIÓ HƯỚNG LINH 1

Tại thôn Hoong, thôn Coóc và thôn Miệt, xã Hướng Linh

Ngày giờ phỏng vấn:……………………………………………………………………………..

Người được phỏng vấn: …………………… Chức vụ/nơi công tác ……..……………………..

Địa chỉ:…..……………………………………………………...………………………………..

Cảm ơn người được phỏng vấn đã tham gia và giới thiệu về chương trình khảo sát

(**THÔNG TIN DỰ ÁN**)

I. Xin ông bà cho biết đôi điều về bản thân (warm-up)

Gợi ý nếu không đề cập:

- Nghề nghiệp, thời gian công tác? Tuổi tác? Gia đình? Thời gian sinh sống tại đây?...

II. Xin ông bà cho biết một số thông tin chung về thôn của mình?

- Tổng số dân trong thôn? Số hộ trong thôn? Trong đó bao nhiêu % các dân tộc? % tôn giáo?

III. Xin ông bà cho biết tình hình chung lao động việc làm của người dân trong khu vực?

<u>Gợi ý nếu không đề cập:</u>

- Các ngành nghề chủ yếu?
- Những ngành nghề truyền thống (chăn nuôi, trồng trọt…) vẫn còn duy trì và phát triển?

IV. Xin ông bà cho biết thực trạng cơ sở hạ tầng hiện nay của thôn mình?

<u>Gợi ý nếu không đề cập:</u>

- Hệ thống điện: Có phủ đủ mọi người? Bao nhiêu % không có điện? Không thì dùng bằng gì?
- Hệ thống cấp nước ở thôn: Nước từ nguồn nào? Có đủ nước sạch sinh hoạt? Có bao giờ thiếu nước? Khắc phục thế nào?
- Hệ thống thoát nước sinh hoạt và nước mưa trong khu vực: Thoát ra đâu? Có xử lý không? Có xây dựng/nâng cấp thường xuyên không? Có hiện trạng ngập lụt không?
- Có bao nhiêu trường học các cấp (mầm non mẫu giáo, tiểu học, trung học phổ thông, trung học cơ sở)? Đánh giá cơ sở vật chất trường học các cấp? Đánh giá trình độ giảng viên các cấp (được đào tạo thế nào, cập nhật kiến thức ra sao)? Số lượng trẻ trong khu vực tới trường (%)? Bỏ học (%)? Tại sao bỏ học? Đường xá cho trẻ em tới trường?
- Đường xá giao thông đi lại: Có thuận lợi không? Có đổ bê tông/trải nhựa không? Có nơi nào không có đường phải qua đò? Hệ thống cầu có đảm bảo an toàn? Có được duy tu, bảo trì bảo dưỡng thường xuyên?

- Hệ thống thu gom rác thải (chất thải rắn): Ai thu gom? Thu gom ở đâu? Đóng phí thế nào? Thu gom ra đâu? Có xử lý sau thu gom không? Nếu không có đơn vị thu gom thì người dân xử lý rác như thế nào?

VI. Xin ông bà cho biết về tình hình sức khỏe của người dân trong thôn trong năm qua (2016- 2017)

Gợi ý nếu không đề cập:

- Những bệnh phổ biến nhất gần đây trong khu vực? Tại sao?
- Những loại bệnh nào có nguyên nhân tử vong cao? Tại sao?
- Có bao nhiêu cơ sở y tế các cấp? Vị trí có thuận lợi cho người dân? Tình hình trang thiết bị các cơ sở thế nào? Trình độ y bác sĩ nhân viên các cơ sở y tế?
- Khi có bệnh người dân có thường tới các cơ sở y tế nào? Nếu có thì tới đâu? Tại sao?
- Người dân có thói quen đi khám chữa bệnh ở các cơ sở y tế không hoặc tự mua thuốc hoặc đến thầy lang?

VII. Xin ông bà cho biết đánh giá về các chương trình hỗ trợ cộng đồng

Gợi ý nếu không đề cập:

- Có chương trình gì cho trường học? Nội dung chính là gì? Có hiệu quả không?
- Có chương trình gì cho các cơ sở y tế? Nội dung chính là gì? Có hiệu quả không?
- Có chương trình gì về đào tạo lao động? Nội dung chính là gì? Có hiệu quả không?
- Có chương trình gì về phục hồi sinh kế sau dự án? Nội dung chính là gì? Có hiệu quả không?
- Còn chương trình gì khác hỗ trợ phát triển cộng đồng, thể hiện trách nhiệm với xã hội của Dự án không? Nội dung chính là gì? Có hiệu quả không?
- Theo ông bà thì cần thêm những chương trình gì sẽ thể hiện tốt hơn trách nhiệm xã hội của Dự án với khu vực bị ảnh hưởng.

Xin cảm ơn ông bà đã tham gia cuộc khảo sát!

Annex D(1)

Minutes of meeting

Huong Linh Commune People's Committee

MINUTE OF MEETING

Project	Huong Linh 1 Wind Power Project
Project number	Consultation meeting with Huong Linh Commune People's Committee
Date	15:00 -16:00 (Vietnam Time), 24 January, 2018
Location	The office of Huong Linh Commune People's Committee (CPC)
Attendees	Huong Linh 1 Wind Power Project (Mr. Liem Nguyen, Site Manager) Huong Linh CPC (Mr. Ho Van Giang – Committee Chairman) ERM (Mr. Phong Pham, Ms. Trinh Nguyen)

Discussion on the purpose of the consultation meeting and the Socio-economic baseline and Environmental and Social Impact Assessment (ESIA) in general

- ERM and Huong Linh 1 briefly introduce the objectives of the session and the background of socio-economic baseline and ESIA observing international standards.
- The Chairman of Huong Linh CPC provided the key socio-economic baseline information of the commune including:
    - Demography (including Ethnic minority);
    - Public Infrastructures and Conditions: electricity, water, waste and wastewater management, healthcare, education, etc.
    - General livelihoods of local people; and
    - Cultural heritage, etc.
- Huong Linh CPC understands the purpose of the meeting is just for collecting socio-economic baseline data and perceptions of the authority.
- It is agreed in the meeting that Huong Linh CPC will prepare the answers and information for the requested consultation questions and ERM will come back later to collect these answers and information. They have prepared and provided the basic socio-economic information as well as annual report of the commune in 2016 and 2017 on 25 January 2018.
- ERM also mentioned the household survey for obtaining socio-economic baseline data at household level will be conducted in Hoong village, Cooc village and Miet village of Huong Linh commune and Huong Linh CPC expressed their full support the survey team.
- Main opinion and perspectives of the Huong Linh CPC:
    - The Project would bring better infrastructure to the commune;
    - The Project would create job opportunities for local people (such as security);

    - However, there might be some negative impacts such as contamination of paddy rice due to soil erosion, unpleasant noise, particularly at night.
- Main suggestions of the Huong Linh CPC:
    - The Project should manage the construction well so that it would minimize the impact to local paddy field;
    - The Project might help to provide the clean water system; and
    - The Project might introduce husbandry technical guidance and provide breeds.

Annex E

Photo logs

Picture 1 – A household survey in Cooc Village on 24th Jan 2018.

Picture 2 – A household survey in Cooc Village on 24th Jan 2018.

Picture 3 – A household survey in Cooc Village on 24th Jan 2018.

Picture 4 – A household survey in Cooc Village on 24th Jan 2018.

Picture 5 – A household survey in Cooc Village on 24th Jan 2018.

Picture 6 - A household survey in Cooc Village on 24th Jan 2018.

Picture 7 – A household survey in Miet Village on 25th Jan 2018.	**Picture 8** – A household survey in Miet Village on 25th Jan 2018.
	
Picture 9 - A household survey in Miet Village on 25th Jan 2018.	**Picture 10** - A household survey in Miet Village on 25th Jan 2018.
	
Picture 11 - A household survey in Miet Village on 25th Jan 2018.	**Picture 12** - A household survey in Miet Village on 25th Jan 2018.
	
Picture 13 - A household survey in Miet Village on 25th Jan 2018.	**Picture 14** - A household survey in Miet Village on 25th Jan 2018.

	
Picture 15 A household survey in Hoong Village on 26th Jan 2018.	**Picture 16** A household survey in Hoong Village on 26th Jan 2018.
	
Picture 17 A household survey in Hoong Village on 26th Jan 2018.	**Picture 18** A household survey in Hoong Village on 26th Jan 2018.
	
Picture 19 A Key Information Interview with the Head of Cooc Village on 24th Jan 2018	**Picture 20** A Key Information Interview with the Head of Miet Village on 25th Jan 2018

Picture 21 A Key Information Interview with the Head of Hoong Village on 26th Jan 2018

Picture 22 Focus Group Discussion with indigenous people (Van Kieu) who are living at Hoong Village on 26th Jan 2018.

Picture 23 : Public House in Cooc Village

Picture 24 - Public House in Hoong Village

Picture 25 – Huong Linh Primary School

Picture 26 – A primary school in Hoong village

Picture 27 - Huong Linh High School

Picture 28 – A concrete road at the surveyed area

Picture 29 – A kindergarten at Miet Village

Picture 30 There is no market in the surveyed area. The local people usually purchase food through local shippers.

Picture 31 Grazing livestock on the village road.

Picture 32 The condition of village road at Miet Village

Picture 33 The health center of Huong Linh commune

Picture 34 Inside of the health center of Huong Linh commune

Picture 35 A digging well is used by local households.

Picture 36 A drilling well is used by local households.

Picture 37 – A affected household by Huong Linh 1 project

Picture 38 - A affected household by Huong Linh 1 project

Picture 39 - A affected household by Huong Linh 1 project

Picture 40 A affected household by Huong Linh 1 project

Picture 41 – A paddy rice field at the surveyed area.

Picture 42 "Boi loi tree" (Scientific name: *Tetranthera*) is planted widely at the surveyed areas

Picture 43

Picture 44

Picture 45 A visiting at the Van Kieu leader's house (Gia Lang's house) at Hoong Village.

Picture 46 Scared forest (Rừng Ma)

Picture 47 This is a livestock training program is run by World Vision Organization at Hoong Village.

Picture 48 – This is a diagram of ginger nutrition procedure which is developed by World Vision Organization at Hoong Village.

Picture 49 Administration Office in Huong Hoa District

Picture 50 Statistical Office in Huong Hoa District

	
Picture 51 Huong Linh 1&2 Operation House – Tan Hoan Cau Company	**Picture 52** Existing turbines in Huong Linh 2 project which is located nearby Huong Linh 1 Project.

Annex F

Focus Group Discussion Questionnaire

Câu hỏi nhóm người dân tộc Vân Kiều bị ảnh hưởng bởi Dự án Hướng Linh 1

Ngày phỏng vấn:
Địa điểm:
Tên người tham gia phỏng vấn:

Stt	Tên	Tuổi	Nghề nghiệp	Địa chỉ
1				
2				
3				
4				
5				
6				

Thực phẩm

1. Hằng ngày, gia đình anh chị thường dùng những loại thực phẩm nào? Và việc tiêu dùng các loại thực phẩm này có thay đổi theo mùa không? Nguồn gốc của các loại thực phẩm này là được mua từ chợ/ gia đình tự gieo trồng/ hay thu nhặt từ nơi khác (vd rừng)?

Hoạt động canh tác

2. Nguồn kiếm sống chính của gia đình Anh/Chị là gì? (Trồng trọt, chăn nuôi gia súc, gia cầm, săn bắt trong rừng, khai thác rừng,…) Anh chị có thường xuyên vào rừng để thu nhặt hái lượm các loại hoa quả, cây lá trong rừng không? Từ khi có dự án điện gió Hướng Linh 2, anh chị có gặp han chế nào trong việc đi vào rừng khai thác những loại thực phẩm này không?

Sức khỏe

3. Khi bệnh, Anh/chị sẽ đi đến trạm xá, bệnh viện để được chữa trị hay sẽ đến gặp thầy lang/ già làng trong khu vực để xin thuốc? Ở thôn có những phong tục chữa bệnh nào

đặc biệt cần phải sử dụng các loại cây thuốc trong rừng không? Nếu có, anh chị có bao giờ hái nhặt các loại cây thuốc nay không? Các loại thuốc này có được bán ra bên ngoài hay chỉ được lưu thông nội bộ cho nhóm người trong thôn mà thôi?

Xây dựng/ nhà cửa

Xin anh chị cho biết những vật liệu nào thường được dùng để xây nhà? Từ khi dự án điện gió Hướng Linh 2 phát triển, thì anh chị có gặp bất kỳ khó khăn gì trong việc tìm kiếm những loại vật liệu xây dựng này không? Những loại vật liệu này có thể tìm thấy được ở đâu?

Di sản/ tín ngưỡng tôn giáo

4. Có khu vực bảo tồn thiên nhiên, hay di sản văn hóa, đền thờ tôn giáo, tính ngưỡng, tâm linh của người dân tộc Vân Kiều nào nằm trong khu vực Dự án hoặc xung quanh đó không? Hiện nay, Anh/chị có gặp khó khăn, cản trở nào trong việc đi đến viếng thăm các khu vực này không?

Nhận thức về khó khăn hiện tại

5. Anh/ chị có thấy mình bị cô lập, hoặc tách biệt so với cộng đồng người Kinh cong dong nguoi Kinh hay không?

6. Anh/ chị có thấy hoàn cảnh gia đình mình có nhiều khó khăn và dễ bị tổn thương hơn so với những hộ gia đình khác không?

7. Những khó khăn lớn nhất mà Anh/ Chị đang gặp phải là gì? Anh/Chị có nhận được bất kỳ một sự hỗ trợ nào từ cơ quan chính quyền địa phương, hay từ các Tổ chức Phi Lợi Nhuận (NGO), Tổ chức Phi Chính Phủ nào không?

   Nếu có, thì anh chị có cảm thấy hoàn cảnh của mình đã vơi bớt phần nào khó khăn hơn kể từ khi nhận được sự hỗ trợ từ các chương trình này không? Xin hãy cho biết tên của các chương trình hỗ trợ này?

Hiểu biết về Dự án Hướng Linh 1 và Hướng Linh 2

8. Anh/Chị có biết đến Dự án điện gió Hướng Linh 1 không? Anh chị có những quan tâm gì từ Dự án này không?

9. Như được biết thì Nhà máy điện gió Hướng Linh 2 đã được đi vào hoạt động, xin được biết là từ khi Dự án này đi vào giai đoạn xây dựng và vận hành thì có gây bất kì cản trở hay khó khăn gì cho bà con địa phương không? (*ví dụ như việc di chuyển*

cánh quạt gió với kích thước lớn như vậy có làm cảnh trở việc giao thông đi lại, canh tác, chăn nuôi trong khu vực không?)

Cám ơn Anh/chị.

Annex G

List of Interviewers in the Social Baseline Survey

A. List of FGP Participants

Câu hỏi nhóm người dân tộc Vân Kiều bị ảnh hưởng bởi

Dự án Hướng Linh 1

Ngày phỏng vấn:

Địa điểm:

Tên người tham gia phỏng vấn:

Stt	Tên	Tuổi	Nghề nghiệp	Địa chỉ
1	Hồ Văn tường	32	Cán bộ NN xã HLinh	thôn Mới. HLinh
2	Hồ Văn Đường	41	nông dân	thôn Hoong HLinh
3	Hồ Văn Mười	23	nông dân	nt
4	Hồ Văn Vân	39	BT Chi bộ	nt
5	Hồ Pá thơn	70	nông dân	nt
6	Hồ xuân vạn	28	trưởng thôn	nt
7	Hồ thị An	41	Nông dân	nt

Thực phẩm

1. Hằng ngày, gia đình anh chị thường dùng những loại thực phẩm nào? Và việc tiêu dùng các loại thực phẩm này có thay đổi theo mùa không? Nguồn gốc của các loại thực phẩm này là được mua từ chợ/ gia đình tự gieo trồng/ hay thu nhặt từ nơi khác (vd rừng)?

Hoạt động canh tác

2. Nguồn kiếm sống chính của gia đình Anh/Chị là gì? (Trồng trọt, chăn nuôi gia súc, gia cầm, săn bắt trong rừng, khai thác rừng,…) Anh chị có thường xuyên vào rừng để thu nhặt hái lượm các loại hoa quả, cây lá trong rừng không? Từ khi có dự án điện gió Hướng Linh 2, anh chị có gặp han chế nào trong việc đi vào rừng khai thác những loại thực phẩm này không?

Sức khỏe

3. Khi bệnh, Anh/chị sẽ đi đến trạm xá, bệnh viện để được chữa trị hay sẽ đến gặp thầy lang/ già làng trong khu vực để xin thuốc? Ở thôn có những phong tục chữa bệnh nào đặc biệt cần phải sử dụng các loại cây thuốc trong rừng không? Nếu có, anh chị có bao giờ hái nhặt các loại cây thuốc nay không? Các loại thuốc này có được bán ra bên ngoài hay chỉ được lưu thông nội bộ cho nhóm người trong thôn mà thôi?

Xây dựng/ nhà cửa

Xin anh chị cho biết những vật liệu nào thường được dùng để xây nhà? Từ khi dự án điện gió Hướng Linh 2 phát triển, thì anh chị có gặp bất kỳ khó khăn gì trong việc tìm kiếm

B. List of Household Interview Participants

Họ tên	Thôn	Ký nhận
1. Hồ Văn Hoả (Hồ Văn Ngộ)	Cốc	[illegible]
2. Hồ Pôi	Cooc	[illegible]
3. Hồ Văn Bân	Cooc	[illegible]
4. Hồ Văn Hinh	Cooc	Hinh
(PVRQ) 5. Hồ Văn Chưởng (0969 192 549)	Tr.Thôn Cooc	[illegible]
(5) 6. Hồ Văn Du	Cooc	[illegible]
(06) 7. Hồ Chí Thanh	Cooc	[illegible]
8. Hồ Văn May	Cooc	[illegible]
9 Hồ Văn Long	Cooc	[illegible]
10. Hồ Văn Khâm	Cooc	[illegible]
11. Hồ Văn Oi	Cooc	[illegible]
12. Hồ Văn Việt	Miệt	[illegible]
13. Hồ Văn Quân	Miệt	[illegible]
14. Hồ Thị Bư	Miệt	[illegible]
15. Hồ pờ năng	Miệt	[illegible]
16. Hồ Văn Ben	Miệt	Ben
17. Trường Hoàn	Miệt	[illegible]
18. Hồ Văn Bôn	Miệt	[illegible]
19. Hồ Văn Khó	Miệt	[illegible]
20. Lê Thanh Sơn	Miệt	[illegible]
21. Hồ Ta On	Miệt	[illegible]

22. Hồ Nhân Miệt

Tòng

23. Hồ Văn Lừng	Hoong	Lung
24. Hồ Chí Trung	Hong	Trung
25. Hồ Pả Đang	Hoong	Đang
88.		
26. Hồ Văn Tường	Hoong	Thanh
27. Hồ Văn Đường	nt	Đường
28. Hồ Văn Mười	nt	
29. Hồ Văn Văn	nt	Văn
30. Hồ Pá Thòn	nt	
31. Hồ Xuân Van	nt	
32. Hồ Thi An	nt	An
33. Hồ Văn Yên	nt	Yê

Annex H

Household Questionnaire

Số phiếu: ………..

PHIẾU KHẢO SÁT NGHIÊN CỨU
DỰ ÁN NHÀ MÁY ĐIỆN GIÓ HƯỚNG LINH 1
Tại thôn Hoong, thôn Coóc và thôn Miệt, xã Hướng Linh

Các nội dung trong phiếu chỉ phục vụ mục đích nghiên cứu và hoàn toàn được giữ bí mật

Trước tiên, tất cả các thành viên trong hộ gia đình sẽ được hỏi về tuổi và ngày sinh nhật của họ. Chọn 01 người từ 18 tuổi trở lên là <u>chủ hộ</u> hoặc <u>có khả năng trả lời đầy đủ các thông tin</u> để phỏng vấn.

ĐỊA CHỈ

Thôn:	
Địa chỉ hiện tại:	
Số điện thoại (nếu có):	

THÔNG TIN TIẾP CẬN

Lần phỏng vấn	Thời gian	Tên người phỏng vấn
Lần thứ nhất:	…Giờ, …Phút, Ngày…..tháng…..../2018	
Thời gian bắt đầu:	… Giờ, … Phút, Ngày….. tháng…../2018	
Thời gian kết thúc:	… Giờ, … Phút, Ngày….. tháng…../2018	

PHẦN 1: THÔNG TIN CHUNG VỀ HỘ GIA ĐÌNH

Q1.01. Xin cho biết một số thông tin về các thành viên của hộ gia đình

	[Tất cả thành viên trong hộ] (đánh dấu * chủ hộ - khoanh tròn người được phỏng vấn)								
#	**Họ và tên thành viên trong hộ gia đình**	**Quan hệ với chủ hộ** *(Mã a)*	**Giới tính** (1. Nam 2. Nữ)	**Năm sinh**	**Hôn nhân** *(Mã b)*	**Học vấn** *(Mã c)*	**Dễ tổn thương** *(Mã d)*	**Sống cùng hộ?** *(1. Có 2. Không)*	**Nghề nghiệp chính** *(Mã e)*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

a. Quan hệ với chủ hộ
1- Là chủ hộ
2- Vợ/chồng
3- Con (Con trai/con gái, con nuôi hay con riêng)
4- Cháu
5- Ông/bà
6- Cha/mẹ
7- Thành viên khác trong gia đình
8- Khác (*Ghi cụ thể*)

b Hôn nhân
1- Đã kết hôn
2- Độc thân
3- Đã ly dị
4- Góa (vợ/chồng chết)
5- Khác (ghi rõ)………..

c Trình độ học vấn
1- Tiểu học
2- Trung học cơ sở (cấp 2)
3- Trung học phổ thông (cấp 3)
4- Cao đẳng, trung học chuyên nghiệp
5- Đại học
6- Sau đại học
7- Mù chữ (không biết đọc/ viết)
8. Khác (ghi rõ) (vd: chưa đi học)

d Dễ tổn thương
1- Tàn tật
2- Tâm thần
3- Người già (trên 65)
4- Góa (đơn thân)
5- Mồ côi
6- Ly dị (đơn thân)
7- Nghèo/cận nghèo

e Nghề nghiệp chính
1- Nông dân (trồng trọt)
2- Nông dân (chăn nuôi)
3- Trồng rừng
4- Săn bắt
5- Buôn bán/ dịch vụ
6- Thợ thủ công
7- Công/viên chức nhà nước
8- Công/nhân viên DN
9- Làm thuê (theo thời vụ)
10- Sinh viên
11- Nghỉ hưu
12- Khác (ghi rõ)

PHẦN 2: THÔNG TIN CHUNG KHÁC VỀ HỘ

Q2.01. Hộ gia đình ông/bà thuộc dân tộc nào?

1- Kinh
2- Vân Kiều
3 - Khác (ghi rõ)………………

Q2.02. Hộ gia đình ông/bà theo tôn giáo nào?

1- Phật giáo
2- Công giáo
3- Khác (ghi rõ)………………..
4- Không tôn giáo

PHẦN 3: THÔNG TIN CÁ NHÂN VỀ NHÀ ĐẤT

Q3.01. Hộ gia đình [ông/bà] có quyền sử dụng đất không? Diện tích đất sử dụng là bao nhiêu? (đánh dấu vào bảng sau tùy theo câu trả lời của người được phỏng vấn)

Loại đất / Loại hình sở hữu	Đất ở (thổ cư) Q8.01.A	Đất vườn Q8.01.B	Đất nông nghiệp Q8.01.C	Đất rừng Q8.01.D
1. Có giấy chứng nhận quyền sử dụng				
2. Không có giấy chứng nhận quyền sử dụng				
3. Đi thuê				
4. Đất dùng miễn phí				
5. Đất cộng đồng/xã				
6. Không có loại này				

Q3.03. Ông/bà dùng vật liệu gì để xây/dựng nhà của mình?

1- Gỗ
2- Tre nứa
3- Lá
4- Khác, nêu rõ

Q3.04 Những vật liệu này có dễ tìm kiếm không? Ông/bà thu gom/ mua các vật liệu đó từ đâu?

1- Khu rừng xung quanh
2- Trong vườn nhà
3- Nơi khác, nêu rõ
4-

Q3.05. Nhà đang ở có các loại tiện ích nào sau đây (có thể chọn nhiều phương án)

1- Điện lưới
2- Nhà vệ sinh riêng
3- Xe gắn máy
4- Xe ô tô
5- Tivi
7- Tủ lạnh
8- Máy vi tính
9- Điện thoại di động
10- Đồ nội thất (giường tủ)
11- Máy giặt

6- Radio

Q3.06. Các nguồn năng lượng đang sử dụng nấu ăn (có thể chọn nhiều phương án)

1- Khí ga sinh học (bio-gas)
2- Điện
3- Than
4- Rơm rạ
5- Bình Gas
6- Năng lượng mặt trời
7- Khác (nêu rõ)…………………………..

Q3.07. Nguồn nước uống được sử dụng từ đâu (có thể chọn nhiều phương án)

1- Sông/ suối (cách nhà bao xa)
2- Giếng khoan (nước ngầm, sử dụng chung nhiều nhà với nhau hay riêng)
3- Nước máy
4- Khác (nêu rõ)………………………….

Q3.08. Điều kiện nhà vệ sinh trong gia đình (có thể chọn nhiều phương án)

1- Hố xí hai ngăn
2- Hố xí tự hoại
3- Khác (nêu rõ)………………..

Q3.09. Hộ gia đình ông/bà có sổ hộ nghèo năm 2017 không?

1- Có
2- Không

PHẦN 4: CHI TIÊU HỘ GIA ĐÌNH

Q4.01. Xin ông/bà cho biết các khoản chi tiêu sau đây của hộ gia đình trong 12 tháng qua? (Điều tra viên hỏi và ghi lại các số liệu hoặc theo tháng hoặc cả năm, quan trọng nhất là các mục lớn)

#	Loại chi tiêu	**Hàng tháng** (nghìn đồng)	**Cả năm** (nghìn đồng)
I	***Chi tiêu sinh hoạt thường xuyên (thức ăn, điện nước sinh hoạt, chi phí đi lại, thông tin liên lạc…)***		
01	Mua thức ăn cho gia đình		
02	Chi điện, nước, năng lượng sinh hoạt		
03	Chi phí xăng xe/đi lại		
04	Thông tin liên lạc (điện thoại, thư tín, internet)		
05	Chi tiêu giáo dục (tiền học, sách vở, đồ dùng học tập)		
II	***Chi tiêu sinh hoạt không thường xuyên khác (đám cưới, đám ma, giày dép, quần áo, y tế…)***		
06	Chi phí y tế (khám chữa bệnh thông thường, thuốc men…)		
07	Quần áo, giày dép cho gia đình		
08	Các hoạt động xã hội/cộng đồng (đám cưới, đám ma, lễ kỷ niệm, dỗ tết, tiệc khác…)		
09	Trả lãi các khoản nợ, vay		
III	***Chi tiêu đột xuất khác (làm nhà, sửa chữa nhà cửa, trả lãi, mua đất…)***		
10	Chi tiêu nhà cửa (sửa chữa)		

#	Loại chi tiêu	Hàng tháng (nghìn đồng)	Cả năm (nghìn đồng)
11	Chi phí y tế chữa bệnh nặng/tai nạn		
IV	***Chi tiêu khác***		
11	Chi tiêu cho sản xuất (nếu có)		
12	Chi tiêu khác (ghi rõ):		
13	Chi tiêu khác (ghi rõ):		
14	Chi tiêu khác (ghi rõ):		

Q4.02. Trong 3 năm qua, thu nhập của hộ ông/bà có ổn định không? (Chỉ chọn 1 phương án)

1- Có

2- Không, có năm không đủ, cần phải tìm nguồn bổ sung (chuyển sang Q4.03.)

Q4.03. Nếu không, gia đình ông/bà có làm gì khác để tăng thu nhập và bù chi tiêu?

STT	Khoản tiền	Tổng số tiền đã dùng bù đắp (nghìn đồng)
1	Tiền dành dụm/tiết kiệm trước đây	
2	Bán tài sản	
3	Mượn tiền (không trả lãi) từ người thân, bạn bè...	
4	Vay/mượn/nợ (có trả lãi)	
5	Khác (ghi cụ thể)...	
	Tổng	

PHẦN 5: ĐIỀU KIỆN KINH TẾ

Q5.01. Xin ông/bà cho biết một số thông tin về các nguồn thu nhập của hộ gia đình mình.

A. Thu nhập từ nông và lâm nghiệp (gia đình tự trồng trọt):

#	Mùa vụ 1	Cây trồng 1	Cây trồng 2	Cây trồng 3
1	Tên loại cây trồng			
2	Diện tích gieo trồng (héc ta/sào)			
3	Thu hoạch cuối vụ (kg)			
4	Tính thành tiền (nghìn đồng/vụ)			
5	Lượng giữ để tiêu dùng và để giống (kg)			
6	Lượng còn lại để bán (kg)			
7	Tính thành tiền (nghìn đồng/vụ)			
8	Chi phí đầu vào (phân, giống,…) (nghìn đồng/vụ)			
9	**Thu nhập ròng mùa vụ**			

#	Mùa vụ 2	Cây trồng 1	Cây trồng 2	Cây trồng 3
1	Tên loại cây trồng			
2	Diện tích gieo trồng (héc ta/sào)			
3	Thu hoạch cuối vụ (kg)			
4	Tính thành tiền (nghìn đồng/vụ)			
5	Lượng giữ để tiêu dùng và để giống (kg)			
6	Lượng còn lại để bán (kg)			
7	Tính thành tiền (nghìn đồng/vụ)			
8	Chi phí đầu vào (phân, giống,…) (nghìn đồng/vụ)			
9	**Thu nhập ròng mùa vụ**			

Q5.02. Tổng thu nhập ròng từ trồng trọt và lâm nghiệp trong 1 năm?__________________(nghìn đồng)

B. Thu nhập từ nuôi gia súc, gia cầm (tính trong 1 năm):

#	Loại vật nuôi	Loại thức ăn cho gia súc, gia cầm	Nguồn thức ăn cho gia súc, gia cầm từ đâu	Sản lượng năm	Sản lượng thành tiền (nghìn đồng)	Giữ lại sử dụng gia đình	Sản lượng bán	Sản lượng bán thành tiền (nghìn đồng)	Chi phí đầu vào (nghìn đồng)	Thu nhập ròng (nghìn đồng)
1	Trâu									
2	Bò									
3	Dê									
4	Gà									
5	Vịt									
6	Khác:									
7	Khác:									

Q5.03. Thu nhập ròng từ chăn nuôi gia súc gia cầm trong 1 năm? ________________(nghìn đồng)

C. Thu nhập từ kinh doanh nhỏ:

#	Loại hình kinh doanh:	Thành tiền (nghìn đồng)
1	Doanh thu/tháng	
2	Chi phí dành cho việc kinh doanh (điện, nước, đầu vào,…)	
3	Thu nhập ròng/tháng	
4	**Tổng ròng thu nhập theo năm ((3) x 12 tháng)**	

Q5.04. Thu nhập ròng từ kinh doanh nhỏ trong 1 năm? ________________(nghìn đồng)

F. Thu nhập từ làm công ăn lương của các thành viên (12 tháng qua):

Như vậy, có____________ thành viên đi làm (kiểm tra thông tin ghi ở phần thông tin chung việc làm).

#	Chi tiết	Thành viên 1	Thành viên 2	Thành viên 3	Thành viên 4	Thành viên 5
1	Loại công việc					
2	Thời gian làm việc trong 12 tháng qua					
3	Thu nhập 1 tháng (nghìn đồng)					

4	Tổng thu nhập cả năm (nghìn đồng)					

<u>Q5.05.</u> Thu nhập cả hộ làm công ăn lương trong 1 năm? _____________(nghìn đồng)

G. Thu nhập từ làm thuê (trả lương theo lần làm việc):

#	Chi tiết	Thành viên 1	Thành viên 2	Thành viên 3	Thành viên 4	Thành viên 5
1	Loại công việc					
2	Số lần làm việc trong 12 tháng qua					
3	Thu nhập 1 lần làm việc (nghìn đồng)					
4	Tổng thu nhập cả năm (nghìn đồng)					

<u>Q5.06.</u> Thu nhập cả hộ từ làm thuê trong 1 năm? _______________(nghìn đồng)

H. Thu nhập khác:

<u>Q5.07.</u> Xin ông/bà cho biết các khoản thu nhập khác của hộ trong năm qua (ví dụ tiền người thân trong gia đình gửi/kiều hối, tiền làm trưởng thôn, thu nhặt lâm sản…)?

#	Thu nhập từ	Tổng thu nhập cả năm (nghìn đồng)
1		
2		
3		

<u>Q5.08.</u> Như vậy, tổng thu nhập của hộ gia đình ông/bà trong năm qua gồm? (Điều tra viên đọc và ghi lại kết quả từ các số liệu ở trên)

#	Thu nhập từ	Tổng thu nhập cả năm (nghìn đồng)
1	Thu nhập từ nông nghiệp (trồng trọt)/lâm nghiệp	
4	Thu nhập từ nuôi gia súc, gia cầm	
5	Thu nhập từ kinh doanh nhỏ	
6	Thu nhập từ làm công ăn lương (trả lương tháng)	
7	Thu nhập từ làm thuê	
8	Thu nhập khác trong năm:	
9	Thu nhập khác trong năm:	
10	Thu nhập khác trong năm:	

PHẦN 6: SỨC KHỎE

<u>Q6.01.</u> Trong 12 tháng qua, khi bị ốm và cần chăm sóc y tế, ông/bà/các thành viên trong gia đình thường đến các cơ sở y tế nào?

#	Cơ sở y tế	Thỉnh thoảng (1)	Thường xuyên (2)	Rất thường xuyên (3)	Không đến nơi nào (hỏi rõ lý do) (4)
1	Trạm y tế xã				
2	Bệnh viện huyện				
3	Bệnh viện tỉnh/thành phố (ghi rõ tỉnh/thành phố nào nếu không				

	phải ở Quảng Trị)				
4	Bệnh viện trung ương				

<u>Q6.02. Ông/bà/ các thành viên trong gia đình có thường khám chữa bệnh bằng phương pháp truyền thống của người Vân Kiều không?</u>

1- Có, nêu rõ tần suất

2- Không

<u>Q6.03.</u> Người nhỏ tuổi nhất trong hộ gia đình được sinh ra ở đâu?

1- Trạm y tế xã
2- Bệnh viện huyện
3- Bệnh viện tỉnh/thành phố
4- Bệnh viện trung ương
5- Tại nhà
6- Khác (ghi rõ)………………..
7- Không nhớ/không trả lời

<u>Q6.04.</u> Trong vòng 1 tháng trở lại đây, <u>bản thân ông/bà</u> có bị tiêu chảy không?

1- Không lần nào
2- Một lần
3- Hai hoặc ba lần
4- Trên 4 lần

<u>Q6.05.</u> Trong vòng 1 tháng trở lại đây, <u>các thành viên khác trong gia đình ông/bà</u> có bị tiêu chảy không?

1- Không lần nào
2- Một lần
3- Hai hoặc ba lần
4- Trên 4 lần

<u>Q6.06.</u> Trong 12 tháng qua, ông/bà hoặc thành viên trong gia đình có bị mắc các bệnh sau đây không?

#	Các nhóm bệnh	Q3.06.a	Q3.06.b
		Bản thân ông/bà	Thành viên gia đình
Bệnh truyền nhiễm			
1	Cảm cúm		
2	Sởi		
3	Lao		
4	Sốt xuất huyết		
5	Bệnh lây nhiễm qua đường tình dục (vd: HIV,…)		
Bệnh không truyền nhiễm			
6	Tiểu đường		
7	Huyết áp		
8	Bệnh tim mạch		
9	Loãng xương		
Bệnh liên quan lối sống/bệnh khác			
10	Ung thư phổi (do hút thuốc, khói bụi)		
11	Bệnh về thần kinh		
12	Nghiện rượu		
13	Bệnh về gan (do lạm dụng rượu/bia)		
14	Bệnh khác (nêu rõ):		
15	Bệnh khác (nêu rõ):		
16	Bệnh khác (nêu rõ):		

Tổng	

PHẦN 7: ĐÁNH GIÁ CƠ SỞ HẠ TẦNG, MÔI TRƯỜNG

Q7.01. Xin cho biết mức độ hài lòng của ông/bà về cơ sở y tế địa phương (trạm y tế xã)

#	Các chỉ tiêu	Rất tốt (5)	Tốt (4)	Bình thường (3)	Không tốt (2)	Rất không tốt (1)	Ko rõ/ Ko trả lời (99)
1	Trang thiết bị máy móc						
2	Giờ giấc làm việc						
3	Thái độ cư xử của nhân viên						
4	Sự sẵn có của thuốc men						
5	Chất lượng nói chung của cơ sở						

Q7.02. Xin cho biết mức độ hài lòng của ông/bà về trường học các cấp tại địa phương

#	Các chỉ tiêu	Rất tốt (5)	Tốt (4)	Bình thường (3)	Không tốt (2)	Rất không tốt (1)	Ko rõ/ Ko trả lời (99)
1	Trang thiết bị phục vụ giảng dạy						
2	Lớp học, nhà học						
3	Chất lượng giảng viên						
4	Môi trường xung quanh trường						
5	Đường xá đến trường						

Q7.03. Xin cho biết mức độ hài lòng của ông/bà về cơ sở hạ tầng địa phương

#	Các chỉ tiêu	Rất tốt (5)	Tốt (4)	Bình thường (3)	Không tốt (2)	Rất không tốt (1)	Ko rõ/ Ko trả lời (99)
1	Chợ						
2	Điện sinh hoạt						
3	Nước sạch sinh hoạt						
4	Dịch vụ Internet						
5	Dịch vụ thu gom rác thải						
6	Đường liên thôn và liên xã						

Q7.04. Nếu chưa hài lòng về cơ sở hạ tầng của địa phương, xin ông/bà cho biết vì sao?

....

....

....

PHẦN 8: HIỂU BIẾT VÀ ĐÁNH GIÁ VỀ DỰ ÁN

(Ghi chú: cần nhấn mạnh rõ Dự án đang làm khảo sát là Hướng Linh 1, để tránh việc người được phỏng vấn nhầm lẫn với Hướng Linh 2)

Q8.01. Anh/ chị biết đến Dự án này từ lúc nào và bằng cách nào?
Biết:

1. □ Lần đầu tiên nghe đến 2. □ < 6 tháng 3. □ 6 thang-1 năm 4. □ > 1 năm

Qua:

1. □ Báo chí/ TV 2. □ Tham vấn cộng đồng của Dự án 3. □ Thông báo từ xã
4. □ Khác: ...

Q8.02. Anh/ chị có tham gia vào buổi tham vấn cộng đồng nào trong quá trình phát triển Dự án hay không?

1. □ Có 2. □ Không

Q8.03. Nếu có tham gia buổi tham vấn cộng đồng anh/ chị có cảm thấy anh/ chị được cung cấp đầy đủ thông tin về Dự án bao gồm mô tả Dự án, các tác động có thể có và các biện pháp giảm thiểu tác động hay chưa?

1. □ Có 2. □ Không

Nếu chưa thì anh/ chị muốn biết thêm những thông tin nào?

1. □ Mô tả Dự án 2. □ Các tác động có thể có 3. □ Biện pháp giảm thiểu tác động
4. □ Khác: ...

PHẦN 9: *ẢNH HƯỞNG SINH KẾ DO MẤT ĐẤT CANH TÁC*

(Phần này chỉ dành để hỏi những hộ bị ảnh hưởng do thu hồi đấy cho Dự án HL1)

Q9.01. Phần đất của gia đình anh/ chị bị thu hồi trong Dự án là bao nhiêu % trong tổng số đất anh/ chị có?

Đất sản xuất:	1. □ < 30%	2. □ 30-70%	3. □ > 70%
Đất thổ cư:	1. □ < 30%	2. □ 30-70%	3. □ > 70%

Q9.02. Công việc/nghề nghiệp của anh/ chị có bị ảnh hưởng bởi Dự án hay không?

1. □ Có 2. □ Không

Nếu có thì ảnh hưởng như thế nào?

1. □ Không đáng kể: vẫn tiếp tục sản xuất trên phần đất còn lại
2. □ Trung bình: vẫn tiếp tục công việc/nghề nghiệp cũ nhưng cần hỗ trợ để cải thiện/ bảo trì/ đầu tư mới
3. □ Đáng kể: không thể tiếp tục với công việc/nghề nghiệp trước đây (chuyển tới Câu 3)

Q9.03. Theo Anh/ chị đánh giá thì việc chuyển đổi sinh kế/ nghề nghiệp khác thì có dễ dàng không? Có nhiều cơ hội để thay đổi việc làm không? Nếu có, chuyển sang Câu Q9.04, Q9.05 và Q9.06.

1. □ Có 2. □ Không

Q9.04. Anh/ chị định chuyển sang công việc/nghề nghiệp nào?

1. □ Đi nơi khác để canh tác hoặc khai hoang 2. □ Buôn bán nhỏ

3.. □ Làm công ăn lương 4. □ Khác:...

Q9.05. Anh/ chị có chuẩn bị gì cho việc chuyển đổi công việc/nghề nghiệp này không? Nếu có xin cho biết cụ thể?

1. □ Có, ghi rõ 2. □ Không

Q9.06. Anh/ chị thấy khó khăn nào khi anh/ chị tiếp tục sống bằng công việc/nghề nghiệp hiện tại?

1. □ Có 2. □ không

Nếu có, anh/ chị định giải quyết những khó khăn này như thế nào?

....
....
....
....

Anh chị đánh giá như thế nào về Dự án Hướng Linh 2 – đang hoạt động? Gia đình anh chị có ảnh hưởng gì kể từ khi dự án Hướng Linh 2 đi vào xây dựng và hoạt động?

....
....
....
....

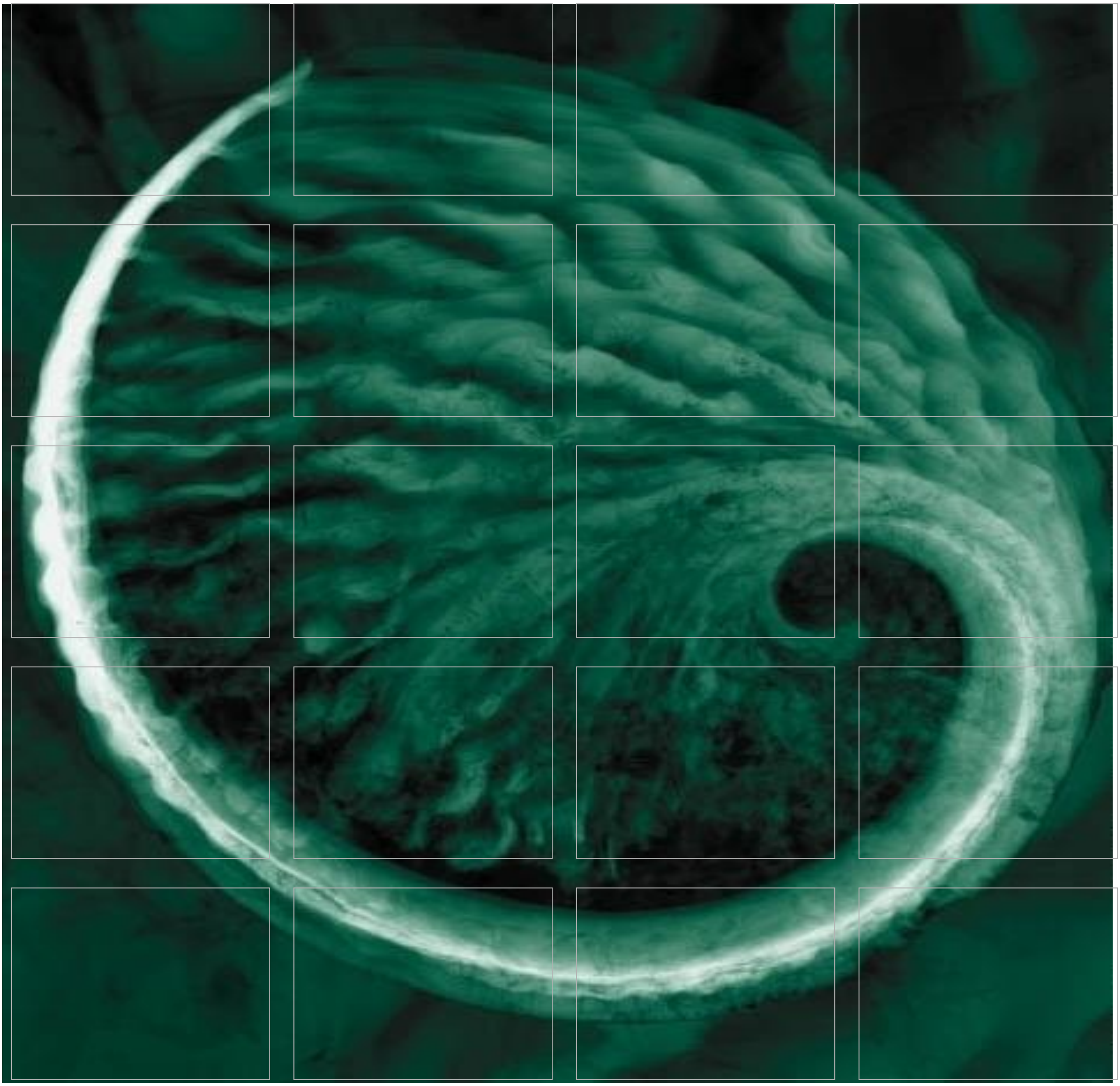
Cảm ơn anh/ chị đã dành thời gian tham gia khảo sát.

Kết thúc điều tra.

Annex I

Shadow Flicker, Blade throw and Visual Aesthetics Assessment

Huong Linh 1 Wind Farm



Shadow Flicker, Blade throw and Visual Aesthetics Assessment of Huong Linh 1 Wind Farm: *Vietnam*

Tan Hoang Cau Join Stock Company.

Draft Report

February 2018

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DRAFT REPORT

Tan Hoang Cau Join Stock Company.

Shadow Flicker, Blade Throw and Visual Aesthetics Assessment of Huong Linh 1 Wind Farm: *Vietnam*

February 2018

Reference # 0440013

Prepared by: Rohan Fernandes, Koel Kumar

Reviewed by:	Naval Chaudhary *Principal Consultant*
Approved by:	

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1 INTRODUCTION

1.1 PRELUDE

This report has been prepared by ERM India Pvt Ltd (ERM) on behalf of ERM Vietnam for Tan Hoang Cau Join Stock Company. It presents the methodology, results and findings of the shadow flicker assessment (Project and cumulative), blade throw (qualitative), visual impact (qualitative) conducted for the Huong Linh 1 wind farm project (hereinafter referred to as the "HL1" project).The purpose of this assessment is to address these potential issues due to operational wind farm and their potential impact on the neighbouring communities. This report has been prepared to document the findings of the assessments, provide an evaluation of potential impacts, identify potential mitigation measures that may be required to achieve compliance and then highlight any potential residual issues from shadow flicker, blade throw or visual impacts.

1.2 OVERVIEW OF THE PROJECT

A snapshot of the project has been summarised in ***Table 1.1.***

Table 1.1 HL1 project - a snapshot

Detail	Description
Location	• Huong Linh and Dakrong communes, Huong Hoa and Dakrong Districts, in Quang Tri Province of central Vietnam
Turbines	It comprises 15 wind turbines: • 11 x Vestas V110 wind turbines with a hub height of 80 metres. • 4 x Vestas V90 wind turbines with a hub height of 80 metres.
Site surroundings	The HL1 wind farm is located within a mountain valley with steep forested hillsides occurring on each side. A relatively remote village area is located in and around the footprint of HL1 and HL2. Residential dwellings as well as community infrastructure such as schools and kindergartens are located within the projects footprint.
Other Wind Projects in vicinity	• The Huong Linh 2 wind farm project (the HL2 project) is located in the same area as the HL1 project and comprises 15 wind turbines, each of which is understood to be a Vestas V100. • The HL2 project is already operational, and as such has been considered in this assessment when addressing potential shadow flicker impacts at nearby receptors.
Ecological sensitivities based on satellite imagery (aerial distance)	• The Bac Huong Hoa Natural reserve is located approximated 3.4 km north of the HL1 wind farm • The Dakrong Natural reserve is located approximately 1.5 km south south east of the HL1 wind farm

Source: Details provided by ERM Vietnam.

Figure 1.1 highlights the wind turbines location of HL1 and HL2 projects and other key features present around the projects footprint.

Figure 1.1   Map showing the location of the wind turbines of HL1 and HL2 projects and surrounding features

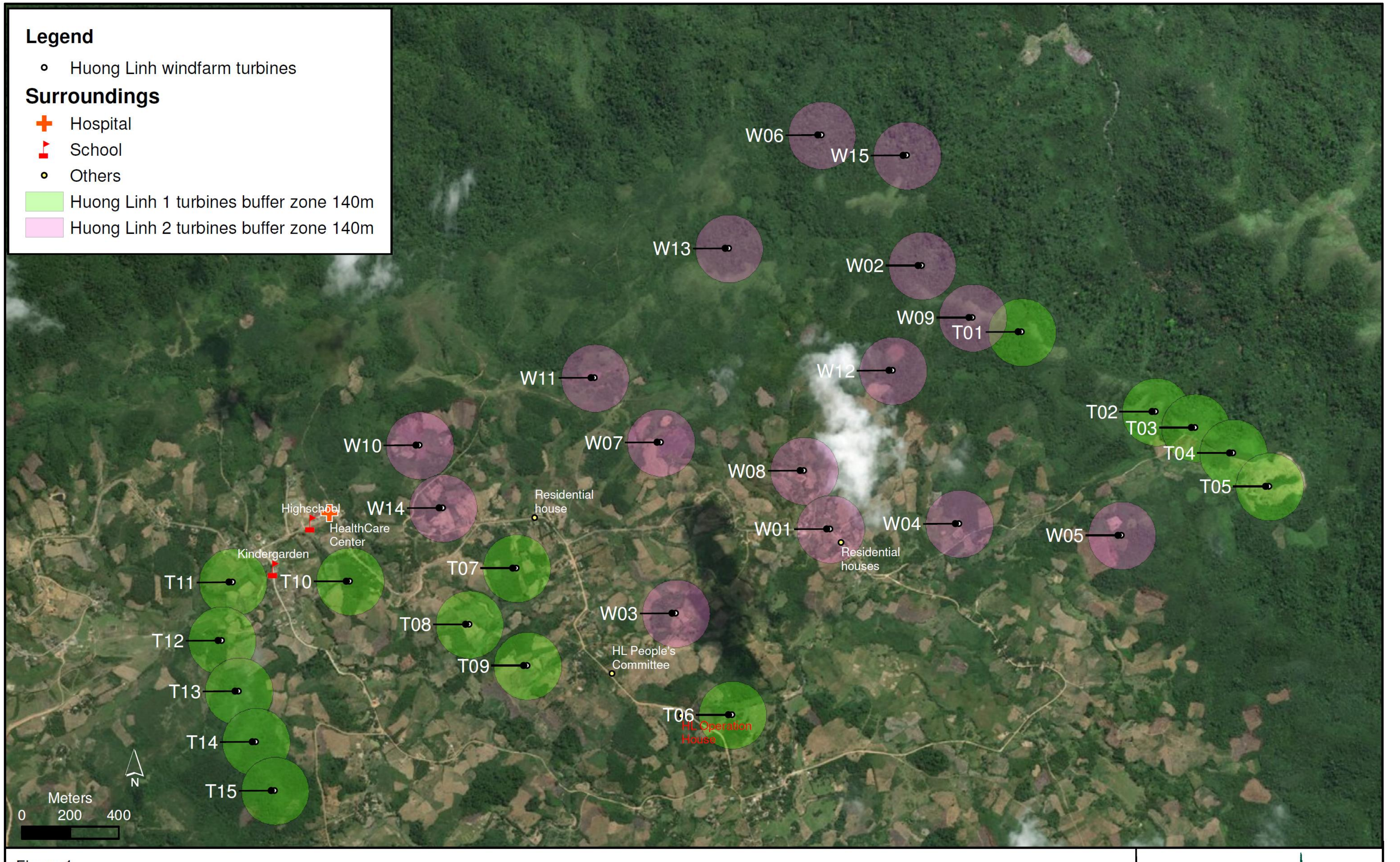


Figure 1

Huong Linh 1 Wind farm project

File: P:\Projects\0440013 Huong Linh 1 Windfarm ESIA.TS\05 Deliverables\FiguresGIS\huong_linh (2) with 140m buffer.mxd
Date: 4/1/2018

Environmental Resources Management ERM

Source: Details provided by ERM Vietnam.

1.3 SCOPE OF THE ASSESSMENT

1.3.1 *Scope of work*

The scope of this assessment is limited to the HL1 (proposed) and HL2 (operational) project designs as identified in Figure 1.1, shadow flicker modelling, qualitative blade throws and qualitative visual aesthetics assessment and associated reporting to document the methodology, findings and any agreed mitigation measures for the wind farm site/design. The assessment scope of works included:

- Reviewing existing project information and operational activities to understand site conditions pertaining to shadow flicker, blade throw scenarios and visual impacts;

- Identify the closest and/or potentially most affected receptors situated within the potential area of influence of the wind farm and discuss the existing conditions near these receptors;

- Establishing a shadow flicker model to predict operational shadow flicker against neighbouring communities;

- Qualitatively assessing blade throw and visual impacts due to the proximity of receptors and the wind farm;

- Developing mitigation options designed to reduce impacts and residual impacts. These recommendations are designed for Tan Hoang Cau Join Stock Company consideration and potential implementation, where considered feasible and reasonable.

1.3.2 *Applicable reference framework*

ERM has conducted the assessment with respect to the following requirements of the specified framework as follows:
- Applicable local, national and international laws and regulations;
- International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012);
- The applicable IFC/World Bank Guidelines:
    - General Environment, Health and Safety (EHS) Guidelines (2007),
    - Environmental, Health and Safety Guidelines for Wind Energy, dated August 2015.

1.3.3 *Limitations*

This report has been developed based on the project level information provided by ERM Vietnam. The impact and mitigations measures may be subject to change based on further detailed information provided or actual conditions on-ground.

ERM India has not carried out any field visits and all the assessments have been carried out based on desktop studies. For certain sections in absence of details from the client, ERM has refrained from assuming the embedded controls /measures and instead proposed them as mitigation measures to be followed for impact management.

The report is based on certain scientific principles and professional judgment to certain facts with resultant subjective interpretation. Professional judgment expressed herein is based on the available data and information. If information to the contrary is discovered, the findings in this ESIA needs to be modified accordingly.

2 SHADOW FLICKER ASSESSMENT

2.1 INTRODUCTION

Shadow flicker is a term used to describe the pattern of alternating light intensity observed when the rotating blades of a wind turbine cast a shadow on a receptor under certain wind and light conditions. Shadow flicker occurs under a limited range of conditions when the sun passes behind the hub of a wind turbine and casts an intermittent shadow over neighbouring properties.

2.1.1 *Regulations pertaining to shadow flicker*

The review of the Vietnam based environmental policies and legislations (Vietnam Environment Administration) contain no specific shadow flicker requirements and recommendations. At present, Germany has detailed guidelines on limits and conditions for calculating shadow impact.[1]

Box 2.1 International Guidelines for Shadow Flicker Assessment

According to the German guidelines, the limit of the shadow is set by two factors:
- The angle of the sun over the horizon must be at least 3 degrees;
- The blade of the WTG must cover at least 20% of the sun.

The maximum shadow impact for a neighbour to a wind farm according to the German guidelines is:
- Maximum 30 hours per year of astronomical maximum shadow (worst case);
- Maximum 30 minutes worst day of astronomical maximum shadow (worst case); and
- If automatic regulation is used, the real shadow impact must be limited to 8 hours per year.

In Sweden and Denmark there are no official guidelines as yet on shadow flickering, but for practical purposes, 10 hours (Denmark) and 8 hours (Sweden) real case (weather-dependent) shadow impact is used as the limit. In the UK, no official limits are in force, however an assessment must be made at all dwellings within ten rotor diameters of the turbine locations (PPS22 (2004) for England), TAN8 for Wales). In Ireland, a worst-case 30 hours per year, 30 minutes per day limit has been set.

Shadow flicker has been elaborated upon in the EHS guidelines for wind energy, by the International Finance Corporation (IFC), dated August 7, 2015 (2) and have been elaborated here. They are as follows:

- Shadow flicker occurs when the sun passes behind the wind turbine and casts a shadow. As the rotor blades rotate, shadows pass over the same point causing an effect termed shadow flicker. Shadow flicker may become a problem when potentially sensitive receptors (e.g., residential properties,

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

(2) EHS guidelines for wind energy, August 7, 2015. http://www.ifc.org/wps/wcm/connect/2c410700497a7933b04cf1ef20a40540/FINAL_Aug+2015_Wind+Energy_EHS+Guideline.pdf?MOD=AJPERES. Accessed 05/12/2017

workplaces, learning and/or health care spaces/facilities) are located nearby, or have a specific orientation to the wind energy facility.

- Potential shadow flicker issues are likely to be more important in higher latitudes, where the sun is lower in the sky and therefore casts longer shadows that will extend the radius within which potentially significant shadow flicker impact will be experienced.
- Where there are nearby receptors, commercially available software can be used to model shadow flicker in order to identify the distance to which potential shadow flicker effects may extend. The same software can typically also be used to predict the duration and timing of shadow flicker occurrence under real weather conditions at specific receptors located within the zone of potential shadow flicker impact.
- If it is not possible to locate the wind energy facility/turbines such that neighbouring receptors experience no shadow flicker effects, it is recommended that the predicted duration of shadow flicker effects experienced at a sensitive receptor not exceed 30 hours per year and 30 minutes per day on the worst affected day, based on a worst-case scenario.

2.1.2 Occurrence of shadow flicker in regards to wind farms

Shadow flicker is most pronounced at sunrise and sunset when shadows are the longest, and at high wind speeds (faster rotating blades leading to faster flicker). A UK government report recommends that for inhabitants near wind turbines, shadow flicker should be limited to 30 hours in a year and 30 minutes in a day[1]. There is anecdotal evidence internationally that shadow flicker could lead to stress and headaches. There is also a fear that shadow flicker, especially in the range of 2.5-50 Hertz (2.5-50 cycles per second) could lead to seizures in epileptics and may also scare away livestock.

An analysis of those conditions that may lead to shadow flicker and the location of potential sensitive receptors (residential and community properties) is provided in this section. The timing and duration of this effect can be theoretically calculated from the geometry of the wind turbines, their orientation relative to nearby houses and the latitude of the potential site, using specialised software such as WindPro 3.1. The results provide the total number of hours in a year when a theoretical shadow flicker will occur. This is most pronounced during sunrise and sunset when the sun's angle is lower and the resulting shadows are longer. However, the actual shadow flicker could be substantially lower compared to theoretical values because shadow flicker does not occur where there is vegetation or other obstructions between the turbines and the shadow receptors; if windows facing a turbine are fitted with blinds or shutters; or if the sun is not shining brightly enough to cause shadows.

It should be noted that the theoretical calculations done by WindPro does take into account the reduction in shadow flicker due to topographic features,

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

however it does not take into account the reduction in shadow flicker due to these onsite factors i.e. vegetation. Simple geometry relating to the position of the sun and the angle of the turbine blades can also eliminate or significantly reduce the effects of shadow flicker. In addition, shadow flicker will only occur inside the properties where the flicker is occurring through openings (e.g. window, door).

2.2 *CONSIDERATIONS AND ASSUMPTIONS FOR THE STUDY*

Weather conditions at the site, such as bright sunshine, will greatly enhance the occurrence and intensity of shadow flicker, whereas cloud density, haze or fog will cause a reduction. Receptors further away from the turbines which may have experienced a shadow flicker effect under bright sunshine conditions will, as a result of these weather conditions, experience either no effect or one which is greatly reduced in intensity. The distance between receptors and turbines has a large effect on the intensity of shadow flicker. Shadow flicker intensity can be defined as the difference in brightness between the presence and absence of a shadow at any given location. This study does not examine variations in intensity but rather the occurrence in number of hours shadow flicker may occur, whether or not this is clearly distinct or barely noticeable. The assessment assumes a conservative worst case of bright sunshine conditions in all periods when flicker may occur.

Considering all of the above points, the likelihood of shadow flicker occurring is greatest when the circumstances listed below exist simultaneously.

- The receptor is at a position which is between 130° clockwise (1) and anticlockwise from north and located within 10 turbine rotor diameters of the wind turbine (~1000 m).
- The sun is shining and visible in the sky in line with the monthly mean sun-shine hours at nearby location.
- The wind speeds are between 3 m/s and 22 m/s and the turbine is therefore in operation.
- The turbine blades are perpendicular to the line between the sun and the observer or receptor most of time.

Due to lack of data regarding epilepsy rates in Vietnam and operation levels below of 1 Hz for modern turbines, seizures caused by shadow flicker are considered to be extremely unlikely. The turbines (proposed to be used in this Project) being considered operate at a frequency outside the range where negative health effects may result (2). Potential effects on people are likely to be limited to nuisance.

(1) It is acknowledged by this assessment however that Vietnam is at lower latitude than the European countries and therefore angles of shadow flicker may be narrower.
(2) See Health and Safety Executive/Local Authority Enforcement Liaison Committee (HELA) circular, entitled 'Disco Lights and Flicker Sensitive Epilepsy' (available at http://www.hse.gov.uk/lau/lacs/51-1.htm). It provides medical details on flicker frequencies likely to give rise to epileptic effects. It states: 'In 1971 the Greater London Council banned the use of flicker rates greater than 8 fps but to be effective the above figures show that any advice on restriction of flicker rate has to limit the frequency to below 5 fps.'

2.2.1 *Standard for shadow flicker*

In the Vietnam context, at present, there is neither regulation nor decided level of shadow flicker identified as causing a significant effect (1). However, the Danish Wind Industry Association note on their website that in Germany, the rule of thumb is that 30 hours shadow flicker a year received at a property is acceptable (2). The 'Wind Energy Development Guidelines, 2006' published by the Irish Government Department of the Environment, Heritage and Local Government recommend that shadow flicker at neighbouring offices and dwellings within 500 m should not exceed 30 hours per year. A threshold of 30 hours per year has therefore been considered and applied for this assessment.

2.3 *ASSESSMENT METHODOLOGY AND MODELLING*

Shadow flicker calculations have been made using windPRO 3.1.617 software. The model used in this analysis is very conservative and assumes the following conditions:

- the average monthly sunshine hours for Ho Chi Minh City[3];
- the wind turbines have been considered operational with wind speed more than 3 m/s and for the same, based on annual wind rose and wind frequency data of Da Nang Airport (located close to the project site), it has been assumed that about 90% time of the year, the wind turbines will be operational;
- the blades of the wind turbines are perpendicular with northwest - southeast orientation have been considered based on the predominant wind direction available from the annual wind rose of Da Nang Airport, which could result in maximum possible size circular/ elliptical;
- there are no trees, or vegetation on the surface which may obscure the line of sight between shadow receptor and turbine;
- the sun can be represented as a single point;
- Flicker is ignored if sun is less than 3° above horizon (due to atmospheric diffusion/ low radiation/ sheltering);
- structures identified within 500 m around the wind turbine locations are considered as shadow receptors.

The following data inputs were used in this study:
- a digital elevation model of the site (National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) Data at 30 m resolution);
- latitude and longitude at centre of the site used to calculate the position of the sun (calculated in GIS using UTM co-ordinates);
- average monthly sun-shine hours recorded;

(1) Assumption based upon review of the Vietnam Environment Administration website.
(2) www.windpower.org
(3)https://weather-and-climate.com/average-monthly-hours-Sunshine,Ho-Chi-Minh-city,Vietnam

- turbine locations – coordinates (provided by the Client);
- turbine rotor diameter for HL1 turbines i.e. Vestas V110 and V 90 turbines are 110 m and 90 m. The turbine rotor diameter for the operational V100 turbines of the HL2 project is 100 m;
- height to bottom of Turbine hub for HL1 turbines i.e. Vestas V110 and V 90 turbines as well as the HL2 turbines (V100) which is 80 m;
- tilt angle of the 'window' (always assumed vertical);
- shadow receptors contain on openings measuring 1 m by 1 m facing towards the closest wind turbines; and
- height above ground level of the 'window' 1 m.

2.3.1 *The model – WindPro Shadow*

SHADOW is the WindPro calculation module that calculates how often and in which intervals a specific neighbour or area will be affected by shadows generated by one or more WTGs. These calculations are worst-case scenarios (astronomical maximum shadow, i.e. calculations which are solely based on the positions of the sun relative to the WTG). Shadow impact may occur when the blades of a WTG pass through the sun's rays seen from a specific spot (e.g. a window in an adjacent settlement). If the weather is overcast or calm, or if the wind direction forces the rotor plane of the WTG to stand parallel with the line between the sun and the neighbour, the WTG will not produce shadow impacts, but the impact will still appear in the calculations. In other words, the calculation is a worst-case scenario, which represents the maximum potential risk of shadow impact. A calendar can be printed for any specific point of observation, which indicates the exact days, and time periods where shadow impact may occur.

Apart from calculating the potential shadow impact at a given neighbour, a map rendering the iso-lines of the shadow impact can also be printed. This printout will render the amount of shadow impact for any spot within the project area.

The calculation of the potential shadow impact at a given shadow receptor is carried out simulating the situation. The position of the sun relative to the WTG rotor disk and the resulting shadow is calculated in steps of 1 minute throughout a complete year. If the shadow of the rotor disk (which in the calculation is assumed solid) at any time casts a shadow reflection on the window, which has been defined as a shadow receptor object, then this step will be registered as 1 minute of potential shadow impact. The following information is required:

- The position of the WTGs (x, y, z coordinates)
- The hub height and rotor diameter of the WTGs
- The position of the shadow receptor object (x, y, z coordinates)
- The size of the window and its orientation, both directional (relative to south) and tilt (angle of window plane to the horizontal).

- The geographic position (latitude and longitude) together with time zone and daylight saving time information.
- A simulation model, which holds information about the earth's orbit and rotation relative to the sun.

2.3.2 *Receptors*

The maximum horizontal distance between a receptor affected by shadow flicker and turbine location for example has been identified as being equal to the diameter of the turbine multiplied by ten. In this instance, turbine rotor diameter is 100 m; and therefore an area envelope of 1000 m from the nearest turbine is used in shadow flicker analyses. However, the shadow receptors have been taken into consideration falling within 500 m from each of the WTG as the impact of shadow flicker reduces with distance.

Figure 2.1 and ***Figure 2.2*** presents identified shadow receptors present within 500 m of the wind turbines of HL1 and HL2 projects, respectively, with the former being the scope of this assessment. A total of 133 receptors[1] have been identified as being within the study area of the HL1 wind farm, whereas a total of 39 receptors as being within the study area of the HL2 wind farm (falling under different villages). All the shadow receptors considered in this study are located within 500 m from any of the WTG location.

(1) [1] The receptors that were identified for this study was obtained from Google earth Imagery dated 04/09/ 2017 and have to be identified during the site visit

Figure 2.1 Wind turbines and shadow receptors of HL1 project

Figure 2.2 Wind turbines and shadow receptors of HL2 project

2.4 *SHADOW FLICKER ANALYSIS*

The maps showing the extent of shadow flicker caused by the proposed HL1 and HL2 wind farms to corresponding receptors within 500 m is shown in Figure 2.3 and Figure 2.4, respectively. The cumulative shadow flicker impacts caused by both HL1 and HL2 windfarms are shown in **Figure 2.5.** Calculated shadow flicker at each identified shadow receptor due to HL1 and HL2 projects are presented in Table 2.1 and Table 2.2, respectively. Shadow main results and shadow graphical calendar illustrate the times of the year at each of the receptors in the analysis where theoretical shadow flicker was predicted to occur are provided in ***Annex A*** and ***Annex B*** for HL1 and HL2 projects.

Figure 2.3 Shadow Flicker Map showing the HL1 turbines and the interactions with the receptors that are located within a radius of 500 m

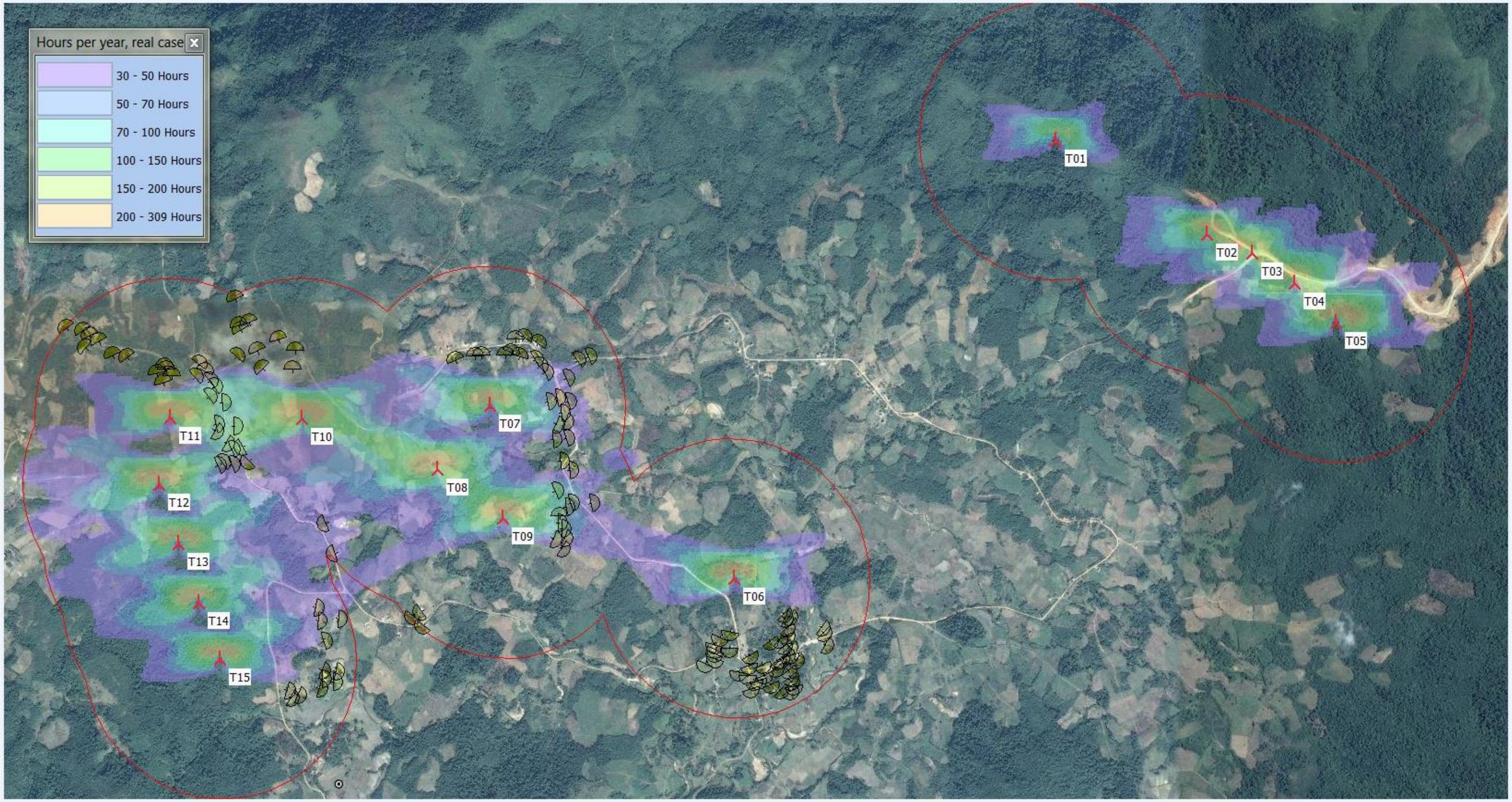


Figure 2.4 Shadow Flicker Map showing the HL1 turbines and the interactions with the receptors that are located within a radius of 500 m

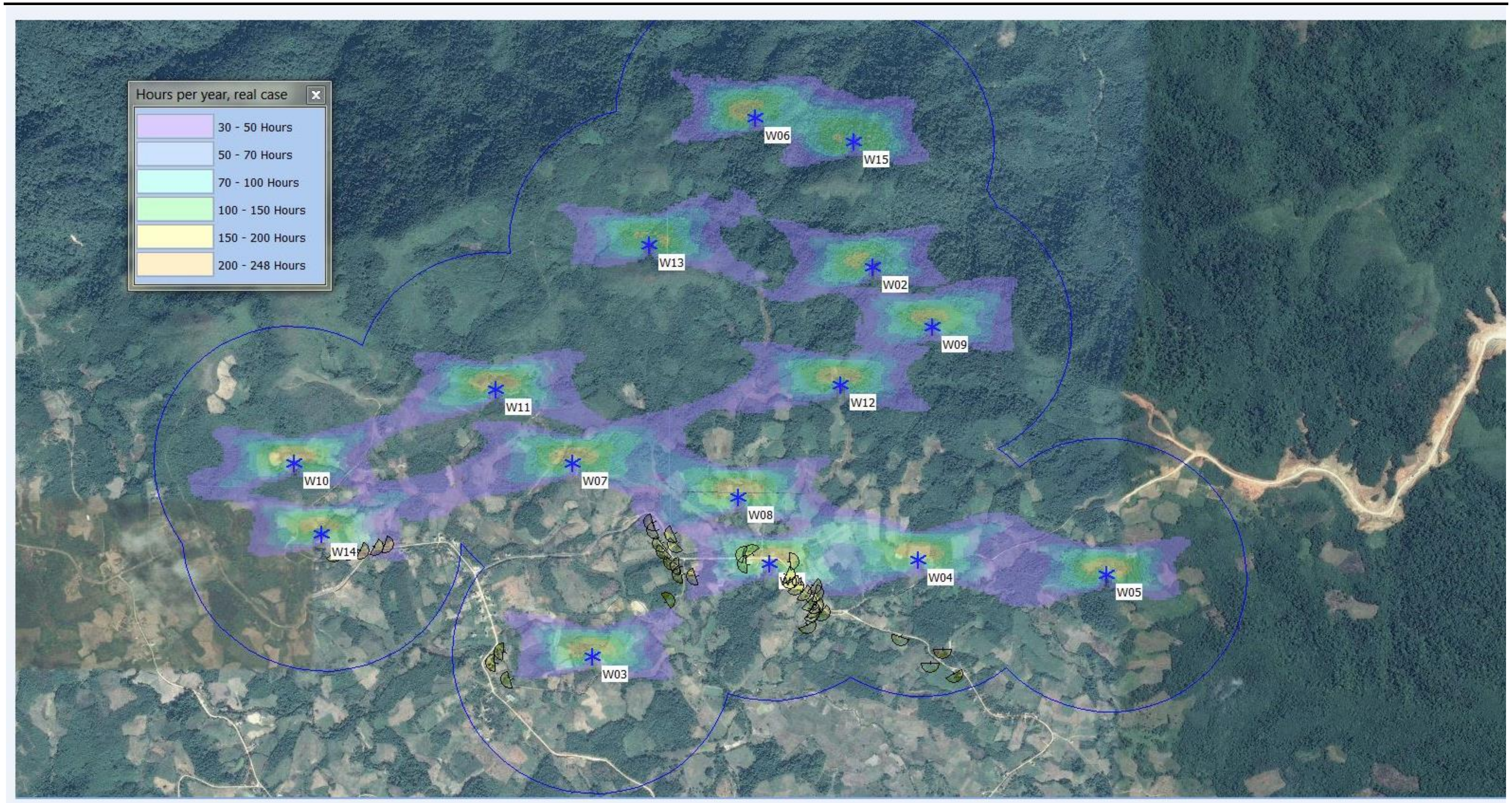


Figure 2.5 Shadow Flicker Map showing the HL1 and HL2 turbines and the interactions with the receptors that are located within a radius of 500 m

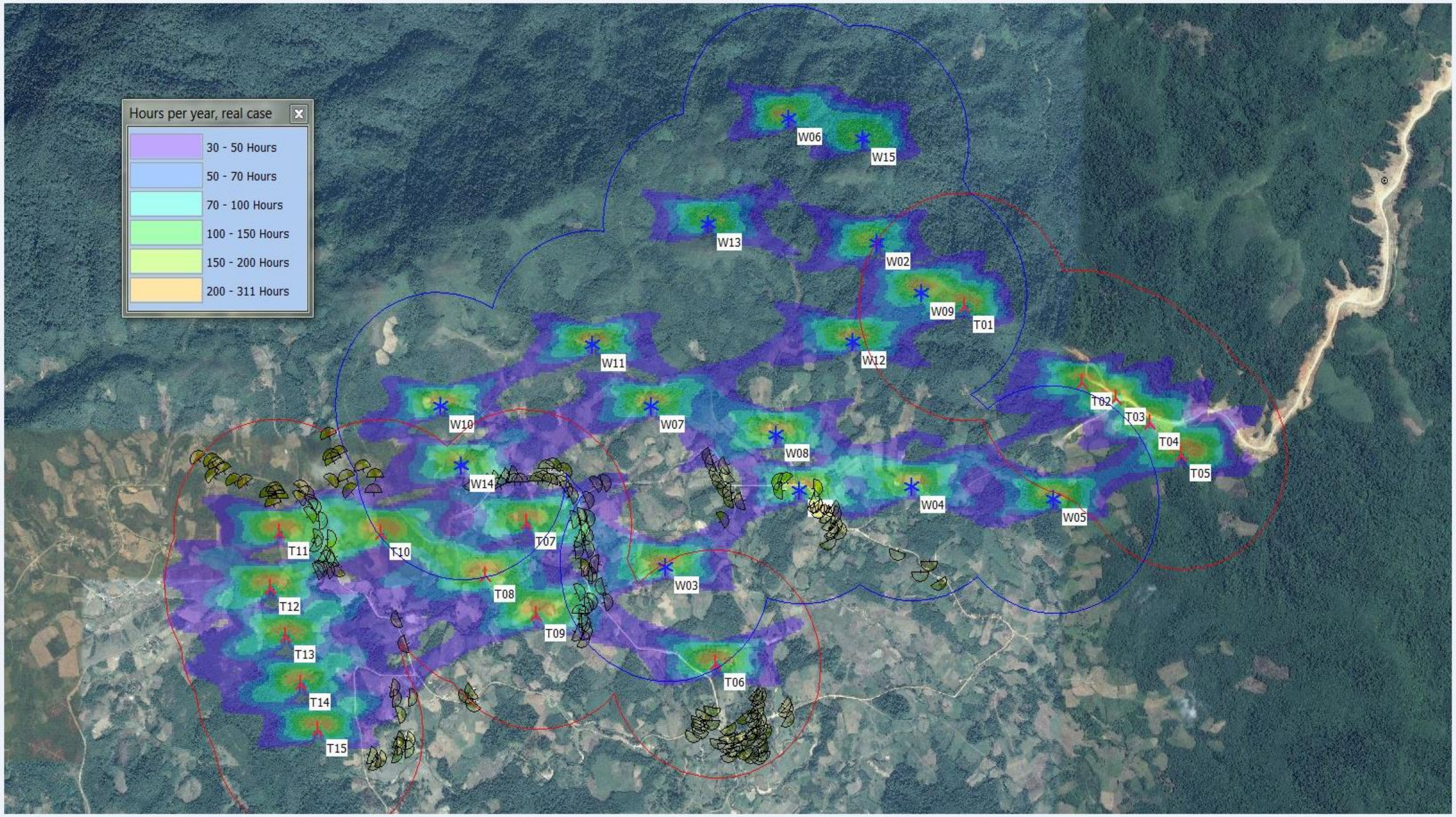


Table 2.1 *Shadow Flicker Analysis at Each Receptor HL1 (Figures highlighted and bold represent greater than 30 hours per year of shadow flicker)*

Shadow Receptor Code	Type of Receptor based on satellite information (1)	Zone	UTM Co-ordinates mE	UTM Co-ordinates mN	Nearest WTG	Approximate Distance from Nearest WTG [m]	Direction from WTG (Degree)	Real Case Scenario Shadow hours per year [hr/year] *
1	Residential dwelling	48 Q	6,87,882	18,47,842	T15	375 m SE	107.00	20:31
2	Residential dwelling	48 Q	6,87,938	18,47,866	T15	428 m ESE	101.22	14:33
3	Residential dwelling	48 Q	6,87,897	18,47,877	T15	389 m ESE	100.43	17:43
4	Residential dwelling	48 Q	6,87,942	18,47,904	T15	417 m ESE	95.36	16:01
5	Residential dwelling	48 Q	6,87,956	18,48,093	T15	452 m ENE	71.12	26:54
6	Residential dwelling	48 Q	6,87,764	18,47,836	T15	265 m SE	114.34	16:59
7	Residential dwe lling	48 Q	6,87,778	18,47,809	T15	283 m SE	118.99	06:23
8	Residential dwelling	48 Q	6,87,803	18,47,820	T15	304 m SE	114.81	13:34
9	Residential dwelling	48 Q	6,87,892	18,47,906	T15	380 m ESE	96.34	17:10
10	Residential dwelling	48 Q	6,87,901	18,48,011	T15	390 m ENE	80.31	29:03
11	Residential dwelling	48 Q	6,87,879	18,48,084	T15 and T14	396 m ENE and 425 m SE	68.21 and 91.81	32:42
12	Residential dwelling	48 Q	6,87,871	18,48,131	T15 and T14	400 m NE and 428 m SE	62.59 and 91.58	41:47
13	Residential dwelling	48 Q	6,86,968	18,49,122	T11	490 m NW	312.07	03:28
14	Residential dwelling	48 Q	6,87,052	18,49,094	T11	410 m NNW	315.06	04:55
15	Residential dwelling	48 Q	6,87,029	18,49,111	T11	436 m NNW	316.00	04:52
16	Residential dwelling	48 Q	6,87,038	18,49,049	T11	372 m NNW	316.28	04:07
17	Residential dwelling	48 Q	6,87,083	18,49,073	T11	373 m NNW	317. 00	05:22
18	Residential dwelling	48 Q	6,87,135	18,49,023	T11	300 m NW	316. 80	05:55
19	Residential dwelling	48 Q	6,87,188	18,49,018	T11	263 m NW	324.48	08:00
20	Residential dwelling	48 Q	6,87,297	18,48,964	T11	165 m NNW	344.26	11:16
21	Residential dwelling	48 Q	6,87,324	18,48,988	T11	185 m N	354.55	13:53
22	Residential dwelling	48 Q	6,87,332	18,48,975	T11	172 m N	176.34	13:32
23	Residential dwelling	48 Q	6,87,320	18,48,929	T12	125 m N	350.18	11:43
24	Residential dwelling	48 Q	6,88,394	18,49,022	T07	215 m NW	316.02	03:31
25	Residential dwelling	48 Q	6,88,465	18,49,039	T07	184 m N	344.99	08:43
26	Residential dwelling	48 Q	6,88,488	18,49,041	T07	182 m N	351.72	07:59
27	Residential dwelling	48 Q	6,88,575	18,49,044	T07	192 m NNE	18.42	05:52
28	Residential dwelling	48 Q	6,88,598	18,49,052	T07	208 m NE	23.44	05:32
29	Residential dwelling	48 Q	6,88,615	18,49,100	T07	257 m NE	23.13	05:40
30	Residential dwelling	48 Q	6,88,644	18,49,107	T07	280 m NE	28.19	05:18
31	Residential dwelling	48 Q	6,88,697	18,49,087	T07	292 m NE	39.08	04:34
32	Residential dwelling	48 Q	6,88,628	18,49,040	T07	214 m NE	32.69	05:15
33	Residential dwelling	48 Q	6,88,684	18,49,032	T07	242 m ENE	45.16	18:12
34	Residential dwelling	48 Q	6,88,701	18,49,008	T07	236 m ENE	52.30	37:22
35	Residential dwelling	48 Q	6,88,723	18,48,985	T07	243 m ENE	59.52	49:52
36	Residential dwelling	48 Q	6,88,839	18,49,031	T07	366 m NE	62.79	28:04
37	Residential dwelling	48 Q	6,88,882	18,49,043	T07	412 m ENE	64.26	24:33
38	Residential dwelling	48 Q	6,88,800	18,48,966	T07	303 m ENE	70.08	36:29
39	Residential dwelling	48 Q	6,88,765	18,48,893	T07	251 m E	83.51	46:00
40	Residential dwelling	48 Q	6,88,806	18,48,882	T07	258 m E	88.11	39:43
41	Residential dwelling	48 Q	6,88,732	18,48,880	T07	217 m E	85.40	58:00
42	Residential dwelling	48 Q	6,88,780	18,48,839	T07	266 m E	95.59	55:24
43	Residential dwelling	48 Q	6,88,759	18,48,798	T07	251 m E	104.90	58:24
44	Residential dwelling	48 Q	6,88,797	18,48,751	T07	303 m ESE	112.21	35:57
45	Residential dwelling	48 Q	6,88,750	18,48,745	T07	239 m ESE	121.61	32:39
46	Residential dwelling	48 Q	6,88,795	18,48,810	T07	283 m ESE	101.36	53:05
47	Residential dwelling	48 Q	6,88,776	18,48,669	T09	300m NE	225.77	15:39
48	Residential dwelling	48 Q	6,88,811	18,48,635	T09	208 m NE	55.38	35:30

(1) The receptors that were identified for this study was obtained from Google earth Imagery dated 04/09/ 2017.

Shadow Receptor Code	Type of Receptor based on satellite information (1)	Zone	UTM Co-ordinates mE	UTM Co-ordinates mN	Nearest WTG	Approximate Distance from Nearest WTG [m]	Direction from WTG (Degree)	Real Case Scenario Shadow hours per year [hr/year] *
49	Residential dwelling	48 Q	6,88,754	18,48,561	T09	218 m ENE	63.79	75:07
50	Residential dwelling	48 Q	6,88,813	18,48,519	T09	360 m ENE	77.99	48:54
51	Residential dwelling	48 Q	6,88,793	18,48,503	T09	235 m ENE	80.43	57:16
52	Residential dwelling	48 Q	6,88,770	18,48,469	T09	212 m E	88.47	37:28
53	Residential dwelling	48 Q	6,88,767	18,48,448	T09	208 m E	94.43	72:16
54	Residential dwelling	48 Q	6,88,885	18,48,519	T09	330 m ENE	80.55	31:02
55	Residential dwelling	48 Q	6,89,394	18,48,064	T06	208 m SSW	184.13	00:46
56	Residential dwelling	48 Q	6,89,354	18,48,043	T06	228 m SW	193.63	00:00
57	Residential dwelling	48 Q	6,89,334	18,48,015	T06	266 m SW	200.00	00:00
58	Residential dwelling	48 Q	6,89,337	18,48,000	T06	270 m SW	195.03	00:00
59	Residential dwelling	48 Q	6,89,333	18,47,986	T06	285 m SW	.195.13	00:00
60	Residential dwelling	48 Q	6,89,387	18,48,004	T06	259 m S	184.83	00:00
61	Residential dwelling	48 Q	6,89,337	18,47,964	T06	307 m SW	193.43	00:00
62	Residential dwelling	48 Q	6,89,302	18,47,949	T06	330 m SW	198.97	00:00
63	Residential dwelling	48 Q	6,89,423	18,47,921	T06	342 m SW	177.83	00:00
64	Residential dwelling	48 Q	6,89,464	18,47,980	T06	290 m SSE	169.36	00:00
65	Residential dwelling	48 Q	6,89,461	18,47,944	T06	323 m SSE	171.08	00:00
66	Residential dwelling	48 Q	6,89,454	18,47,906	T06	360 m SSE	173.06	00:00
67	Residential dwelling	48 Q	6,89,493	18,47,890	T06	381 m SSE	167.39	00:00
68	Residential dwelling	48 Q	6,89,479	18,47,886	T06	381 m SSE	169.47	00:00
69	Residential dwelling	48 Q	6,89,466	18,47,861	T06	402 m S	171.94	00:00
70	Residential dwelling	48 Q	6,89,538	18,47,877	T06	408 m S	161.53	00:00
71	Residential dwelling	48 Q	6,89,518	18,47,912	T06	367 m S	162.60	00:00
72	Residential dwelling	48 Q	6,89,511	18,47,947	T06	332 m SSE	161.97	00:00
73	Residential dwelling	48 Q	6,89,537	18,48,032	T06	263 m SSE	150.78	01:56
74	Residential dwelling	48 Q	6,89,564	18,47,961	T06	338 m SSE	152.72	00:00
75	Residential dwelling	48 Q	6,89,578	18,47,965	T06	340 m SSE	150.19	00:00
76	Residential dwelling	48 Q	6,89,611	18,47,981	T06	346 m SE	144.24	00:59
77	Residential dwelling	48 Q	6,89,599	18,47,984	T06	338 m SE	145.66	00:54
78	Residential dwelling	48 Q	6,89,589	18,48,016	T06	306 m SE	143.75	02:01
79	Residential dwelling	48 Q	6,89,610	18,48,013	T06	322 m SE	141.19	02:08
80	Residential dwelling	48 Q	6,89,571	18,48,041	T06	275 m SE	144.03	02:41
81	Residential dwelling	48 Q	6,89,598	18,48,053	T06	283 m SE	137.74	03:12
82	Residential dwelling	48 Q	6,89,599	18,48,079	T06	266 m SE	133.77	03:39
83	Residential dwelling	48 Q	6,89,593	18,48,114	T06	238 m SE	128.48	03:46
84	Residential dwelling	48 Q	6,89,590	18,48,131	T06	225 m SE	124.97	03:57
85	Residential dwelling	48 Q	6,89,611	18,48,120	T06	249 m SE	124.96	03:56
86	Residential dwelling	48 Q	6,89,633	18,47,966	T06	378 m SE	142.82	00:41
87	Residential dwelling	48 Q	6,89,557	18,47,934	T06	365 m SSE	155.49	00:00
88	Residential dwelling	48 Q	6,89,606	18,47,931	T06	392 m SSE	148.12	00:00
89	Residential dwelling	48 Q	6,89,615	18,47,888	T06	432 m SSE	151.03	00:00
90	Residential dwelling	48 Q	6,89,572	18,47,858	T06	443 m SSE	157.03	00:00
91	Residential dwelling	48 Q	6,89,624	18,47,871	T06	446 m SSE	151.12	00:00
92	Residential dwelling	48 Q	6,89,610	18,47,856	T06	459 m SSE	153.70	00:00
93	Residential dwelling	48 Q	6,89,610	18,47,907	T06	416 m SSE	150.34	00:00
94	Residential dwelling	48 Q	6,89,726	18,48,085	T06	373 m ESE	150.34	06:04
95	Residential dwelling	48 Q	6,89,736	18,48,065	T06	390 m SE	121.41	01:54
96	Residential dwelling	48 Q	6,89,740	18,48,021	T06	418 m SE	126.28	02:54
97	Residential dwelling	48 Q	6,88,781	18,48,426	T09	220 m ESE	99.12	62:08
98	Residential dwelling	48 Q	6,88,745	18,48,389	T09	198 m SE	111.18	46:23
99	Residential dwelling	48 Q	6,88,775	18,48,357	T09	236 m SE	116.12	25:36
100	Residential dwelling	48 Q	6,88,787	18,48,392	T09	236 m SE	107.12	45:39
101	Residential dwelling	48 Q	6,88,259	18,48,125	T09	462 m SW	223.44	01:10
102	Residential dwelling	48 Q	6,88,229	18,48,108	T09	484.53 SW	223.81	01:05

Shadow Receptor Code	Type of Receptor based on satellite information (1)	Zone	UTM Co-ordinates mE	UTM Co-ordinates mN	Nearest WTG	Approximate Distance from Nearest WTG [m]	Direction from WTG (Degree)	Real Case Scenario Shadow hours per year [hr/year] *
103	Residential dwelling	48 Q	6,88,265	18,48,072	T09	489.84 SW	217.57	01:12
104	Residential dwelling	48 Q	6,87,605	18,49,122	T10	384 m NW	325.07	02:36
105	Residential dwelling	48 Q	6,87,637	18,49,150	T10	390 m NNW	331.17	02:57
106	Residential dwelling	48 Q	6,87,599	18,49,138	T10	402 m NNW	326.03	02:35
107	Residential dwelling	48 Q	6,87,587	18,49,231	T10	481 m NNW	151.03	03:05
108	Residential dwelling	48 Q	6,87,449	18,48,997	T11	221 m ENE	209.10	00:00
109	Residential dwelling	48 Q	6,87,472	18,48,971	T11	209 m NE	216.83	16:52
110	Residential dwelling	48 Q	6,87,489	18,48,937	T11 and T10	195 m NE and 363 m NNW	227.82 and 291.22	36:11
111	Residential dwelling	48 Q	6,87,505	18,48,918	T11 and T10	194 m ENE and 342 m NNW	234.99 and 291.42	51:21
112	Residential dwelling	48 Q	6,87,484	18,48,881	T11 and T10	157 m ENE and 352 m NNW	241.43 and 351.77	82:47
113	Residential dwelling	48 Q	6,87,579	18,48,778	T11 and T10	236.33 m ESE and 277 m W	276.93 and 263.95	52:44
114	Residential dwelling	48 Q	6,87,513	18,48,783	T11 and T10	170 m ESE and 323 m W	277.93 and 263.07	67:31
115	Residential dwelling	48 Q	6,87,510	18,48,760	T11 and T10	169 m ESE and 322 m W	286.04 and 265.59	58:40
116	Residential dwelling	48 Q	6,87,547	18,48,718	T11 and T10	215 m SE and 320 m W	292.64 and 261.47	56:16
117	Residential dwelling	48 Q	6,87,568	18,48,692	T11 and T10	251 m SE and 320 m W	297.82 and 261.66	51:37
118	Residential dwelling	48 Q	6,87,610	18,48,703	T11	285 m ESE	291.97	28:59
119	Residential dwelling	48 Q	6,87,631	18,48,653	T11	325 m ESE	298.22	10:26
120	Residential dwelling	48 Q	6,87,567	18,48,640	T11	277 m SE and 315 m SSW	307.42 and 237.69	30:58
121	Residential dwelling	48 Q	6,87,535	18,48,646	T12	252 m ENE and 242 m SSW	70.43 and 241.63	45:33
122	Residential dwelling	48 Q	6,87,518	18,48,635	T12	231 m ENE and 358 m SW	72.37 and 241.20	48:11
123	Residential dwelling	48 Q	6,87,912	18,48,436	T10	375 m S	168.14	13:33
124	Residential dwelling	48 Q	6,87,946	18,48,327	T10	488 m S	166.80	07:21
125	Residential dwelling	48 Q	6,87,435	18,48,950	T10	172 m NE	32.27	08:15
126	Residential dwelling	48 Q	6,87,351	18,48,952	T10	148 m NNE	2.70	13:47
127	Residential dwelling	48 Q	6,87,804	18,49,051	T10	146 m NNE	3.05	17:41
128	Residential dwelling	48 Q	6,87,794	18,48,984	T10	178 m N	350.04	20:37
129	Residential dwelling	48 Q	6,87,687	18,48,986	T10	228 m NNW	321.81	06:14
130	Residential dwelling	48 Q	6,87,588	18,49,027	T10	321 m NE	47.87	00:00
131	High School	48 Q	6,87,668	18,49,047	T11	292 m NNW	326.37	05:31
132	Health care Centre	48 Q	6,87,744	18,49,091	T11	290 m N	343. 26	03:56
133	Kindergarten	48 Q	6,87,536	18,48,860	T11	499 m ENE	99.59	53:14

Total Number of receptors based on Google Earth Analysis= 133

Table 2.2 Shadow Flicker Analysis at Each Receptor HL2 (Figures highlighted and bold represent greater than 30 hours per year of shadow flicker)

Shadow Receptor Code	Type of Receptor based on satellite information (1)	Zone	UTM Co-ordinates mE	UTM Co-ordinates mN	Nearest WTG	Approximate Distance from Nearest WTG [m]	Direction from WTG (Degree)	Real Case Scenario Shadow hours per year [hr/year] *
A	Residential dwelling	48 Q	6,88,253	18,49,042	W14	82 m SSE	151.51	20:31
B	Residential dwelling	48 Q	6,88,310	18,49,048	W14	116 m SE	125.04	14:33
C	Residential dwelling	48 Q	6,88,350	18,49,054	W14	151 m SE	114.53	17:43
D	Residential dwelling	48 Q	6,88,399	18,49,067	W14	193 m ESE	105.07	16:01
E	Residential dwelling	48 Q	6,88,437	18,49,076	W14	228 m ESE	100.45	26:54
F	Residential dwelling	48 Q	6,88,859	18,48,689	W03	315 m WNW	272.62	16:59
G	Residential dwelling	48 Q	6,88,827	18,48,649	W03	351m W	264.82	06:23
H	Residential dwelling	48 Q	6,88,881	18,48,589	W03	305 m W	253.01	13:34
I	Residential dwelling	48 Q	6,89,752	18,49,060	W01	72 m NW	301.48	17:10
J	Residential dwelling	48 Q	6,89,722	18,49,054	W01	97 m NW	288.88	29:03
K	Residential dwelling	48 Q	6,89,730	18,49,022	W01	83 m W	269.05	32:42
L	Residential dwelling	48 Q	6,89,547	18,48,974	W01	300 m W	260.44	41:47
M	Residential dwelling	48 Q	6,89,440	18,48,883	W01	396 WSW	249.65	03:28
N	Residential dwelling	48 Q	6,89,495	18,48,979	W01	315 m WSW	258.40	04:55
O	Residential dwelling	48 Q	6,89,489	18,49,012	W01	323 m W	268.23	04:52
P	Residential dwelling	48 Q	6,89,467	18,49,027	W01	227 m NW	281.64	04:07
Q	Residential dwelling	48 Q	6,89,481	18,49,092	W01	345 m NW	277.64	05:22
R	Residential dwelling	48 Q	6,89,440	18,49,066	W01	378 m NW	276.88	05:55
S	Residential dwelling	48 Q	6,89,427	18,49,095	W01	395 m NW	281.05	08:00
T	Residential dwelling	48 Q	6,89,471	18,49,129	W01	357 m WNW	287.42	11:16
U	Residential dwelling	48 Q	6,89,406	18,49,140	W01	423 m NW	286.30	13:53
V	Residential dwelling	48 Q	6,89,397	18,49,170	W01	440 m NW	289.84	13:32
W	Residential dwelling	48 Q	6,89,872	18,48,986	W04	480 m WSW	263.02	11:43
X	Residential dwelling	48 Q	6,90,427	18,48,716	W04	345 m S	167.01	03:31
Y	Residential dwelling	48 Q	6,90,466	18,48,631	W04	440 m S	163.94	08:43
Z	Residential dwelling	48 Q	6,90,382	18,48,667	W04	385 m S	174.71	07:59
AA	Residential dwelling	48 Q	6,90,278	18,48,761	W04	295 m SW	193.17	05:52
AB	Residential dwelling	48 Q	6,89,995	18,48,848	W01	399 m WSW	240.63	05:32
AC	Residential dwelling	48 Q	6,89,948	18,48,886	W01	195 m WSW	135.87	05:40
AD	Residential dwelling	48 Q	6,89,972	18,48,921	W01	190 m SE	123.04	05:18
AE	Residential dwelling	48 Q	6,89,944	18,48,801	W01	260 m SSE	150.31	04:34
AF	Residential dwelling	48 Q	6,89,957	18,48,846	W01	230 m SSE	141.77	05:15
AG	Residential dwelling	48 Q	6,89,974	18,48,874	W01	222 m SE	133.70	18:12
AH	Residential dwelling	48 Q	6,89,965	18,48,948	W01	171 m SE	116.99	37:22
AI	Residential dwelling	48 Q	6,89,928	18,48,920	W01	167 m SSE	135.19	49:52
AJ	Residential dwelling	48 Q	6,89,902	18,48,941	W01	132 m SSE	134.33	28:04
AK	Residential dwelling	48 Q	6,89,958	18,48,858	W01	221 m SSE	139.67	24:33
AL	Residential dwelling	48 Q	6,89,886	18,48,964	W01	88 m SSE	130.10	36:29
AM	Residential dwelling	48 Q	6,89,886	18,49,033	W01	75 m ESE	84.65	46:00

Total Number of receptors based on Google Earth Analysis= 39

(1) The receptors that were identified for this study was obtained from Google earth Imagery dated 04/09/ 2017.

2.5 IMPACT ASSESSMENT

2.5.1 *Potential shadow flicker impact due to HL1 project*

Given the guidelines of 30 hours or less per year is considered to be acceptable, the operation of the wind farm theoretically results in shadow flicker impacts that could be considered as significant for the purposes of this study. The results show that theoretical shadow flickers in real case scenario occur at 35 shadow receptors. The maximum shadow flicker occurs at receptor '112', located close to the wind turbines *T11* and *T10*, with a maximum of 82:47 hr/year followed by receptor '49', located close to wind turbine *T09*, with a maximum of 75:07 hr/ year, followed '114' (located close to *T11 and T10*) with 67:31 hr. The other receptors are highlighted in ***Table 2.1.***

2.5.2 *Potential cumulative impacts due to HL2 project*

Potential cumulative impacts within the HL1 wind farm have been envisaged at receptors '11' (32:42 hr/ year), '12' (41:47 hr/ year) caused by the interaction between WTGs T14 and T15. Cumulative impacts are also envisaged at Receptors '110' (36:11 hr/ year), '111' (51:21 hr/ year), '112' (82:47 hr/ year), '113' (52:44 hr/ year), '114 (67: 31 hr/ year), '115' (58:40 hr/ year), '116' (56:16 hr/ year) and 117 hr/ year). With regards to the HL2 windfarm, there is likelihood that receptor '133' may experience shadow flicker impacts as a result of the interaction between WTG T11 (of HL1 wind farm) and W14 (of HL2 wind farm).

It is relevant to emphasise that predicted hours of shadow flicker effects are real case scenarios with certain assumptions. Assumptions made during the analysis include optimal meteorological, natural light and geometrical conditions for the generation of shadow flicker. The assessment does not account for trees or other obstructions that intervene between receptor and turbine during times when effects may occur. The assessment calculation is therefore an over estimation in the probability of effects. It should also be noted that for shadow effects to occur, properties need to be occupied, with blinds or curtains open and views to the wind turbine unobstructed. However, for the purposes of assessment, it has been assumed that all worst-case circumstances apply.

Table 2.3 ***Impact Significance of Shadow Flickering pertaining to the HL1 Turbine***

Impact Description	Shadow flicker due to the wind farm							
Impact Nature		Positive				Negative		
Impact Type		Direct				Indirect		
Magnitude		Negligible		Small		Medium		Large
Sensitivity/Vulnerability		Low		Medium		High		
Significance		Negligible		Minor		Moderate		Major

2.5.3 *Mitigation Measures*

- In case the locations have been finalised by the project proponent and earmarked for construction, there needs to be close monitoring through engagement with residents during the operational phase where there are predicted impacts from shadow flicker.
- The likelihood of direct line of sight to the location of proposed turbine locations can be assessed visually and the potential for using screening like higher fencing and planting trees can be explored at problem locations. The use of curtains can also be explored.
- If these prove effective and the impacts mitigated, the shutting down of turbines during certain environmental conditions, which meet the physical requirements for theoretical shadow flicker to occur, will not be required.

Should the impact of shadow flicker be identified, and the mitigation measures proposed above prove ineffective, further analysis can be carried out to identify the exact timings and conditions under which shadow flicker occurs, and a technical solution sought. This is likely to involve pre-programming the turbine with dates and times when shadow flicker would cause a nuisance for nearby receptors. A photosensitive cell can be used to monitor sunlight, and the turbine could potentially then be shut down, when the strength of the sun, wind speed and the angle and position of the sun combines to cause a flicker nuisance.

2.5.4 *Assessment of Residual Impacts*

The results of the windPro shadow flicker assessment show a real case estimate with certain assumptions and the mitigation measures above will be implemented for the identified properties that experiences shadow flicker.

Residual impacts following the application of required mitigation measures, as discussed above, is likely to result in **minor** impacts.

3 BLADE THROW/ BLADE EJECTION ASSESSMENT

3.1 INTRODUCTION

Blade throw events that have been reported worldwide occur as a result of the failure of the rotor blade which thereby results in the ejection or throwing of the rotor blade which can which can endanger people living/working close to the wind farm. Assessment of reports and case studies in the open domain have revealed an increasing trend to locate them in proximity of build-up areas which can endanger people living/working close to the wind farm. Therefore, it becomes strictly necessary to define setback distances and/or buffer zones to minimize the risk of damage or injury from components failure. Research has been conducted in the past to assess the root cause of blade throw incidents and is currently ongoing [1] [2] [3] [4] .

3.2 CONSIDERATIONS AND ASSUMPTIONS

The blade throw/ ejection incidents have been classified into the following based on photographic evidence over the years, modelling studies by various research groups and blade test practices are based on the IEC 61400-23 technical specifications. They have been classified as (a) root connection failure; (b) catastrophic structural buckling or separation; (c) leading edge, trailing edge, or other bond separation; (d) lightening damage; (e) erosion; (f) failure at outboard aerodynamic device; (g) reduction in stiffness of blades (upto to 10 %); (h) superficial structural or delamination/ laminate wrinkling that eventually become permanent leading to damage; and (h) over speeding due to failure of SCADA to rectify the failure or high wind/ cyclonic/ meteorological conditions [5] .

Considering all of the above points, it is difficult to attribute blade throw failure to a single attribute or a combination of attributes, thus leading to these incidents. Therefore, host country regulations in some countries and recommendations to define setback distances and/or buffer zones to minimize the risk of damage or injury from components failure.

(1) Eggwertz S, Carlsson I, Gustafsson A, Linde M, Lundemo C, Montgomerie B, Thor S. Safety of wind energy conversion systems with horizontal axis. Technical Note HU-2229, Flygtekniska Försöksanstalten (FFA—The Aeronautical Research Institute of Sweden), Stockholm, 1981

(2) Eggers AJ, Holley WE, Digumarthi R, Chaney K. Exploratory study of HAWT blade throw risk to nearby people and property. Proceedings of the 2001 ASME Wind Energy Symposium, Reno, Nevada, 2001; 355–367

(3) Montgomerie B. Horizontal axis wind turbine blade failure, blade fragment six degrees of freedom trajectory, site risk level prediction. Fourth International Symposium on Wind Energy Systems, Stockholm, Sweden, HRA Fluid Engineering, 1982; 389–401

(4) Turner D. A Monte Carlo method for determining the risk presented by wind turbine blade failures. Wind Engineering 1986; 11: 1–20

(5) Robinson et al. Study and development of a methodology for the estimation of the risk and harm to persons from wind turbines. 2013. Prepared by MMI Engineering Ltd for the Health and Safety Executive 2013

3.3 *EXISTING STANDARDS FOR BLADE EJECTION/ BLADE THROW*

In the Vietnam context, at present, there is no decided level of setback distance identified to ensure safety of settlements. However, the International Finance Corporation (1) has recommended a setback distance, based on the review of existing literature in this domain, (encompassing the rationale that WTG models have varying dimensions) which is 1.5 x turbine height (tower + rotor radius), although modelling suggests that the theoretical blade throw distance can vary with the size, shape, weight, and speed of the blades, and the height of the turbine. It is therefore recommended that the minimum setback distances required to meet noise and shadow flicker limits be maintained with respect to sensitive residential receptors to provide further protection. The IFC also recommends minimising the probability of a blade failure:

- by selecting wind turbines that have been subject to independent design verification/certification (e.g. IEC 61400-1)
- surveillance of manufacturing quality;
- ensuring that lightning protection systems are properly installed and maintained.

Recommendations also include carrying out periodic blade inspections and repair any defects that could affect blade integrity and equipping wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.

3.4 *QUALITATIVE BLADE THROW ASSESSMENT METHODOLOGY*

The qualitative blade throw assessment encompasses the rationale that has been proposed by the IFC pertaining to setback distances which is 1.5 x turbine height (tower + rotor radius)

The HL1 project comprises 15 wind turbines, as follows:

- 11 x Vestas V110 wind turbines with a hub height of 80 metres.
- 4 x Vestas V90 wind turbines with a hub height of 80 metres.

The HL 2 wind farm project is located in the same area as the HL1 project and comprises 15 wind turbines, each of which is understood to be a Vestas V100.

The theoretical setback distances of the WTGs as per IFC wind guidelines have been presented in ***Table 3.1.*** This information was utilised to independently assess the setback distances of the receptors that were identified using the latest satellite imagery of the Project Area. The qualitative assessment has been elaborated upon in ***Table 3.2.***

(1) EHS guidelines for wind energy, IFC, August 7, 2015

Table 3.1 ***Setback distances adopted for the HL1 and HL2 turbines as per IF Wind EHS guidelines***

WTG Model	Project	Tower height	Rotor Radius	Calculated setback distances in metres as per IF Wind EHS guidelines (1)
Vestas V110	HL1	80 m	55m	202.5 m
Vestas V90	HL1	80m	45 m	187.5 m
Vestas V100	HL2	80 m	40 m	180 m

Source: EHS guidelines for wind energy, IFC, August 7, 2015

(1) https://www.vestas.com/en/products/turbines/v110-2_0_mw#!technical-specifications
https://www.vestas.com/en/products/turbines/v90-2_0_mw
https://www.vestas.com/en/products/turbines/v100-2_0_mw
Accessed 04/02/2018

3.5 *RECEPTORS*

The number of receptors and the setback distance with regard to the HL1 wind farm has been elaborated upon in ***Table 3.2.***

(1) EHS guidelines for wind energy, IFC, August 7, 2015

Table 3.2 Assessment of Receptors within the setback distance of HL1 WTGs

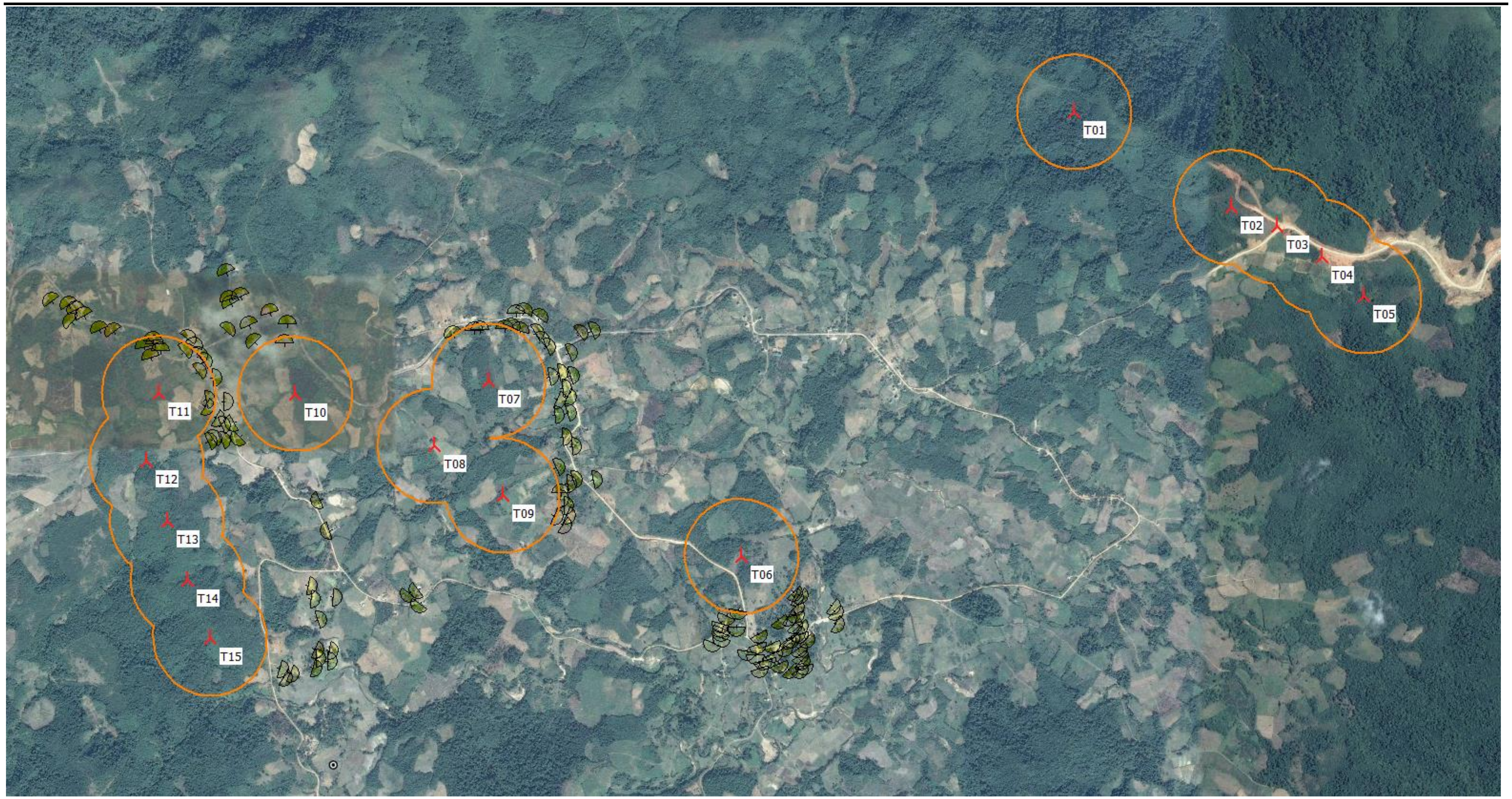
Receptor	Type of Receptor based on satellite information (1)	Zone	UTM Co-ordinates mE	UTM Co-ordinates mN	Turbine Model	Nearest WTG	Approximate Distance from Nearest WTG [m]	Direction from WTG (Degree)	Potential Impact to Blade Throw
55	Residential dwelling	48 Q	6,89,394	18,48,064	Vestas V110	T06	208 m SSW	184.13	No perceivable Impact
56	Residential dwelling	48 Q	6,89,354	18,48,043	Vestas V110	T06	228 m SW	193.63	No perceivable Impact
57	Residential dwelling	48 Q	6,89,334	18,48,015	Vestas V110	T06	266 m SW	200	No perceivable Impact
58	Residential dwelling	48 Q	6,89,337	18,48,000	Vestas V110	T06	270 m SW	195.03	No perceivable Impact
59	Residential dwelling	48 Q	6,89,333	18,47,986	Vestas V110	T06	285 m SW	195.13	No perceivable Impact
60	Residential dwelling	48 Q	6,89,387	18,48,004	Vestas V110	T06	259 m S	184.83	No perceivable Impact
61	Residential dwelling	48 Q	6,89,337	18,47,964	Vestas V110	T06	307 m SW	193.43	No perceivable Impact
62	Residential dwelling	48 Q	6,89,302	18,47,949	Vestas V110	T06	330 m SW	198.97	No perceivable Impact
63	Residential dwelling	48 Q	6,89,423	18,47,921	Vestas V110	T06	342 m SW	177.83	No perceivable Impact
64	Residential dwelling	48 Q	6,89,464	18,47,980	Vestas V110	T06	290 m SSE	169.36	No perceivable Impact
65	Residential dwelling	48 Q	6,89,461	18,47,944	Vestas V110	T06	323 m SSE	171.08	No perceivable Impact
66	Residential dwelling	48 Q	6,89,454	18,47,906	Vestas V110	T06	360 m SSE	173.06	No perceivable Impact
67	Residential dwelling	48 Q	6,89,493	18,47,890	Vestas V110	T06	381 m SSE	167.39	No perceivable Impact
68	Residential dwelling	48 Q	6,89,479	18,47,886	Vestas V110	T06	381 m SSE	169.47	No perceivable Impact
69	Residential dwelling	48 Q	6,89,466	18,47,861	Vestas V110	T06	402 m S	171.94	No perceivable Impact
70	Residential dwelling	48 Q	6,89,538	18,47,877	Vestas V110	T06	408 m S	161.53	No perceivable Impact
71	Residential dwelling	48 Q	6,89,518	18,47,912	Vestas V110	T06	367 m S	162.6	No perceivable Impact
72	Residential dwelling	48 Q	6,89,511	18,47,947	Vestas V110	T06	332 m SSE	161.97	No perceivable Impact
73	Residential dwelling	48 Q	6,89,537	18,48,032	Vestas V110	T06	263 m SSE	150.78	No perceivable Impact
74	Residential dwelling	48 Q	6,89,564	18,47,961	Vestas V110	T06	338 m SSE	152.72	No perceivable Impact
75	Residential dwelling	48 Q	6,89,578	18,47,965	Vestas V110	T06	340 m SSE	150.19	No perceivable Impact
76	Residential dwelling	48 Q	6,89,611	18,47,981	Vestas V110	T06	346 m SE	144.24	No perceivable Impact
77	Residential dwelling	48 Q	6,89,599	18,47,984	Vestas V110	T06	338 m SE	145.66	No perceivable Impact
78	Residential dwelling	48 Q	6,89,589	18,48,016	Vestas V110	T06	306 m SE	143.75	No perceivable Impact
79	Residential dwelling	48 Q	6,89,610	18,48,013	Vestas V110	T06	322 m SE	141.19	No perceivable Impact
80	Residential dwelling	48 Q	6,89,571	18,48,041	Vestas V110	T06	275 m SE	144.03	No perceivable Impact
81	Residential dwelling	48 Q	6,89,598	18,48,053	Vestas V110	T06	283 m SE	137.74	No perceivable Impact
82	Residential dwelling	48 Q	6,89,599	18,48,079	Vestas V110	T06	266 m SE	133.77	No perceivable Impact
83	Residential dwelling	48 Q	6,89,593	18,48,114	Vestas V110	T06	238 m SE	128.48	No perceivable Impact
84	Residential dwelling	48 Q	6,89,590	18,48,131	Vestas V110	T06	225 m SE	124.97	No perceivable Impact
85	Residential dwelling	48 Q	6,89,611	18,48,120	Vestas V110	T06	249 m SE	124.96	No perceivable Impact
86	Residential dwelling	48 Q	6,89,633	18,47,966	Vestas V110	T06	378 m SE	142.82	No perceivable Impact
87	Residential dwelling	48 Q	6,89,557	18,47,934	Vestas V110	T06	365 m SSE	155.49	No perceivable Impact
88	Residential dwelling	48 Q	6,89,606	18,47,931	Vestas V110	T06	392 m SSE	148.12	No perceivable Impact
89	Residential dwelling	48 Q	6,89,615	18,47,888	Vestas V110	T06	432 m SSE	151.03	No perceivable Impact
90	Residential dwelling	48 Q	6,89,572	18,47,858	Vestas V110	T06	443 m SSE	157.03	No perceivable Impact
91	Residential dwelling	48 Q	6,89,624	18,47,871	Vestas V110	T06	446 m SSE	151.12	No perceivable Impact
92	Residential dwelling	48 Q	6,89,610	18,47,856	Vestas V110	T06	459 m SSE	153.7	No perceivable Impact
93	Residential dwelling	48 Q	6,89,610	18,47,907	Vestas V110	T06	416 m SSE	150.34	No perceivable Impact
94	Residential dwelling	48 Q	6,89,726	18,48,085	Vestas V110	T06	373 m ESE	150.34	No perceivable Impact
95	Residential dwelling	48 Q	6,89,736	18,48,065	Vestas V110	T06	390 m SE	121.41	No perceivable Impact
96	Residential dwelling	48 Q	6,89,740	18,48,021	Vestas V110	T06	418 m SE	126.28	No perceivable Impact
25	Residential dwelling	48 Q	6,88,465	18,49,039	Vestas V110	T07	184 m N	344.99	Potential Impact
26	Residential dwelling	48 Q	6,88,488	18,49,041	Vestas V110	T07	182 m N	351.72	Potential Impact
27	Residential dwelling	48 Q	6,88,575	18,49,044	Vestas V110	T07	192 m NNE	18.42	Potential Impact
28	Residential dwelling	48 Q	6,88,598	18,49,052	Vestas V110	T07	208 m NE	23.44	No perceivable Impact
29	Residential dwelling	48 Q	6,88,615	18,49,100	Vestas V110	T07	257 m NE	23.13	No perceivable Impact
30	Residential dwelling	48 Q	6,88,644	18,49,107	Vestas V110	T07	280 m NE	28.19	No perceivable Impact
31	Residential dwelling	48 Q	6,88,697	18,49,087	Vestas V110	T07	292 m NE	39.08	No perceivable Impact
32	Residential dwelling	48 Q	6,88,628	18,49,040	Vestas V110	T07	214 m NE	32.69	No perceivable Impact
33	Residential dwelling	48 Q	6,88,684	18,49,032	Vestas V110	T07	242 m ENE	45.16	No perceivable Impact

(1) The receptors that were identified for this study was obtained from Google earth Imagery dated 04/09/ 2017.

Receptor	Type of Receptor based on satellite information (1)	Zone	UTM Co-ordinates mE	UTM Co-ordinates mN	Turbine Model	Nearest WTG	Approximate Distance from Nearest WTG [m]	Direction from WTG (Degree)	Potential Impact to Blade Throw
34	Residential dwelling	48 Q	6,88,701	18,49,008	Vestas V110	T07	236 m ENE	52.3	No perceivable Impact
35	Residential dwelling	48 Q	6,88,723	18,48,985	Vestas V110	T07	243 m ENE	59.52	No perceivable Impact
36	Residential dwelling	48 Q	6,88,839	18,49,031	Vestas V110	T07	366 m NE	62.79	No perceivable Impact
37	Residential dwelling	48 Q	6,88,882	18,49,043	Vestas V110	T07	412 m ENE	64.26	No perceivable Impact
38	Residential dwelling	48 Q	6,88,800	18,48,966	Vestas V110	T07	303 m ENE	70.08	No perceivable Impact
39	Residential dwelling	48 Q	6,88,765	18,48,893	Vestas V110	T07	251 m E	83.51	No perceivable Impact
40	Residential dwelling	48 Q	6,88,806	18,48,882	Vestas V110	T07	258 m E	88.11	No perceivable Impact
41	Residential dwelling	48 Q	6,88,732	18,48,880	Vestas V110	T07	217 m E	85.4	No perceivable Impact
42	Residential dwelling	48 Q	6,88,780	18,48,839	Vestas V110	T07	266 m E	95.59	No perceivable Impact
43	Residential dwelling	48 Q	6,88,759	18,48,798	Vestas V110	T07	251 m E	104.9	No perceivable Impact
44	Residential dwelling	48 Q	6,88,797	18,48,751	Vestas V110	T07	303 m ESE	112.21	No perceivable Impact
45	Residential dwelling	48 Q	6,88,750	18,48,745	Vestas V110	T07	239 m ESE	121.61	No perceivable Impact
46	Residential dwelling	48 Q	6,88,795	18,48,810	Vestas V110	T07	283 m ESE	101.36	No perceivable Impact
24	Residential dwelling	48 Q	6,88,394	18,49,022	Vestas V110	T07	215 m NW	316.02	No perceivable Impact
47	Residential dwelling	48 Q	6,88,776	18,48,669	Vestas V110	T09	300m NE	225.77	No perceivable Impact
48	Residential dwelling	48 Q	6,88,811	18,48,635	Vestas V110	T09	208 m NE	55.38	No perceivable Impact
49	Residential dwelling	48 Q	6,88,754	18,48,561	Vestas V110	T09	218 m ENE	63.79	No perceivable Impact
50	Residential dwelling	48 Q	6,88,813	18,48,519	Vestas V110	T09	360 m ENE	77.99	No perceivable Impact
51	Residential dwelling	48 Q	6,88,793	18,48,503	Vestas V110	T09	235 m ENE	80.43	No perceivable Impact
52	Residential dwelling	48 Q	6,88,770	18,48,469	Vestas V110	T09	212 m E	88.47	No perceivable Impact
53	Residential dwelling	48 Q	6,88,767	18,48,448	Vestas V110	T09	208 m E	94.43	No perceivable Impact
54	Residential dwelling	48 Q	6,88,885	18,48,519	Vestas V110	T09	330 m ENE	80.55	No perceivable Impact
97	Residential dwelling	48 Q	6,88,781	18,48,426	Vestas V110	T09	220 m ESE	99.12	No perceivable Impact
98	Residential dwelling	48 Q	6,88,745	18,48,389	Vestas V110	T09	198 m SE	111.18	Potential Impact
99	Residential dwelling	48 Q	6,88,775	18,48,357	Vestas V110	T09	236 m SE	116.12	No perceivable Impact
100	Residential dwelling	48 Q	6,88,787	18,48,392	Vestas V110	T09	236 m SE	107.12	No perceivable Impact
101	Residential dwelling	48 Q	6,88,259	18,48,125	Vestas V110	T09	462 m SW	223.44	No perceivable Impact
102	Residential dwelling	48 Q	6,88,229	18,48,108	Vestas V110	T09	484.53 SW	223.81	No perceivable Impact
103	Residential dwelling	48 Q	6,88,265	18,48,072	Vestas V110	T09	489.84 SW	217.57	No perceivable Impact
104	Residential dwelling	48 Q	6,87,605	18,49,122	Vestas V110	T10	384 m NW	325.07	No perceivable Impact
105	Residential dwelling	48 Q	6,87,637	18,49,150	Vestas V110	T10	390 m NNW	331.17	No perceivable Impact
106	Residential dwelling	48 Q	6,87,599	18,49,138	Vestas V110	T10	402 m NNW	326.03	No perceivable Impact
107	Residential dwelling	48 Q	6,87,587	18,49,231	Vestas V110	T10	481 m NNW	151.03	No perceivable Impact
123	Residential dwelling	48 Q	6,87,912	18,48,436	Vestas V110	T10	375 m S	168.14	No perceivable Impact
124	Residential dwelling	48 Q	6,87,946	18,48,327	Vestas V110	T10	488 m S	166.8	No perceivable Impact
127	Residential dwelling	48 Q	6,87,804	18,49,051	Vestas V110	T10	246 m N	355	No perceivable Impact
128	Residential dwelling	48 Q	6,87,794	18,48,984	Vestas V110	T10	178 m N	350.04	Potential Impact
129	Residential dwelling	48 Q	6,87,687	18,48,986	Vestas V110	T10	228 m NNW	321.81	No perceivable Impact
130	Residential dwelling	48 Q	6,87,588	18,49,027	Vestas V110	T10	321 m NE	47.87	No perceivable Impact
125	Residential dwelling	48 Q	6,87,435	18,48,950	Vestas V110	T11	172 m NE	32.27	Potential Impact
126	Residential dwelling	48 Q	6,87,351	18,48,952	Vestas V110	T11	148 m NNE	2.7	Potential Impact
13	Residential dwelling	48 Q	6,86,968	18,49,122	Vestas V110	T11	490 m NW	312.07	No perceivable Impact
14	Residential dwelling	48 Q	6,87,052	18,49,094	Vestas V110	T11	410 m NNW	315.06	No perceivable Impact
15	Residential dwelling	48 Q	6,87,029	18,49,111	Vestas V110	T11	436 m NNW	316	No perceivable Impact
16	Residential dwelling	48 Q	6,87,038	18,49,049	Vestas V110	T11	372 m NNW	316.28	No perceivable Impact
17	Residential dwelling	48 Q	6,87,083	18,49,073	Vestas V110	T11	373 m NNW	317. 00	No perceivable Impact
18	Residential dwelling	48 Q	6,87,135	18,49,023	Vestas V110	T11	300 m NW	316. 80	No perceivable Impact
19	Residential dwelling	48 Q	6,87,188	18,49,018	Vestas V110	T11	263 m NW	324.48	No perceivable Impact
20	Residential dwelling	48 Q	6,87,297	18,48,964	Vestas V110	T11	165 m NNW	344.26	Potential Impact
21	Residential dwelling	48 Q	6,87,324	18,48,988	Vestas V110	T11	185 m N	354.55	Potential Impact
22	Residential dwelling	48 Q	6,87,332	18,48,975	Vestas V110	T11	172 m N	176.34	Potential Impact
108	Residential dwelling	48 Q	6,87,449	18,48,997	Vestas V110	T11	221 m ENE	209.1	No perceivable Impact
109	Residential dwelling	48 Q	6,87,472	18,48,971	Vestas V110	T11	209 m NE	216.83	No perceivable Impact
118	Residential dwelling	48 Q	6,87,610	18,48,703	Vestas V110	T11	285 m ESE	291.97	No perceivable Impact
119	Residential dwelling	48 Q	6,87,631	18,48,653	Vestas V110	T11	325 m ESE	298.22	No perceivable Impact
120	Residential dwelling	48 Q	6,87,567	18,48,640	Vestas V110	T11	277 m SE	307.42	No perceivable Impact
131	High School	48 Q	6,87,668	18,49,047	Vestas V110	T11	292 m NNW	326.37	No perceivable Impact

Receptor	Type of Receptor based on satellite information (1)	Zone	UTM Co-ordinates mE	UTM Co-ordinates mN	Turbine Model	Nearest WTG	Approximate Distance from Nearest WTG [m]	Direction from WTG (Degree)	Potential Impact to Blade Throw
132	Health care Centre	48 Q	6,87,744	18,49,091	Vestas V110	T11	290 m N	343. 26	No perceivable Impact
133	Kindergarten	48 Q	6,87,536	18,48,860	Vestas V110	T11	499 m ENE	99.59	No perceivable Impact
23	Residential dwelling	48 Q	6,87,320	18,48,929	Vestas V110	T11	125 m N	350.18	Potential Impact
110	Residential dwelling	48 Q	6,87,489	18,48,937	Vestas V110	T11	195 m NE	227.82	Potential Impact
111	Residential dwelling	48 Q	6,87,505	18,48,918	Vestas V110	T11	194 m NE	234.99	Potential Impact
112	Residential dwelling	48 Q	6,87,484	18,48,881	Vestas V110	T11	157 m ENE	241.43	Potential Impact
113	Residential dwelling	48 Q	6,87,579	18,48,778	Vestas V110	T11	236.33 m ESE	276.93	No perceivable Impact
114	Residential dwelling	48 Q	6,87,513	18,48,783	Vestas V110	T11	170 m ESE	277.93	Potential Impact
115	Residential dwelling	48 Q	6,87,510	18,48,760	Vestas V110	T11	169 m ESE	286.04	Potential Impact
116	Residential dwelling	48 Q	6,87,547	18,48,718	Vestas V110	T11	215 m SE	292.64	No perceivable Impact
117	Residential dwelling	48 Q	6,87,568	18,48,692	Vestas V110	T11	251 m SE m W	297.82	No perceivable Impact
121	Residential dwelling	48 Q	6,87,535	18,48,646	Vestas V110	T12	252 m ENE	70.43	No perceivable Impact
122	Residential dwelling	48 Q	6,87,518	18,48,635	Vestas V110	T12	231 m ENE	72.37	No perceivable Impact
1	Residential dwelling	48 Q	6,87,882	18,47,842	Vestas V110	T15	375 m SE	107	No perceivable Impact
2	Residential dwelling	48 Q	6,87,938	18,47,866	Vestas V110	T15	428 m ESE	101.22	No perceivable Impact
3	Residential dwelling	48 Q	6,87,897	18,47,877	Vestas V110	T15	389 m ESE	100.43	No perceivable Impact
4	Residential dwelling	48 Q	6,87,942	18,47,904	Vestas V110	T15	417 m ESE	95.36	No perceivable Impact
5	Residential dwelling	48 Q	6,87,956	18,48,093	Vestas V110	T15	452 m ENE	71.12	No perceivable Impact
7	Residential dwelling	48 Q	6,87,778	18,47,809	Vestas V110	T15	283 m SE	118.99	No perceivable Impact
8	Residential dwelling	48 Q	6,87,803	18,47,820	Vestas V110	T15	304 m SE	114.81	No perceivable Impact
9	Residential dwelling	48 Q	6,87,892	18,47,906	Vestas V110	T15	380 m ESE	96.34	No perceivable Impact
10	Residential dwelling	48 Q	6,87,901	18,48,011	Vestas V110	T15	390 m ENE	80.31	No perceivable Impact
11	Residential dwelling	48 Q	6,87,879	18,48,084	Vestas V110	T15	396 m ENE and 425 m SE	68.21 and 91.81	No perceivable Impact
12	Residential dwelling	48 Q	6,87,871	18,48,131	Vestas V110	T15	400 m NE and 428 m SE	62.59 and 91.58	No perceivable Impact
6	Residential dwelling	48 Q	6,87,764	18,47,836	Vestas V110	T15	265 m SE	114.34	No perceivable Impact
	Total Number of receptors based on Google Earth Analysis= 133								

Figure 3.1 Receptors within potential impact zone of blade throw of HL1 project



3.6 IMPACT ASSESSMENT

The impacts from blade throw may result in various scenarios as property damage, injuries and/or fatality depending on where the missile/fragment lands. It might not affect any property or person if it lands on vacant land. The probability of fatality within occupied properties would also be subject to Impact Impulse, type of structure, number of occupants at the time of the impact etc (coverage beyond the scope of this qualitative study).

Based on the qualitative analysis of blade throw considering the setback distance as proposed by the IFC in ***Table* 3.2,** blade throw impacts are envisaged at 16 receptors out of total 133 receptors identified around the proposed wind turbines of HL1 project, which are located between 125 m to 198 m from the nearest wind turbines (T07, T09, T10,and T11,). As can be observed from ***Figure 3.1 and Table 3.2***, Turbine T-11 has the largest number of receptors ie 11 receptors within the impact zone followed by T-07 (3 receptors), T-09 (1 receptor) and T-10 (1 receptor).

Although the incident data for blade isn't extensive, there are now over 200,000 turbine years of operating experience in Europe for which reliable data is available. This includes around 100 incidents of blade failure in Europe over the period 1995 to 2009. The failure frequency per 1 MW turbine per year = 5 x 10^{-4} blade failures/turbine /year[1]. Note however, this approach cannot be used to identify the blade failure frequency as a function of WT power rating.

Table 3.3 Significance of impacts of blade throw

Impact Description	Impacts of blade throw							
Impact Nature		Positive				Negative		
Impact Type		Direct				Indirect		
Magnitude		Negligible		Small		Medium		Large
Sensitivity/Vulnerability		Low		Medium		High		
Significance		Negligible		Minor		Moderate		Major

Based on the above the significance of the impact is assessed to be **moderate**.

3.6.1 *Mitigation/Management Measures*

Mitigation measures, in this case, would be possibly to relocate the proposed WTG locations, specifically for WTG's T-11 which has maximum number of receptors in the Section 7.4.1. Although the IFC suggests a setback distance for

[1] [1] Study and development of a methodology for the estimation of the risk and harm to persons from wind turbines. HSE Report No. RR968, 2013

avoiding blade throw impact in the EHS guidelines for wind power projects, a more holistic approach would be to establish a setback distance of about 300 m or more to encompass the findings in the shadow flicker and noise modelling studies.

If relocation of either turbines or receptors are not feasible options the potential risk reduction options to consider include:

- 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.
- Carry out periodic blade inspections and repair any defects that could affect blade integrity.
- Ensure that lightning protection systems are properly installed and maintained.
- Equipping wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary.
- Create awareness amongst the community about any potential impacts and bringing to immediate notice of the client any abnormal sound/changes noticed by the residents regarding operations of the turbines.
- The disaster management cell of the local administrative unit/ district administration and the nearest fire-service station should be involved in preparedness for emergency situation.

3.6.2 *Assessment of Residual Impacts*

Residual impacts following the application of required mitigation measures, as discussed above, is likely to result in **minor** impacts.

4 Visual Impact Assessment (Qualitative)

4.1 INTRODUCTION

Visual impact assessment means assessing the impacts on specific views and on the general visual amenity experienced by people. Landscapes are not static but are dynamic, not least due to the range of natural and human factors that define their characteristics, but also due to the many different pressures that have altered landscapes in the past and will continue to do so in the future. Therefore, determining the significance of visual effects identified can be particularly challenging.

4.2 CONSIDERATIONS AND ASSUMPTIONS

Visual impacts relate to changes that arise in the composition of available views as a result of changes to the landscape, to people's response to any changes, and the overall impacts with respect to visual amenity.

Based on the SRTM data, it is observed that the wind turbines of HL1 project are having site elevation between 472 m to 511 m above mean sea level. It is also noted that there is no major elevation difference between the receptors within 500 m of the wind turbines and the turbines.

4.3 ASSESSMENT METHODOLOGY

Visual impacts relate to changes that arise in the composition of available views as a result of changes to the landscape, to people's response to any changes, and the overall impacts with respect to visual amenity. The methodology followed to identify and assess the significance of and the effect of changes resulting from the project on both the landscape as an environmental resource in its own right, and on people's views and visual amenity is presented in the subsequent section. People have different responses to views and visual amenity depending on their context and purpose, with certain activities specifically associated with the enjoyment of the landscape (e.g., the use of footpaths and tourist routes and attractions) generally more susceptible to change. Residents are also considered to be particularly susceptible to change and the combined effects on a number of residents within an area may also be considered.

4.3.1 Sensitivity of Receptors

Judgements about the sensitivity of visual receptors should be recorded on a scale (e.g., low, medium and high) with clearly stated criteria. ***Table 4.1, Table 4.2*** and ***Table 4.3*** indicate the relative sensitivities of a number of visual receptors.

Figure 4.1 Wind turbines and receptors around HL1 project in topographic map

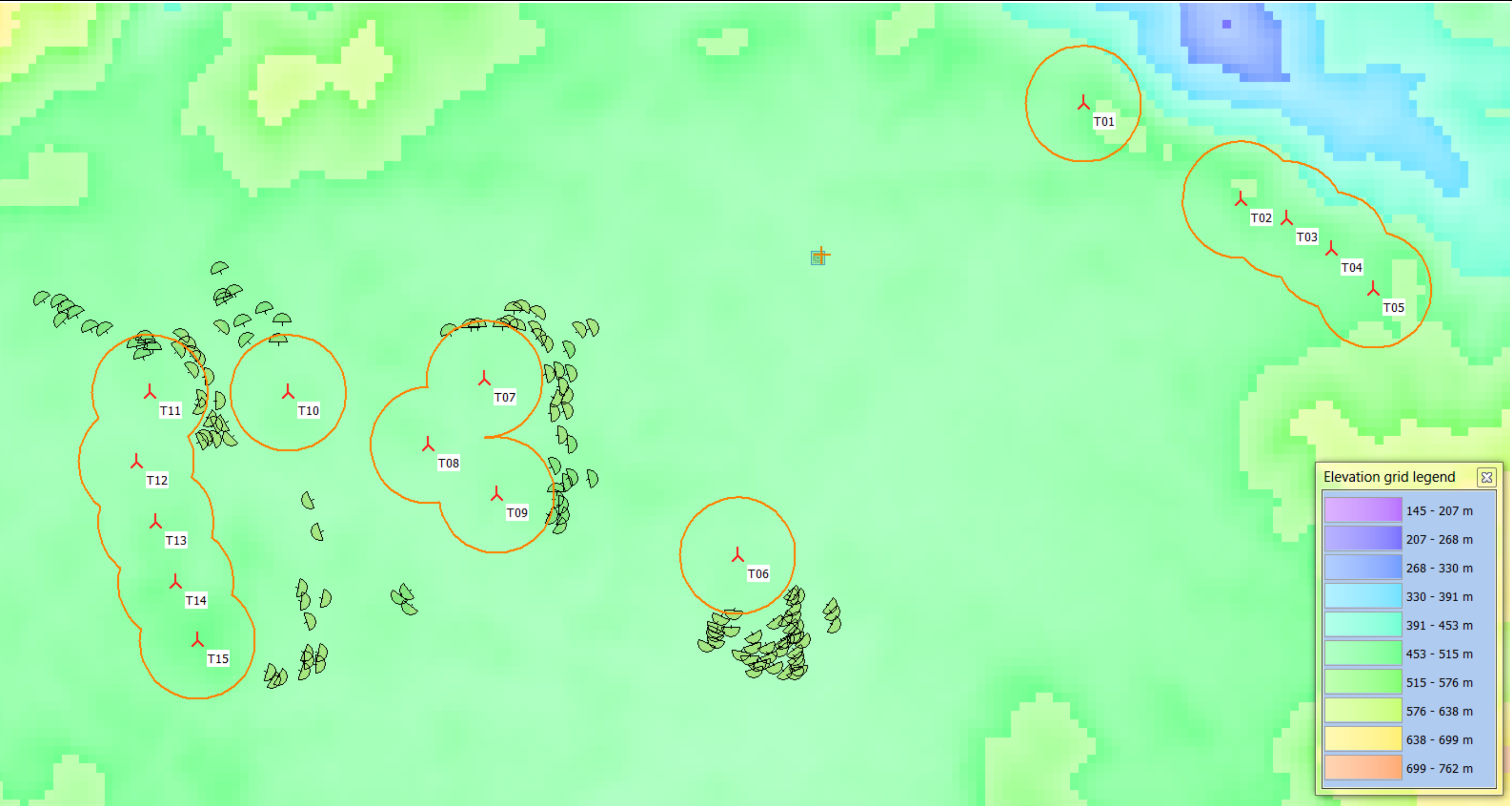


Table 4.1 High Sensitivity Visual Receptors

Visual Receptors	Sensitivity
Users of all outdoor recreational facilities including public rights of ways, whose interest may be focused on the landscape.	High
Communities, settlements, villages where the development results in changes in the landscape setting and valued views.	High
Occupiers of residential properties with views affected by the development.	High

Table 4.2 Medium Sensitivity Visual Receptors

Visual Receptors	Sensitivity
People engaged in outdoor sports or recreation (other the appreciating the landscape.	Medium
People travelling through or past the affected landscape in cars or trains along a recognised scenic route.	Medium
People enjoying passive recreation such as urban viewpoints, locations with scenic views and seating facilities.	Medium

Table 4.3 Low Sensitivity Visual Receptors

Visual Receptors	Sensitivity
People travelling through or past the affected landscape in cars or trains along a recognised commuter route, major road or motorway.	Low
People at their place of work whose attention is focused on their work or	Low

4.3.2 *Magnitude of visual effects*

There is no standard methodology for the scale or magnitude of effects on views and visual amenity. However, it is generally based on the:

- scale of change relating to the loss or addition of features in the view, including the proportion of the view occupied by the proposed development;
- degree of contrast or integration of any new feature or changes in the composition of the view;
- duration of the effect, whether temporary or permanent, intermittent or continuous;
- angle of view in relation to the main activity of the receptor;
- distance of the viewpoint from the Project; and
- extent of the area over which the changes would be visible.

As there is likely to be a variation in the degree of visibility of the Project, it is helpful to categorise these variations.

Box 4.1 *Points to consider during the visual aesthetics assessment*

The extent of the view that would be occupied by the Project: full, partial, glimpse etc. The distance of the viewpoint from the Project and whether the viewer would focus on the Project due to proximity or the Project would form one element in a particular view.	The proportion of the Project or particular features that would be visible: full, most, small amount, none. Whether the view is transient or one of a sequence of views as from a moving vehicle or footpath.

Consideration may also be given to the time of day and seasonal differences in effects. The worst case may need to be demonstrated (i.e., during winter, when the extent of leaf cover is minimal). The typical criteria and thresholds in determining the magnitude of effect on visual receptors are set out in ***Table 4.4.***

Table 4.4 *Visual Magnitude of Effect*

Visual Magnitude of effect	Typical criteria and thresholds
Negligible	A change which is barely or rarely perceptible, at very long distance, or visible for a short duration, perhaps at an oblique angle, or which blends in with the existing view. The change may be short term.
Small	A subtle change in the view, at long distances, or visible for a short distance, perhaps at an oblique angle, or which blends in with the existing view. The change may be short term.
Medium	A noticeable change in the view at an intermediate distance, affecting a substantial part of the view, part a more wide-ranging, less concentrated change across an expansive area. The change may be medium to long term and may not be reversible.
Large	A clearly evident change in the view at a close distance, affecting a substantial part of the view, continuously visible for a long duration, or obstructing important elements of the view. The change may be medium to long term and would not be reversible.

4.3.3 Significance of visual effects

When determining the significance of visual effects, the following is taken into account:

- Large scale changes which introduce new discordant or intrusive elements into the view are more likely to be significant than small changes or changes involving features already present in the view;
- Changes in views from recognised and important viewpoints or amenity routes are likely to be more significant than changes affecting less important paths and roads; and
- Changes affecting large numbers of people are generally more significant than those affecting a relatively small group of users. However, in wilderness landscapes the sensitivity of the people who use the areas may be very high and this will be reflected in the significance of effect.

The significance matrix below illustrates the relationship between the sensitivity of a visual receptor and the magnitude of the visual effect. The significance of a visual effect may be adverse or beneficial dependent upon the nature of the change. Each case is assessed on its own merits using professional judgement and experience, and there is no defined boundary between levels of effects. What level of effect constitutes a **significant** effect will vary on a project by project basis.

Figure 4.2 ***The significance matrix below illustrates the relationship between the sensitivity of a visual receptor and the magnitude of the visual effect***

		Sensitivity of Visual Receptor		
		Low	Medium	High
Magnitude of Visual Effect	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

4.4 *PROJECT CHARACTERISTICS AND SITE SETTING*

As stated in the report, the HL1 wind farm comprises of 15 wind turbines with a hub height of 80 m. The wind farm is spread across an aerial distance of approximately 5 km. From the technical specifications of the Vestas V110 and V90 turbines which is the scope of this assessment[1)] , the tower type is tubular steel tower and turbines have rotating blades of 54 m length. The typical turbine colour is white and has aviation markings on the blades.

4.4.1 *Site Settings*

Based on review of project site and surroundings from satellite imageries and field survey work done by ERM Vietnam, the Project footprint is sparsely populated rural area located within a mountain valley with steep forested hills occurring within the 5 km radius of the Project (Figure 4.1). The residential area has been observed to comprise of residential dwellings (one to two storeyed) as well as community infrastructure such as schools, kindergartens and health centres, which has been to be located within the projects footprint. However, the project area already has precedent in the form of an operational project - Huong Linh 2 (HL-2) project which has 15 wind turbines and has been reported to be operational with Vestas V100 turbines. Therefore, the individual elements that make up the landscape of the project area are hills, dense vegetation, open lands, small buildings/houses, roads and existing wind turbines of HL-2 project (***Figure 4.3, Figure 4.4***). In addition to this, the Bac Huong Hoa Natural reserve is located approximated 3.4 km north of the HL1 wind farm. The Dakrong Natural reserve is located approximately 1.5 km south south east of the HL1 wind farm

(1) https://www.vestas.com/en/products/turbines/v110-2_0_mw#!technical-specifications
https://www.vestas.com/en/products/turbines/v90-2_0_mw
https://www.vestas.com/en/products/turbines/v100-2_0_mw
Accessed 04/02/2018

Figure 4.3 ***Examples of residential structures and village related infrastructure that have been observed during the site visit. The operation HL2 wind farm can be seen in the background.***

Source: ERM site visit

Figure 4.4 ***Examples landscape that have been observed during the site visit***

Source: ERM site visi

4.5 RECEPTORS

The receptors in the Project area are mostly people staying in the individual houses, a health care centre and a high school and have been elaborated upon in ***Table 2.1 and Table 2.2*** which has been utilised for establishing the extent of shadow flicker and blade throw scenarios. However the nature of impact would vary based on the outdoor activities by the people of the area and the viewshed[1]. From the google imagery and information available, it is understood that there are no historically or culturally relevant structures associated with the landscape of the project area.

4.6 IMPACT ASSESSMENT

It is understood from the google imagery that the turbine locations T-01, T-02, T-03, T-04 and T-05 are far away (> 1 km) from the habitation/houses and would not pose direct impacts on the visual aesthetics of the area or the people. However, these turbines are located close to a road and may have transient impact on the people traversing through the road. The other ten turbines are located in and around houses within a range of < 2 km and most likely be visually dominating (refer to Figure 4.5). However, there are dense vegetation between the houses and the turbines at T-06, T-07, T-08, T-10, T-12, T-13, T-14 and T-15, which may significantly make the turbines as visually noticeable from a distance range.

4.6.1 *Analysis of sensitivity of visual receptors*

The visual receptors in this case are residents in the houses within the project area of influence and the people traversing through the roads in the project area. As discussed earlier, there is no associated importance of the views with respect to the landscape of the area as a tourist place/scenic view and the review of information in the public domain shows no evidence of the same. Also, the change is expected to not be new or unprecedented as the people of the area are already used to view of turbines due to the existing HL-2 project. Therefore, the sensitivity of visual receptors is assigned as *low (Refer* ***Table 4.3*** *on Low Sensitivity Visual Receptors)*.

4.6.2 *Visual Magnitude of the effect*

The visual magnitude of the effect is assessed as *Medium* as the project will result in noticeable change in the view at an intermediate distance and less concentrated change across an expansive area. The change will be medium to long term though not irreversible.

[1] The view shed is the area in which the Project could create a recognisable visual impact for a viewer.

Figure 4.5 View of HL1 and HL2 wind farms

4.6.3 *Embedded controls*

- The siting has been carried out appropriately so that the site can comfortably accommodate the proposed number of turbines without being visually overwhelming.
- The turbines are white in colour which will help them in blending into the background and make it less visually obtrusive.

Based on the above analysis, the impact of the project on the visual aesthetics is assessed as ***Minor.***

Impact Description	Impact on visual aesthetics during operations							
Impact Nature		Positive				Negative		
Impact Type		Direct				Indirect		
Magnitude		Negligible		Small		Medium		Large
Sensitivity/Vulnerability		Low		Medium		High		
Significance		Negligible		Minor		Moderate		Major

4.6.4 *Mitigation Measures*

- Use of materials that will minimize light reflection should be used for all project components.
- Bright patterns and obvious logos should be avoided.
- The replacement of wind turbines with visually different wind turbines can result in visual clutter, so replacing wind turbines with the same or a visually similar model over the lifetime of the project may be an important requirement.
- Existing vegetation should be retained to the greatest extent possible. Vegetation should be retained along roads and around turbine pads, substations, and other project infrastructure.

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