Gia Lai Investment Energy JSC

Environmental and Social Impact Assessment

Gia Lai Wind Power Project, Ia Grai District, Gia Lai Province

7 February 2022

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The business of sustainability

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Paola Romero
Partner-in-Charge

ERM Vietnam
3rd Floor, Saigon Finance Centre
09 Dinh Tien Hoang, Dakao Ward
District 1, Ho Chi Minh City
Vietnam

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Acronyms and Abbreviations

Name	Description
ACSR	Aluminum Conductor Steel Reinforced
ADB	Asian Development Bank
AHP	ASEAN Heritage Parks
AIDS	Acquired Immunodeficiency Syndrome
AIIB	Asian Infrastructure Investment Bank
AL	Action Levels
ALARP	As Low As Reasonably Practicable
ALRI	acute lower respiratory infection
AOI	Project's Area and Influence
APL	Agriculture Production Land
APLIC	Avian Power Line Interaction Committee
ASEAN	Association of Southeast Asian Nations
AZE	Alliance for Zero Extinction
BF	blade failure
BMP	Biodiversity Management Plan
CBES	Center for Biodiversity Conservation and Endangered species
CCD	Centre for Natural Conservation
CDEGS	Current Distribution, Electromagnetic Fields, Grounding and Soil Structure Analysis
CDP	Community Development Plan
CEEVN	Center for Educational Exchange with Vietnam of the American Council of Learned
CEMA	Committee for Ethnic Minority Affairs
CGM	Community Grievance Mechanism
CHA	critical habitat assessment
CIA	Cumulative Impact Assessment
COPD	Chronic Obstructive Pulmonary Disease
CPC	Commune People's Committee
CR	Critically Endangered
CSR	Compensation, Support and Resettlement
DARD	Department of Agriculture and Rural Development
DBS	Development Bank of Singapore
DMS	Detailed Measurement Survey
DOLISA	Labour, War Invalids and Social Affairs
DPC	District People's Committee
DUI	Driving under influence

Name	Description
EAAA	Ecologically Appropriate Area of Analysis
EBA	Endemic Bird Area
EBRD	European Bank for Reconstruction and Development's
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMF	Electric and Magnetic Fields
EN	Endangered
EOO	Extent of Occurrence
EOR	Energy Outlook Report
EP	Equator Principles
EPAP	Equator Principles Action Plan
EPC	Engineering Procurement and Construction
EPFI	Equator Principles Financial Institution
EPP	Environmental Protection Plan
ERM	Environmental Resources Management Ltd.
ES	Environmental and Social
ESAP	Environmental and Social Action Plan
ESF	Environmental and Social Framework
ESHIA	Environmental, Social and Health Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMPF	Environmental and Social Management Plan Framework
ESMS	Environmental Social Management System
ESP	Environmental and Social Policy
ESS	environmental and social standards
EU	European Union
EVN	Vietnam Electricity Corporate
EVNCPC	Central Power Corporation
EVNEPTC	Electricity Power Trading Company
EVNNLDC	National Load Dispatch Center
FAO	Food and Agriculture Organisation
FDI	foreign direct investment
FGD	Focus Group Discussion
FI	financial intermediary
FPIC	Free, Prior and Informed Consent

Name	Description
FS	Feasibility Study
VietGAP	Vietnamese Good Agricultural Practices
GBIF	Global Biodiversity Information Facility
GBV	Gender based violence
GDP	gross domestic product
GHG	Greenhouse Gas
GISD	Global Invasive Species Database
GL	Garden land
GN	IFC Guidance Note
GRDP	Gross Regional Domestic Product
GSID	Global Invasive Species Database
GSO	General Statistics Office of Vietnam
GWP	Global Warming Potential
HR	Human Resources
IA	Impact Assessment
IBA	Important Bird and Biodiversity Areas
IBAT	Integrated Biodiversity Assessment Tool
ICNIRP	International Commission on Non-Ionising Radiation Protection
IFC	International Finance Corporation
ILO	The International Labour Organization
IOA	UK Institute of Acoustics
IOL	Inventory of Losses
IP	Indigenous People
IPA	Important Plant Areas
IPCC	Intergovernmental Panel on Climate Change
IPP	Indigenous Peoples Plan
ISO	International Organisation for Standardisation
IUCN	International Union for Conservation of Nature
JHA	Job Hazard Analysis
JSC	Joint Stock Company
KBA	Key Biodiversity Areas
KII	Key Informant Interview
LAA	Land Acquisition Audit
LARP	Land Acquisition and Resettlement Plan
LC	Least Concern

Name	Description
LEP	Law on Environmental Protection
LRP	Livelihood Restoration Plan
LULUCF	for Land Use, Land-Use Change and Forestry
LURC	Land Use Right Certificate
MDF	medium-density fibreboard
MOIT	Ministry of Industry and Trade
MOLISA	Ministry of Labour, Invalids and Social Affairs
MONRE	Ministry of Natural Resources and Environment
NCV	net calorific values
NDC	Nationally Determined Contribution
NDVI	Normalised Differential Vegetation Index
NGO	non-governmental organisations
NML	Noise Monitoring Location
NSR	Noise sensitive receivers
NTFP	Non-timber forest product
OECD	Economic Co-operation and Development
OHS	Occupational Health and Safety
PAP	Project Affected People
PC	People’s Committee
PDR	People's Democratic Republic
PL	Public land
PPC	Province People’s Committee
PPE	Personal Protective Equipment
PS	IFC Performance Standards
PTS	Permanent Threshold Shift
QGIS	Quantum Geographic Information System software
RE	Renewable Energy
RL	Residential land in rural area
ROW	Right of Way
RP	Rubber Plantation
RSZ	Rotor Swept Zone
SCADA	Supervisory Control and Data Acquisition
SEA	Strategic Environmental Assessment
SEP	Stakeholder Engagement Plan
SRTM	Shuttle Radar Topography Mission

Name	Description
STD	Sexually Transmitted Diseases
STI	sexually transmitted infections
TMP	Traffic Management Plan
TPES	Total Primary Energy Supply
UN	United Nations
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UXO	Unexploded Ordnance
VCF	VinaCapital Foundation
VEC	Valued Environmental and Social Components
VEPA	Vietnam Environment Protection Agency
VNRB	Vietnam Red Data Book
VRDB	Vietnam's Red Data Book
VSR	Visual Sensitive Receptors
VU	Vulnerable
WB	World Bank
WBG	World Bank Group
WC	Worst Case
WHO	World Health Organization
WHS	World Heritage Sites
WRI	World Resource Institute
WSPA	World Society for the Protection of Animals
WSW	World Society for the Protection of Animals
WSWB	Willing selling-willing-buying
WTG	Wind Turbine Generator
WWF	World Wide Fund for Nature
ZTV	Zone of Theoretical Visibility

Definition of Terms

Term	Definition
Alliance for Zero Extinction	The Alliance for Zero Extinction (AZE) work to safeguard the last remaining areas where certain critically endangered and endangered species exist at only a single site in the world. This involves eliminating human threats such as commercial exploitation, disease, and introduction of invasive species.
ASEAN Heritage Parks	ASEAN Heritage Parks (AHPs) are selected protected areas in the ASEAN region recognized for their unique flora and fauna and ecosystems, wilderness and excellent values. There are 10 AHPs located within Vietnam.
Ecologically Appropriate Area of Analysis (EAAA)	Areas used to determine the presence of critical habitat for each species or ecosystem with occurrence in the Project area of influence.
Ecoregion	World Wildlife Fund (WWF) defines an ecoregion as a “large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions”. The boundaries of an ecoregion are not fixed, but rather encompass an area within which important ecological and evolutionary processes most strongly interact.
Endemic Bird Area	An Endemic Bird Area (EBA) is defined as an area which encompasses the overlapping breeding ranges of restricted-range species, such that the complete ranges of two or more restricted-range species are entirely included within the boundary of the EBA.
Important Bird and Biodiversity Area (IBA)	Important Bird and Biodiversity Areas (IBA) are defined as places of international significance for the conservation of birds and other biodiversity. An IBA includes sites that together form part of a wider integrated approach to the conservation and sustainable use of the natural environment.
Integrated Biodiversity Assessment Tool	A multi-institutional tool that draws together information from a number of IUCN’s Knowledge Products: IUCN Red List of Threatened Species, Key Biodiversity Areas and Protected Planet/The World Database on Protected Areas. Through an interactive mapping tool, decision-makers are able to identify biodiversity risks and opportunities within or close to a project boundary.
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, environmental harm or harm to human health. These species become naturalized in their introduced range, and often reproduce in large numbers and spread over a large area. This can result in competition and threaten native species and ecosystems.
Important Conservation Areas	Include Biosphere Reserves, World Heritage Sites, Ramsar sites, ASEAN Heritage Parks, Protected Areas and Key Biodiversity Areas.
Key Biodiversity Areas	Key Biodiversity Areas (KBAs) are defined by the Key Biodiversity Areas Partnership as sites that contribute significantly to the global persistence of biodiversity, applicable to terrestrial, freshwater, and marine ecosystems. Sites qualify as KBAs if they meet one or more of 11 criteria as defined by the Partnership, grouped into the following five categories: threatened biodiversity, geographically restricted biodiversity, ecological integrity, biological processes and irreplaceability. KBAs include Important Bird and Biodiversity Areas (IBA) and Alliance for Zero Extinction (AZE) sites.

Migratory and/or Congregatory Species	Migratory species are defined as any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem). Congregatory species are defined as species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis.
Modified	Area 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 composition
Natural	Areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
Production forest	Production forests are used mainly for production and trading of timber and non-timber forest products. Production forests include natural and planted forests.
Project Area of Influence	The Project Area of Influence (AoI) includes the area likely to be affected by the Project including all its ancillary aspects, such the Project components and unplanned developments induced by the Project.
Project area	Area within the Project boundary where Project activities take place.
Project footprint	Areas cleared for infrastructure development.
Protected Area	A Protected Area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve long-term conservation of nature with associated ecosystem services and cultural values. Under the provisions of IFC PS6, a Protected Area require specific management actions if development proceeds within the boundary
Protection forest	Protection forests are used mainly to protect water sources and land, prevent erosion and desertification, restrict natural calamities and regulate climate, thus contributing to environmental protection. Protection forest may include (1) headwater protection forests; (2) wind- and sand-shielding protection forests; (3) protection forests for tide shielding and sea encroachment prevention; and (4) protection forests for environmental protection.
Ramsar Sites	The Convention of Wetlands, also known as the Ramsar Convention, is an intergovernmental treaty that provides the framework for the conservation and use of wetlands and their resources. Wetlands designated under the Convention are known as Ramsar Sites. The Ramsar Convention for Vietnam has been effective from 20 January 1989; currently Vietnam has nine sites designated as Wetlands of International Importance.
Restricted range species	According to IFC PS6, restricted range species is defined as species with an estimated extent of occurrence (EOO) of $\leqslant$ 50,000 km^2 for terrestrial vertebrates and $\leqslant$ 100,000 km^2 for marine species. For coastal, riverine, and other aquatic species in habitats that do not exceed 200 km width at any point (for example, rivers), restricted range is defined as having a global range of less than or equal to 500 km linear geographic span (i.e., the distance between occupied locations furthest apart).
Special-use forest	Special-use forests are used mainly for conservation of nature, specimens of the national forest ecosystems and forest biological gene sources; for scientific research; protection of historical and cultural relics as well as landscapes; in service of recreation and tourism in combination with protection, contributing to environmental protection. Special-use forest may include (1) national parks; (2) nature conservation zones; (3) landscape protection areas; and (4) scientific research and experiment forests.

Threatened species	Threatened species are identified as those classified on the IUCN Red List of Threatened Species. The Red List provides the conservation status of these listed species as being critically endangered (CR) and endangered (EN). CR and EN species are considered to be at a heightened risk of extinction and are treated with an elevated level of consideration under IFC PS6.
World Heritage Sites	World Heritage Sites (WHS) are sites selected by UNESCO as having cultural, historic, scientific or other form of significance that have outstanding universal value to humanity. Countries which are signatories to the World Heritage Convention (which includes Vietnam) are required to legally protect and manage the outstanding values of such Sites. This allows for practical conservation of areas, which would otherwise be subjected to threats such as uncontrolled and unrestricted access, and associated activities such as poaching and illegal logging.

1. INTRODUCTION

1.1 Purpose

The Environmental and Social Impact Assessment (ESIA) presents an assessment of the potential environmental and social impacts associated with the proposed CPIH Gia Lai Wind Power Project within Ia Pech Commune, Ia Grai District, Gia Lai Province, Vietnam (thereafter refers as “the Project”).

ERM Vietnam (ERM) was commissioned by Gia Lai Investment Energy JSC CPIH (herein referred as” Gia Lai JSC” or “Client”) to undertake an ESIA of the Project. The purpose of the ESIA is to inform Gia Lai JSC and their Project partners of the environmental and social impacts associated with the Project and in particular the extent to which the Project aligns with the expectations of the Asian Infrastructure Investment Bank (AIIB) Performance Standards, along with Health and Safety (EHS) Guidelines.

The ESIA assesses the environmental and social impacts based on the agreed scope of baseline data collection and impact assessment and supports the preparation of an Environmental and Social management Plan (ESMP).

1.2 Project Background

The Gia Lai Wind power project of the Gia Lai Investment Energy JSC CPIH composes two separate wind power projects, which are the Ia Pech and Ia Pech 2 wind power projects.

According to Letter No. 128/KTHT dated 8 November 2020, the People’s Committee of Gia Lai Province has permitted Gia Lai Investment Energy JSC CPIH to develop the CPIH Gia Lai Wind Power Project at Ia Pech Commune, Ia Grai District, Gia Lai Province. The project has been approved to develop renewable energy for Gia Lai province in general and specially for Ia Grai district. Gia Lai investment Energy JSC CPIH is expected to construct the project with a capacity of 50MW, including 20 turbines with the capacity of 2.5 MW. The area of the project is expected to be 1,455 ha within Ia Pech commune, Ia Grai district; operations are scheduled to commence in October 2021.

According to Circular No 16/2015/TT-BKHDT dated 18 November 2015, the Ministry of Planning and Investment has permitted Gia Lai Investment Energy JSC CPIH to develop Ia Pech 2 Wind Power Project. The project is located within Ia Pech commune, Ia Grai District, Gia Lai Province. The project is designed to have a total capacity of 50MW, including 20 turbines with an individual capacity of 2.5MW. This project is expected to produce electricity for approximately 143 million kWh annually.

During the implementation of the Project, the designs of both Ia Pech and Ia Pech 2 wind power projects have been changed, which reduced the number of turbines to 30 in total instead of the initial 40. According to the information provided by the Client, the estimated electricity capacity produced annually would still remain close to the initial estimation.

In accordance with Decree No. 40/2019/ND – CP on Amendments to Decrees on Guidelines for the Law on Environment Protection of the Government dated 19 December 2019, JSC CIPH Gia Lai does not need to develop an Environmental Protection Plan (EPP). However, the development of the Gia Lai Wind Power project in Ia Pech commune has to be fully compliant with the local technical and social infrastructure, building density, height and underground depth and ensuring the project implementation must not affect the national defense and securities.

1.3 Environmental and Social Impact Assessment Objective

The overall objectives of this assessment are to:

- Identify key environmental and social risks associated with the Project, based on the applicable international and local regulations;
- Document the Project background, site context and current status of permits and approvals;
- Document the Project’s land acquisition and resettlement status and process;

- Assess the presence of Indigenous People in the Project area to the extent possible;
- Review biodiversity status which might be impacted by the Project development;
- Conduct a document review to confirm the extent to which the Project aligns with ESF performance standards (2019) and propose appropriate actions to close the gaps; and
- Identify the necessary actions to manage and mitigate the risks assessed

1.4 Limitations and Assumptions

Due to the restrictions imposed from July 2021 by the Vietnamese Government to manage the COVID-19 pandemic, access to the Project site has been severely restricted to the ESIA team. As a result, conventional methodologies of conducting environmental and social baseline and impact assessments had to be adjusted to ensure reporting timelines met the Project schedule. These adjustments included replacing baseline surveys that are typically undertaken in situ by the use of either remote techniques or implementing reduced scope or survey duration. This resulted in a narrower sample area and/or less diversity in sampling that one can usually obtain when using traditional in situ sampling methods. Where the assessment has identified that data gaps remains, these have been in the Environmental and Social Action Plan (ESAP).

Further details on these limitations are provided in Table 1.1, as well as in the relevant sections of the ESIA.

Table 1.1 Baseline Survey Scope Adjustments

ESIA component		Original scope	Completed scope	Main limitation
Shadow Flicker / blade throw assessment		Desktop assessment (satellite imagery analysis and modelling) Validation survey	Desktop assessment (satellite imagery analysis and modelling)	Validation survey could not be undertaken due to site access restrictions imposed to manage the COVID-19 situation
Social baseline	Ia Pech commune (30 turbines, 22kv transmission lines, 110kv transmission line, Substation, Internal access roads, Administration office)	50 households 7 KIIs 4 FGDs (Face to Face)	63 households 5 KIIs 4 FGDs (Phone interviews)	The survey was undertaken as Gia Lai province experienced a surge in Covid-19 cases. Authorities' efforts were redirected towards COVID-19 mitigation; therefore could not facilitate two KIIs. All interviews were conducted by phone, rather than face to face.
	- Ia Kha town (110kv transmission line)	30 households 7 KIIs (Face to Face)	None	ERM was unsuccessful in establishing contact with, and getting agreement from, the

ESIA component		Original scope	Completed scope	Main limitation
	Ia Hrung commune (110kv transmission line)	30 households 7 KIIs (Face to Face)	None	local authorities to conduct interviews by phone.
	Ia Der commune (110kv transmission line)	30 households 7 KIIs (Face to Face)	None	

1.5 Structure of the ESIA

The structure and contents of the ESIA are as follows:

Volume	Chapter	Chapter Title
Executive Summary		
1	1	Introduction
	2	Project Description
	3	Administrative Framework
	4	Impact Assessment Methodology
	5	ESIA Screening and Scoping
	6	Stakeholder Engagement
2	7	Environmental Baseline
	8	Biodiversity Baseline
	9	Socio-economic Baseline
3	10	Environmental Impact Assessment
	11	Biodiversity Impact Assessment
	12	Social Impact Assessment
	13	Unplanned Events
Environmental and Social Management Plan		
Appendices		

2. PROJECT DESCRIPTION

This chapter provides a description of the Project development, including project alternatives, project status and proposed a schedule and a description of the facilities, equipment and the associated activities that will be carried out during the preconstruction, construction and operation phases. It also provides a description of potential unplanned events and details of employment and accommodation for workers during construction and operation.

2.1 Project Alternative

IFC Performance Standard 1 (IFC, 2012), and the associated IFC Guidance Note 1 (IFC, 2012), and the AIIB Environmental and Social Framework (AIIB ESF) requires that the ESIA shall identify and analyse alternatives, including but not limited to project site location, design, technology and no project alternative (which assumes that the Project development does not happen). This section provides an analysis of certain alternatives to the Project development in relation to: (i) the “no project scenario” and (ii) methods of power generation alternatives.

2.1.1 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. During the period 2007-2017, Vietnamese total primary energy supply (TPES[1]) grew at 4.7 % per annum. Hydropower experienced the highest growth at 14.5 % per annum, followed by coal at 11.3 % per annum. The share of coal increased from the third largest fuel source in 2007 to the largest in 2017. Meanwhile, the share of biomass fell from being the largest contributor in 2007 to the third largest in 2017. Oil, growing at the rate of 4.3 % per annum, is the second largest fuel source. Solar and wind have historically only contributed a very small share in TPES. An overview of the progress of primary energy supply mix from 2007 to 2017 is presented in Figure 2.1.

[1] Total primary energy supply describes the total input of primary energy to the energy system. TPES is the sum of production and imports subtracting exports and storage changes. Where primary energy is used to describe fuels, it is the energy available as thermal energy in the fuel. When solar and wind energy is converted to electricity, the electricity made from wind and solar counts as the primary energy for these sources.

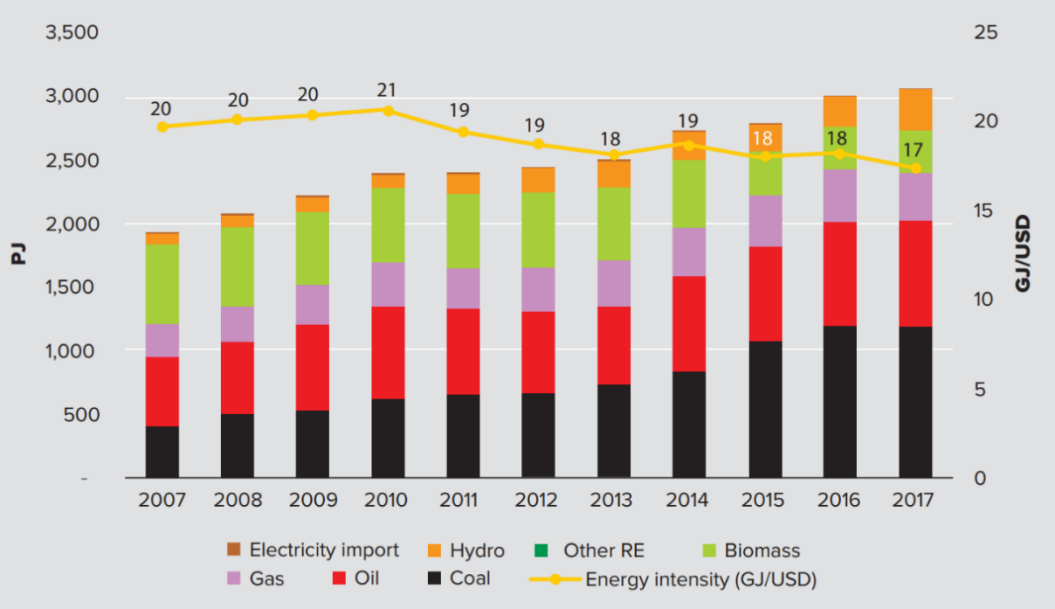
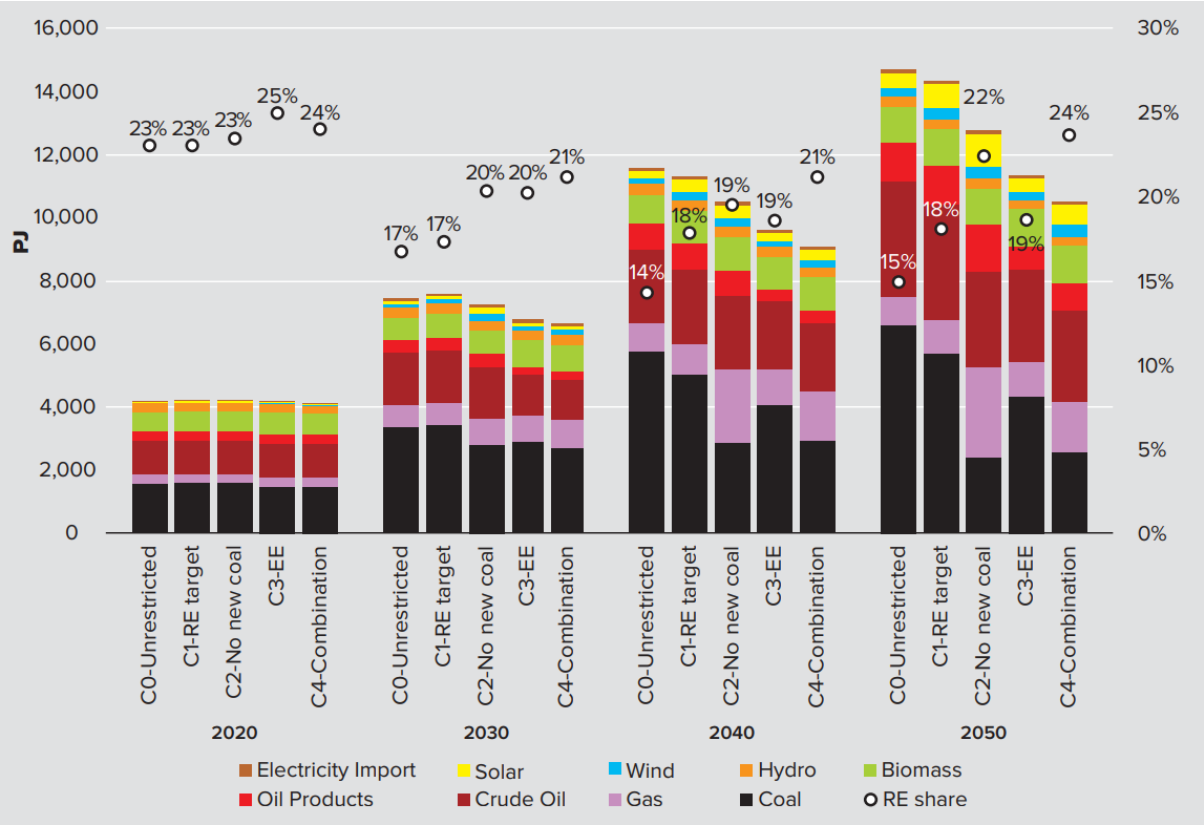


Figure 2.1 Progress of Primary Energy Supply Mix from 2007 to 2017

Figure 2.2 shows the predicted power generation make-up of Vietnam by fuel type to 2050. 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.

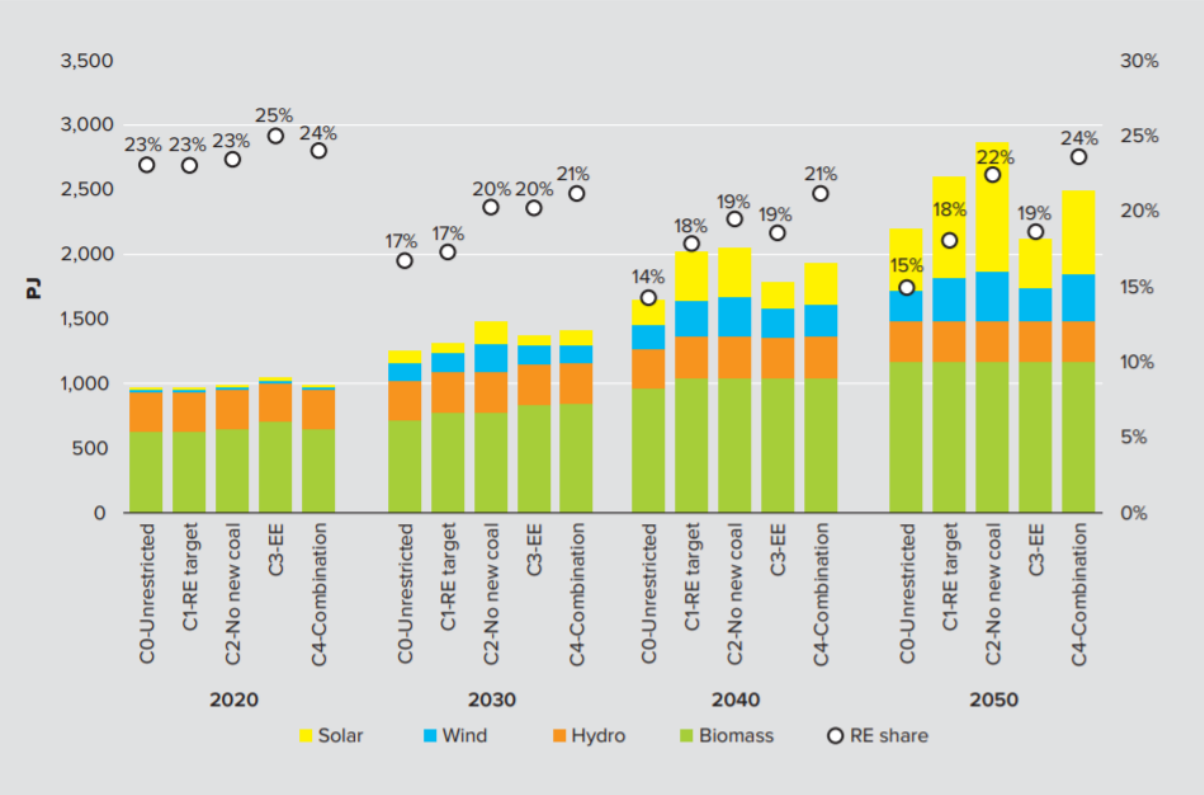


Source: Vietnam Energy Outlook Report, 2019

Figure 2.2 Total Primary Energy Supply (TPES) and RE Share in TPES across Analysed Scenarios in the Period 2020 – 2050.

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 of the planning period at the 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.

The Energy Outlook Report (EOR) 2019 showed that the RE shares in TPES have a slightly decreasing trend in future years, primarily due to a large increase in fossil fuel consumption. With the proposed scenarios, the share of RE in the total primary energy supply could reach 21% in 2030, then increase to 24% in 2050. This ratio is remarkably higher than the one under the Business as Usual (BaU) scenario, but still fails to meet the required target in the RE Development Strategy (32% in 2030 and 44% in 2050).



Source: Vietnam Energy Outlook Report, 2019

Figure 2.3 Renewable Energy Sources and Their Share in TPES for All Analysed Scenarios

Figure 2.3 shows that wind and solar shares significantly increase across all scenarios, as due to their low operation and maintenance costs and no fuel costs. Additional analysis showed that with increasing wind and solar shares, the total energy system cost slightly increases while capital cost increases rapidly (EOR 2019). Therefore, in the transition from conventional power production to wind and solar, consideration should be given to access to capital cost, even considering the expectation that the investment costs of wind and solar will decrease drastically in the coming 30 years.

Financing of clean energy investments is a booming market. After 2030, it is expected that the investment cost of fossil fuel power sources will increase due to stricter environmental standards while the power production cost of RE sources will fall as a result of technology improvement. As a result, RE would be able to compete with traditional power sources.

Should the Project not proceed, power supply would continue to be met by other sources; however as noted there is clearly a current and future reliance on fossil fuel generated power, particularly coal. In

addition, should the project not move forward, the significant positive economic and environmental benefits would not be realized. Some of the benefits are highlighted below:

- Producing clean energy which contributes to the national energy security through development of local energy resources and decreasing dependency on traditional energy sources;
- The clean energy produced from renewable energy resources contributes to decreasing global warming due to the fact that it produces no greenhouse gas emission and reduces some types of air pollution.
- During the construction and operation phase, the Project is expected to generate local employment opportunities. As such, this is expected, to a certain extent, to enhance the socio-economic conditions and standards of living of local community where the project will be developed.
- Although it is crucial to take into consideration both positive and negative environmental and social impacts incurred from the project development, it could be concluded that the “no project” is not a preferable option.

2.1.2 Alternative Methods of Power Generation

This section discusses alternatives to the development of a wind farm project. This mainly includes other renewable energy alternatives suitable in general as well as other alternatives for power generation such as conventional thermal power plants.

There are a range of power generation options potentially available and a summary of the advantages and disadvantages of these options are provided at Table 2.1.Compared to most other traditional power generation methods, wind power projects have a limited reversible impact on the environment while contributing to reducing the production and use of energy from fossil fuels, which causes the increase of greenhouse gas emissions and impacts from climate change. With a purpose to improve national electricity demand in the coming years, the wind power method is selected for producing electricity to meet the supply-demand of power resource.

The Project is currently consistent with the Vietnamese National Power Development Plan for the period 2011 – 2020 with the vision to 2030 (under Decision No. 428/QD-TTg, dated 18 March 2016), which mostly focused on renewable power development. The revised Power Development Plan VII outlined a master plan for power source development, in which renewable energy (wind energy, solar energy, bio energy) will be prioritized, so as to gradually increase the proportion of electricity generated from renewable energy sources. The key objective of the Project is to meet the supply-demand balance of power resource by exploiting potential wind power for producing electricity while increasing environmental efficiency.

Table 2.1 Comparison of Power Generation Methods

System	Advantage	Disadvantage
Supercritical Thermal Power	■ Large-scale production potential ■ Moderate gestation period ■ Wider distribution potential ■ Provides cheap electricity to the consumer ■ Provide stable output and reliable electricity on the grid ■ Easily accessible and well established technology ■ Requires less land per Megawatt	■ 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
Ultra Supercritical Thermal Power	In addition to the above advantages:	As above.

System	Advantage	Disadvantage
	■ Improved efficiency by reaching higher pressure and temperatures compared to supercritical boilers. ■ Reduced emissions, particularly of CO and mercury. ■ The general rule of thumb is that each percentage point of efficiency improvement yields 2–3% less CO. ■ Potentially lower operating costs	
Hydropower	■ GHG emission estimated as low ■ 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 estimated as low	■ Large land requirement ■ Site-specific, dependent on solar insolation ■ Expensive installation
Wind power	■ Pollution levels are low ■ Inexpensive power generation ■ Inexhaustible wind resource ■ GHG emissions estimated as low	■ Large land requirement ■ Site-specific, dependent on wind pattern ■ Expensive installation
Nuclear power	■ GHG emissions estimated as low ■ 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

2.2 Project Permitting

The Gia Lai Wind Power Project consists of two sub-projects of Ia Pech Wind Power and Ia Pech 2 Wind Power. This section presents the permits for these two sub-projects of Gia Lai Wind Power Project.

2.2.1 Ia Pech Wind Power Project

The feasibility study for the Project was carried out by PRP and PECC5, two Vietnamese engineering consultants. The results of the feasibility study were accepted and approved by Ministry of Industry and Trade (MOIT). Permit documents of the project is presented in Table 2.2.

Table 2.2 Legal Documents of Ia Pech Wind Power Project

No.	Documents	Date issued	Content
1	Decision No. 419/QD-UBND	25 August 2020	Gia Lai Provincial People Committee approved the investment of Ia Pech Wind Power Project
2	Decision No. 715/QD-UBND	18 December 2020	Gia Lai Provincial People Committee approved the adjusting investment of Ia Pech Wind Power Project
3	Contract No. 12/2020/HD-NMDG-Ia Pech.GL	December 2020	Gia Lai Green Power Investment Co., Ltd executed its PPA, granting the right to sell the electricity generated up to a maximum of 50 MW export capacity. Gia Lai Green Power Investment Co., Ltd will sell electricity to EVN, the single buyer of electricity in Vietnam, under a 20-year PPA. Under the PPA, EVN is responsible for purchasing the entire power output from the wind farm.
4	Directive 2567/STNMT-QHDD	21 July 2020	Gia Lai Department of Natural Resources and Environment, dated on, the project is not required to conduct environmental protection plan
5	Investment Certificate No. 1683322445	27 August 2020	Land use has been legally approved by Department of Planning and Investment Gia Lai
6	Official Letter No. 289/ UBND-KTHT	15 March 2021	Agreement about the station location and direction of 22kV transmission line connecting Ia Pech and Ia Pech 2 Wind Power Projects Gia Lai District People's Committee
7	Directive No.128/KTHT	08 November 2020	Department of Economic and Infrastructure, Ia Grai District People's Committee, the project is not required to obtain construction permits.

2.2.2 Ia Pech 2 Wind Power Project

The feasibility study for the Project was carried out by PRP and PECC5. The results of the feasibility study were accepted and approved by Ministry of Industry and Trade (MOIT). Permit documents of the project is presented in Table 2.3.

Table 2.3 Legal Documents of Ia Pech 2 Wind Power Project

No.	Documents	Date issued	Content
1	Decision No. 420/QD-UBND	25 August 2020	Gia Lai Provincial People Committee approved the investment of Ia Pech 2 Wind Power Project
2	Decision No. 716/QD-UBND	18 December 2020	Gia Lai Provincial People Committee approved the adjusting investment of Ia Pech 2 Wind Power Project
3	Contract No. 12/2020/HD-NMDG-Ia Pech 2.GL	December 2020	Gia Lai Green Power Investment Co., Ltd executed its PPA, granting the right to sell the electricity generated up to a maximum of 50 MW export capacity. Gia Lai Green Power Investment Co., Ltd will sell electricity to EVN, the single buyer of electricity in Vietnam, under a 20-year PPA. Under the PPA, EVN is responsible for purchasing the entire power output from the wind farm.

No.	Documents	Date issued	Content
4	Directive 2563/STNMT-QHDD	21 July 2020	Gia Lai Department of Natural Resources and Environment approved no environmental protection plan by the project
5	Investment Certificate No. 3582871783	27 August 2020	Land use has been legally approved Department of Planning and Investment Gia Lai
6	Official Letter No. 289/ UBND-KTHT	15 March 2021	Agreement about the station location and direction of 22kV transmission line connecting Ia Pech and Ia Pech 2 Wind Power Projects Gia Lai District People's Committee
7	Directive No.128/KTHT	08 November 2020	Department of Economic and Infrastructure, Ia Grai District People's Committee approved no construction permits by the project.

2.3 Project Location

The Gia Lai Wind Power Project, comprising both Ia Pech and Ia Pech 2 wind farms, is located in Ia Pech commune, Ia Grai district, Gia Lai province.

La Grai district is a mountainous area, located along the western border of Gia Lai province, in the Central Highlands region of Vietnam. The district has 89,297 people, over a total area of 1,157.3 km^2. La Grai district comprises 12 communes and one town with 150 villages and clusters. La Kha is the township of Ia Grai district. The district is bounded by the following areas:

- Chu Pah district to the West
- Duc Co district to the South
- Pleiku city to the East
- Chu Prong district to the Southeast
- Ia H'Drai district of Kom Tum province
- Ratanakiri province of Cambodia

Ia Pech commune is one of 12 communes in Ia Grai district. Ia Pech commune is bounded by the following areas:

- Ia Kha town of Ia Grai district to the North
- Ia Der commune of Ia Grai district to the North
- Pleiku City of Gia Lai province to the Southeast
- Duc Co district of Gia Lai province to the South
- Ia Grang commune of Ia Grai district to the West

The Ia Pech and Ia Pech 2 Wind Power Projects are located, at their closest, 176 km from Qui Nhon port (Binh Dinh province) and 356 km from Cam Ranh port (Khanh Hoa).

Coordinates of the two wind farm locations, namely Ia Pech and Ia Pech 2, are shown in Figure 2.4.

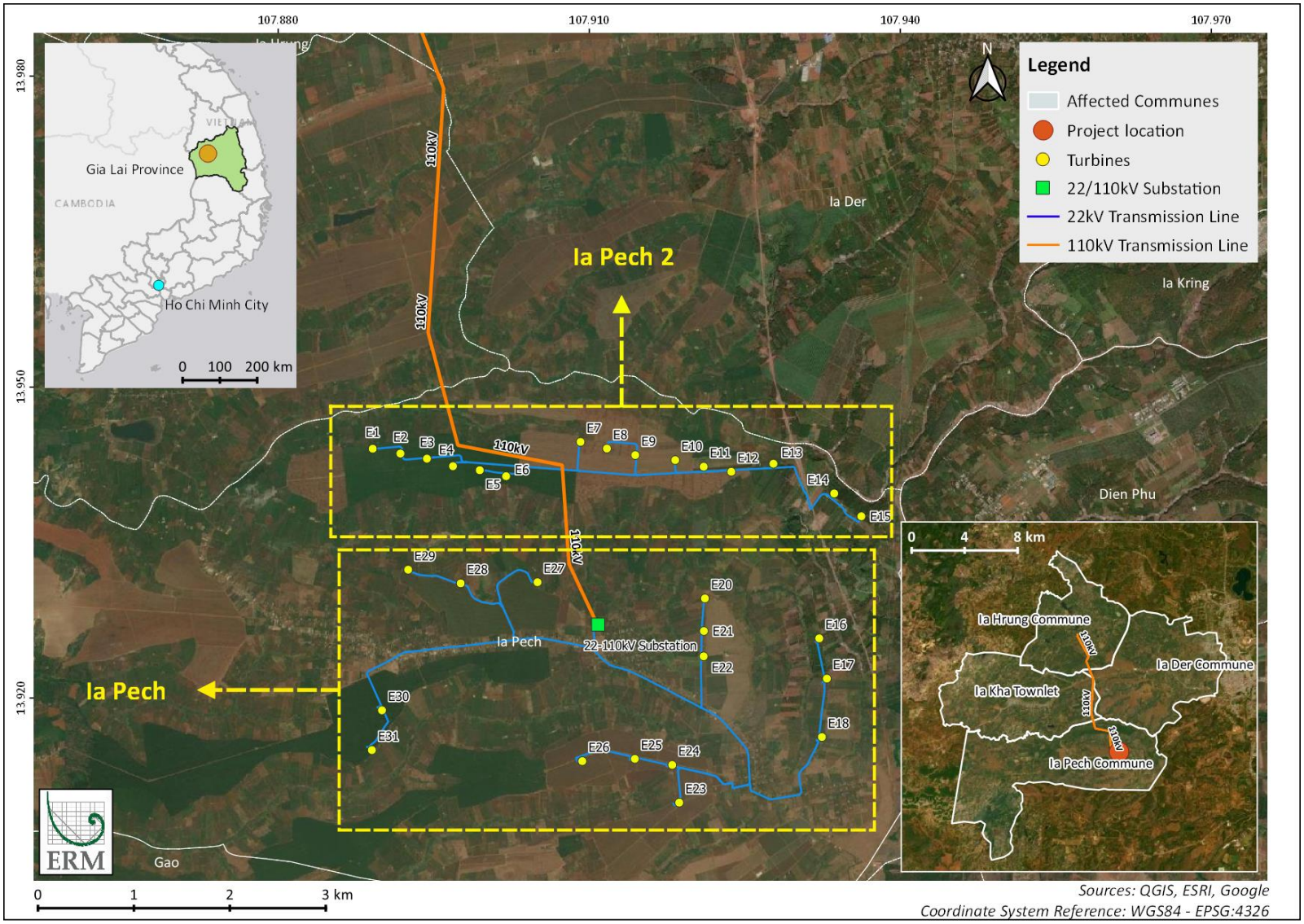


Figure 2.4 Project Location

2.4 Project Components

2.4.1 22kV Transmission Line

The generators of each wind turbine will generate 3 phase AC 1140V. A step-up transformer placed at the bottom of each turbine tower will boost up the power to 22kV. Those step-up transformers will be connected to each other and to the 22kv busbar of the 22/110kV substation by the 22kV underground cable and above ground transmission line.

2.4.1.1 Ia Pech Wind Farm

A total of 15 step-up transformers (1.14/22kV) are planned for Ia Pech wind farm project and divided into 4 sets connecting to the 22/110kV. Connection of turbines in each set will be as follows:

- Set 1: E27, E28, E29, E30, and E31 are connected with each other using underground cable and overhead transmission line (using ACSR-240/32 wire). The set is connected to the 22/110kV by underground cable.
- Set 2: E23, E24, E25, and E26 are connected with each other by underground cable and overhead transmission line (using ACSR-95/16 and ACSR-240/32 wire). The set is connected with the 22/110kV using underground cable.
- Set 3: E16, E17, and E18 are connected with each other by underground cable and overhead transmission line (using ACSR-240/32 wire). The set is connected with the 22/110kV using underground cable.
- Set 4: E20, E21, E22 and the 22-110kV substation are connected by underground cable.

The total length of the underground cable and the above ground transmission line are 8.143km and 3.625km respectively.

2.4.1.2 Ia Pech 2 Wind Farm

A total of 15 step-up transformers (1.14/22kV) are planned for Ia Pech 2 wind farm project and divided into 4 sets connecting to the 22/110kV. Connection of turbines in each set will be as follows:

- Set 1: E1, E2, E3, and E4 are connected with each other using underground cable and overhead transmission line (using ACSR-95/16 cable. The set is connected to the 22/110kV by underground cable and overhead transmission line (using ACSR-240/32 wire).
- Set 2: E5, E6, E7, and E9 are connected with each other by underground cable and overhead transmission line (using ACSR-240/32 wire). The set is connected with the 22/110kV using underground cable.
- Set 3: E8, E10, and E11 are connected with each other by underground cable and overhead transmission line (using ACSR-240/32 wire). The set is connected with the 22/110kV using underground cable.
- Set 4: E15 and E14 are connected with E12 by underground cable and overhead transmission line (using ACSR-95/16 wire). E13 connects E12 by underground cable. E12 connected to the 22/110kV by underground cable and overhead transmission line (using ACSR-240/32 wire).

The total length of the underground cable and the above ground transmission line are approximately 6.6 km and 3.6 km respectively.

2.4.2 110/22kV Substation and 110kV Transmission Line

A 110/22kV substation will be located within the Ia Pech wind farm, covering a total area of 6,313m^2. The substation will have two transformers with capacity of 63MVA each.

The 110kV duo line will use ACSR240 wire with 10,5km length. The transmission line will commence from the 110/22kV substation and connect to single line 110kV Ia Grai-Pleiku. The 110kv transmission line will connect Ia Pech wind farm and the National Grid as follows:

- Starting point: the 110kV -TBA 22/110kV of the Ia Pech wind farm
- Ending point: 110kV Ia Grai – Pleiku. A new pole will be built at the point of connection.

2.4.3 Internal Roads

2.4.3.1 Ia Pech Wind Farm

The internal road system of the Ia Pech wind farm requires the construction of four roads, to connect the existing residential road and wind turbine locations. The roads are designed at level 4 standard with 4.5m-wide and 9.8km-length. The system has a standard water drainage system and can accommodate vehicle speed of 20km/h.

2.4.3.2 Ia Pech 2 Wind Farm

The internal road system of the Ia Pech 2 wind farm requires one main road connecting the existing residential road and wind turbine locations, and two roads connecting the Ia Pech 2 wind farm to turbine locations. The roads are designed at level 4 standard with 4.5m-wide and 8.3km length. The road has the radius of curvature of at least 90m to facilitate the transportation of the blades and turbine towers. The system has a standard water drainage system and can accommodate vehicle speed of 20km/h.

2.4.4 Administration Building

Each wind farm will have one administration building, each covering an area of 1,000m^2. This building will be located inside the stockyard which is used for gathering of all the equipment and material (such as turbine package, vehicles) required for the projects.

2.4.5 Other Components

2.4.5.1 Communication System and SCADA

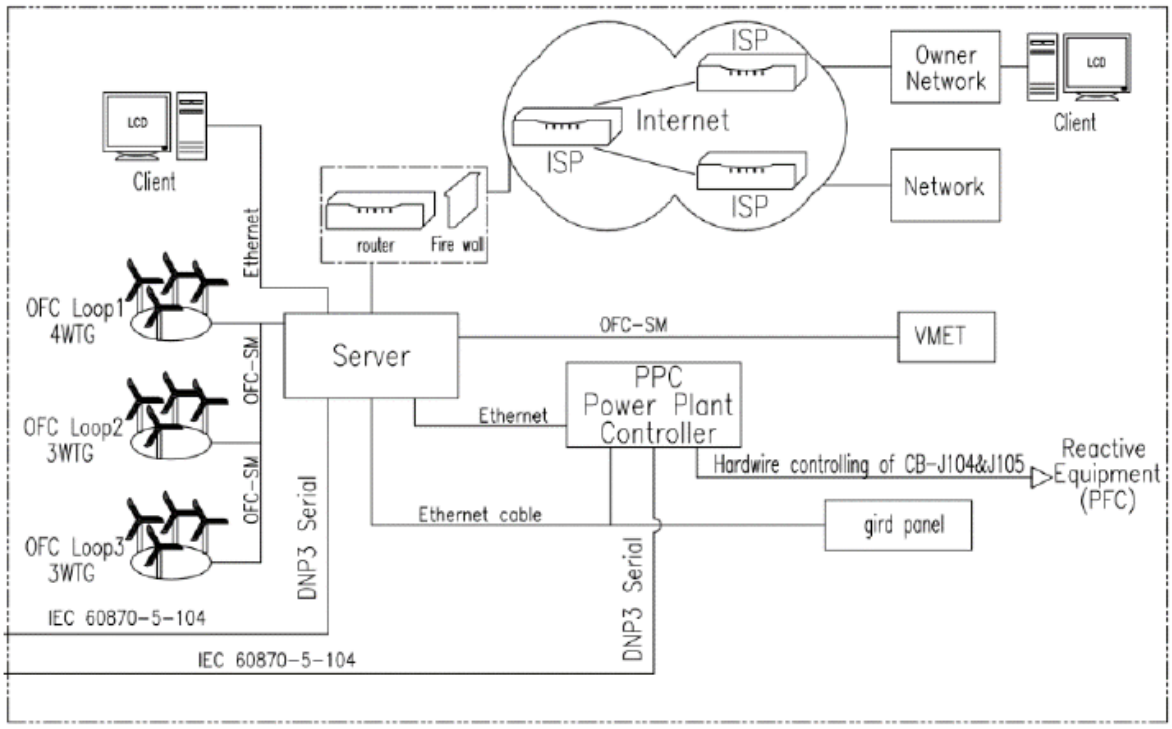
The Supervisory Control and Data Acquisition (SCADA) system is designed to automatically collect data through establishment of control centre, terminals and suitable devices. A SCADA system will be installed in both wind farms.

The purposes of SCADA system are to:

- Control wind turbines and collect data from wind power plant
- Analyse and report on wind farm’s performance
- Reduce the breakdown time of power plant and power grid

The functions of the SCADA system are to:

- Control the ability to rotate turbine blades, control the ability of wind direction of turbine, switching between generators, blade failure (dust, water, etc.), vane failure fan, turbine operation, generator and gearbox.
- Keep the statistical analysis of turbine events such as faults, start/stop.
- Control the turbines
- Access to the turbines’ specifications and I/O values
- Check wind speed and ambient temperature
- Access the wind farm system remotely



Source: Feasibility Report (PECC5, 2020)

Figure 2.5 Map of the SCADA

2.4.5.2 Lightning Protection Grounding System

A grounding system is installed for each wind pillar, using ϕ20 copper poles 3m long and bare copper wire with a cross section of 120mm². This forms a ground loop in the form of a grid circle.

2.5 Project Schedule and Activities

2.5.1 Project Schedule

According to the information provided by the Developer, the total construction time of the Project, including both Ia Pech and Ia Pech 2 wind farms, is estimated to be 18 months. A detailed schedule is provided in Table 2.4.

Table 2.4 Construction Schedule of the Ia Pech and Ia Pech 2 Wind Farms

Time	Activity
June 2020 – February 2021	Pre-construction works including ground-breaking, preparatory work
March 2021 – July 2021	Construction of internal roads, preliminary installation of crane yard
April 2021 – October 2021	Construction of wind turbine foundation and completion of crane yard
May 2021 – August 2021	Construction and installation of underground cable and communication system
July 2021 – October 2021	Wind turbine installation and power generation for the first turbine tower on October 2021
November 2021	Complete the power generation for all the turbines towers and national grid connection

Table 2.5 The Project Progress as of 23 September 2021

Components	Completed	Not yet completed	Estimated complete time (if not yet completed)
Turbine	6 turbines	24 turbines	Before 30/10/2021
22kv transmission line			Before 30/10/2021
- Foundation	87%	13%	
- Transmission line	60%	40%	
110kv transmission line			Before 30/10/2021
- Foundation	100%		
- Transmission line	60%	40%	
110/kv/22kv substation	90%	10%	30/9/2022
Internal road	95%	5%	On-going maintenance process
Administration office	100%		
Information hub	100%		
SCADA	20%	80%	Before 30/10/2021
Lighting Protection System	100%		

2.5.2 Pre-construction Phase

2.5.2.1 Land Acquisition and Compensation

The development of the Ia Pech and Ia Pech 2 wind farms resulted in land acquisition. The detail of land acquired by the wind farms is presented in Table 2.6. Based on the documents and information in relation to land acquisition available to ERM at the writing of this report, the earliest date documented for the land acquisition process was in November 2020, and in March 2021 the Compensation, Support and Ground Clearance Committee for the Project land acquisition was established, and at the time of developing this ESIA, the Project land acquisition process was on-going. Detailed discussion on land acquisition process for the Project is presented in Section 12.5.1.

Table 2.6 Details of Area of Acquired Land Ia Pech and Ia Pech 2 Wind Farms by Project Component

Activity	Ia Pech (ha)	Ia Pech 2 (ha)
Long-term land acquisition	**17.08**	**13.86**
Internal roads and underground cable	13.75	11.67
Wind turbine foundation	2.07	2.07
Substation and administration building	0.90	N/A
Foundation of 110kV transmission line	0.32	N/A
Foundation of 22kV transmission line	0.04	0.13

Activity	Ia Pech (ha)	Ia Pech 2 (ha)
Short-term land acquisition	**14.42**	**14.43**
Internal roads	7.00	7.00
Crane yard	6.36	6.36
Construction of cable and substation	0.07	0.07

Source: Feasibility Study by Gia Lai Energy Investment JSC

2.5.3 Construction Phase

2.5.3.1 Transportation of the Material

Heavy and long material such as turbine tower, blades, nacelle, which are imported from foreign countries, will be transported in a safe and economical way. The transportation plan is as follows:

- Unloading material at Cam Ranh port (Khanh Hoa province)
- Transportation of the material by road ways. The total length of the route is 350 km. The road map could be as follows:

  Cam Ranh Port → National Road 1A → Provincial Road 8 → National Highway 26 → National Highway 29 → National Highway 14 → The Project area.

The transportation plan may be optimised during the construction stage based on the type of turbine selected, and the conditions of ports, canals, roads and bridges leading to the construction site.

2.5.3.2 Construction of Wind Turbine Foundation

The procedure of construction of wind turbine foundation is as follows:

- Set up location of the wind turbine tower
- Excavation
- Check the wind turbine foundation
- Foundation treatment
- Pouring concrete buffer
- Installing the foundation ring
- Rebar assembly
- Installation of cable duct
- Create formwork
- Conducting inspection
- Pouring concrete in the foundation
- Maintenance of the concrete
- Dismantling formwork
- Ground levelling

Key considerations for the constructing of wind turbine foundation include:

- The foundation system is designed as a specialised foundation to place the wind turbine system

- Before pouring concrete foundation, formwork, brace resistance, reinforcement and other material need to be well-prepared. The formwork used can be made of wood planks, panels steel or a combination of both. Formwork must be erected and secured before pouring cardboard.
- The reinforcement in the foundation is processed and installed at the construction site in accordance with the design. Steel reinforcement must be scraped (if any) before being put into use.

Source: Feasibility Study (PECC5, 2020)

Figure 2.6 Construction of the Wind Turbine Foundation

2.5.3.3 Installation of Tower, Nacelle and Blade

Installation of the wind turbine includes but not limited to the following works:

- Transportation of the tower to the location of the foundation
- Installation of the tower onto the foundation
- Installation of the nacelle
- Installation of the hub
- Installation of the 03 blades

Source: Feasibility Report (2020)

Figure 2.7 Installation of the Wind Turbines

2.5.4 Operation Phase

The operation of both wind farms need to consider the following points:

- Having a proper and efficient management organization which ensure the sufficient professional personnel
- Maintenance works need to respond promptly to defects and equipment breakdowns.
- Staff of the wind farms should be equipped with necessary skills and knowledge. Personnel of the wind farms should be divided into two teams including direct operation and indirect operation.
- Staff should be equipped with tools and means for operation management and regular repair
- The test procedure to put the wind farm into operation should be carried out in accordance with the instructions in the IEC-61400-12-1 standard.
- To ensure the safety of the wind farms' operation, maintenance must be carried out regularly in accordance with the maintenance schedule specified by the manufacturer. In addition, the detailed operation manuals of equipment manufacturers need to be followed strictly.

2.5.5 Decommissioning Phase

Both wind farms will be decommissioned in accordance with the regulatory framework at the time of decommissioning and a decommissioning plan will be developed prior to commencement.

2.6 Project Management

The Project is managed by Gia Lai Investment Energy JSC CPIH.

3. ADMINISTRATIVE FRAMEWORK

3.1 Overview

The Project will be developed and operated in accordance with two main administrative frameworks: the first is the Vietnamese regulatory assessment and approval process, which must be followed to achieve regulatory environmental approvals. Secondly, as the proponent seeks to adhere to international standards, standards such as the equator principles and the AIIB's environment and social framework as well as other international conventions need to be considered.

The two administrative frameworks and their applicability to the Project are described in detail below.

3.2 National Regulatory Framework of Vietnam

3.2.1 Environmental Regulations/Standards

Decree No. 38/2015/ND-CP dated 24 April 2015 on waste and scrap management

Decree No. 80/2014/ND-CP dated 06 August 2014 on the drainage and treatment of wastewater

Circular No. 02/2019/TT-BCT dated 15 January 2019 on wind power project development and power purchase agreement for Projects thereof

Circular No. 36/2015/TT-BTNMT dated 30 June 2015 on hazardous waste management

Circular No. 04/2015/TT-BXD Providing guidance on a number of articles of the government Decree No. 80/2014/ND-CP dated 06 August 2014 on drainage and wastewater treatment

Circular No. 08/2017/TT-BXD dated 16 May 2017 on construction waste management

QCVN 03-MT:2015/BTNMT - National Technical Regulation on the allowable limits of heavy metals in the soils

QCVN 05:2013/BTNMT - National Technical Regulation on Ambient Air Quality

QCVN 06:2009/BTNMT - National Technical Regulation on Hazardous Substances in Ambient Air

QCVN 07:2009/BTNMT - National Technical Regulation on Hazardous Waste Thresholds

QCVN 08-MT:2015/BTNMT - National Technical Regulation on Surface Water Quality

QCVN 09-MT:2015/BTNMT - National Technical Regulation on Ground water Quality

QCVN 14:2008/BTNMT - National Technical Regulation on Domestic Wastewater

QCVN 40:2011/BTNMT - National Technical Regulation on Industrial Wastewater, and

QCVN 26:2010/BTNMT - National Technical Regulation on Noise.

3.2.2 Law on Environmental Protection

The Law on *Environmental Protection (LEP) No.55/2014/QH13*, dated 23 June 2014 is the main piece of environmental legislation currently in force in Vietnam. The law assigns national responsibility to environmental strategy, the drafting of regulations and standards and all monitoring to the Ministry of National 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).

3.2.3 Environmental Impact Assessment

The Law on Environmental Protection states that all enterprises, as prescribed by the Government within the law, shall conduct a Strategic Environmental Assessment (SEA), an EIA or Environmental

Protection Plan (EPP), and obtain approval prior to the development and operation of a facility. The key EIA regulations are given below:

- *The Law on Environmental Protection No. 52/2005/QH11, dated 29 November,2011*
- *The Law on Environmental Protection No. 55/2014/QH13, dated 23 June 2014*
- *Decree No. 21/2008/ND-CP dated 28 February 2008 on the amendment and revision of Decree No. 80/2006/ND-CP on SEA, EIA and EPP*
- *Decree No. 18/2015/ND-CP dated 14 February 2015 on environmental protection planning, SEA, EIA and EPP*
- *Decree No. 19/2015/ND-CP dated 14 February 2015 detailing the implementation of a number of articles of the law on environmental protection*
- *Circular No. 05/2008/TT-BTNMT dated 08 December 2008 of the Ministry of Natural Resources and Environment on SEA, EIA and EPP, and*
- *Circular No. 25/2019/TT-BTNMT dated 31 December 2019 providing detailed regulations for Decree No. 40/2019/ND-CP.*

3.2.4 Law on Forestry 2017 and Law on Biodiversity 2008

Law No. 16/2017/QH14 dated 15 November 2017 of the National Assembly. This Law deals with management, protection, development and use of forests; forest products processing and trade.

Law No. 20/2008/QH12 dated 13 November 2008 of the National Assembly. This Law provides for the biodiversity conservation and sustainable development; rights and obligations of organizations, households and individuals in the biodiversity conservation and sustainable development. This Law applies to organizations, households and individuals in the country, overseas Vietnamese, foreign organizations and individuals carrying out activities of or related to the biodiversity conservation and sustainable development in Vietnam.

3.2.5 Regulations on Land Acquisition, Compensation, Support and Resettlement

3.2.5.1 National Level

Land Law No. 45/2013/QH13 issued by the National Assembly on 29 November 2013 of the National Assembly, effective on 1/7/2014. This Law prescribes the regime of land ownership, powers and responsibilities of the State in representing the entire-people owner of land and uniformly managing land, the regime of land management and use, the rights and obligations of land users involving land in the territory of the Socialist Republic of Vietnam.

Decree No. 47/2014/ND-CP issued by the Government on 15 May 2014 on compensation, support and resettlement when the government acquire land.

Decree No. 43/2014/ND-CP issued by the Government on 15 May 2014 regulating expenditure detailing the implementation of a number of articles and clauses of the Land Law that took effect on July 1, 2014.

Decree No. 44/2014/ND-CP issued by the Government on 15 May 2014 on regulation on the land price.

Circular No. 37/2014/TT-BTNMT issued by the Ministry of Natural Resources and Environment on 30 June 2014 on detailed regulation on compensation, support and resettlement when the government acquire land.

Circular No. 30/2014/TT-BTNMT of the Ministry of Natural Resources and Environment on 2 June 2014 on regulations on land allocation, land lease, land use purposes, and land acquisition.

3.2.5.2 Provincial Regulations

Decision No. 11/2021/QD-UBND issued by the People's Committee of Gia Lai Province on 20 May 2021 on regulations on compensation for plants in case of land acquisition in Gia Lai province.

Decision No. 09/2018/ QD-UBND issued by the People's Committee of Gia Lai Province 21 March 2018 on compensation, support and resettlement when the state acquire land in Gia Lai province.

Decision No. 02/2020/QD-UBND issued by the People's Committee of Gia Lai Province on 9 January 2020 amending and complementing some articles on Decision No. 09/2018/QD-UBND issued by on 21 March 2018 on regulations on compensation, support and resettlement when the state acquire land in Gia Lai province.

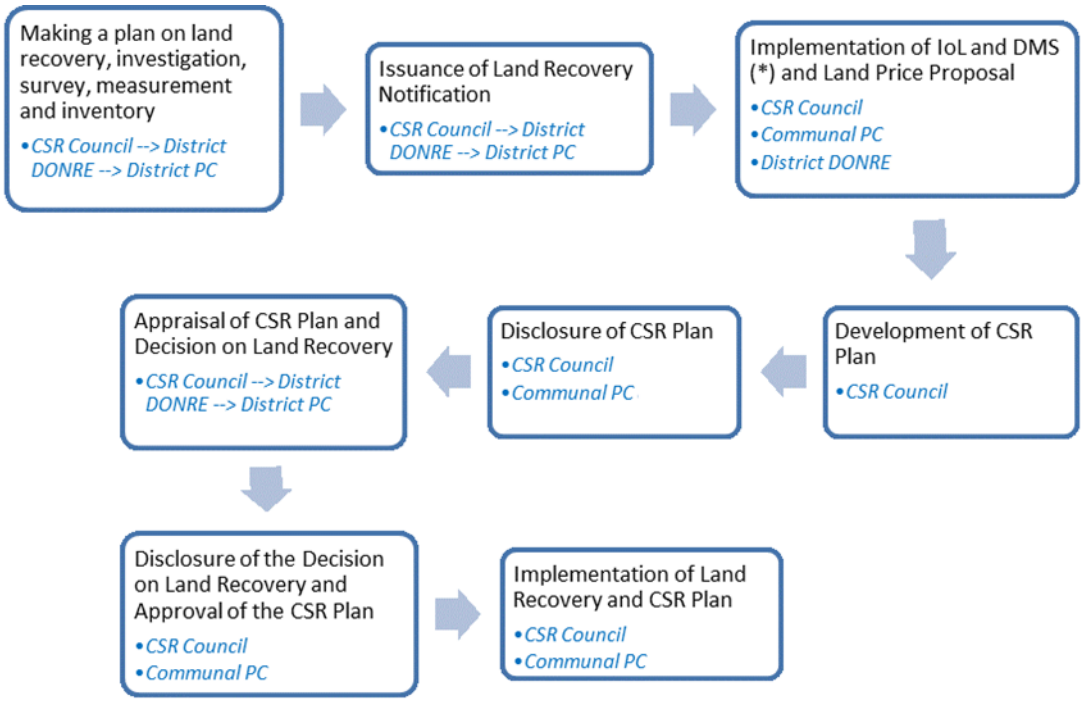


Figure 3.1 Land Compensation, Support and Resettlement Process Required in Vietnam

Note: Inventory of Loss (IOL) and Detailed Measurement Survey (DMS) are conducted under the presence of members of the CSR Council and affected household's representative(s). IOL and DMS results will be disclosed to the Project affected persons (PAPs) for review and signature. All DMS results will be collected and sent back to the PC at provincial or district level who is tasked with the CSR process for signing and stamping.

The conventional process of land acquisition led by the government in Vietnam, regulated in Article 66, 69 and 93 of the Land Law 2013 is as follows:

Step 1: Making a plan on land acquisition, investigation, survey, measurement and inventory

- Develop a plan for land acquisition.
- Notice of land acquisition: The People's Committee having the competence to acquire land shall issue a notice of land acquisition:
  - Notice of land acquisition must be sent to each person whose land is acquired;
  - Meeting to disseminate information to people in areas where land is acquired;
  - Announcement in the mass media; and

- Notice of land acquisition must be posted at the headquarters of the commune-level People's Committee, the common place of the residential area where the acquired land is located.

- Implement the plan for land acquisition, investigation, survey, measurement and inventory.
- Land users are responsible for coordinating with organisations in charge of compensation and ground clearance in conducting investigation, survey and measurement of land area, inventory of houses and other land-attached assets to develop plans for compensation, support and resettlement.

Note: In case the land user does not cooperate with the investigation, survey, measurement and inventory, the commune-level People's Committee and Vietnam Fatherland Front Committee of the commune where the acquired land is located must organise mobilisation and persuasion for the users. Within 10 days, if it still fails to do so, the Chairman of the People's Committee who has the power to acquire the land shall issue a decision on compulsory inventory and a decision on enforcement of the decision on compulsory inventory if it still fails to do so.

Step 2: Formulate and evaluate compensation, support and resettlement plans

- Organisations in charge of compensation and ground clearance are responsible for making plans for compensation, support and resettlement and coordinate with the People's Committees of communes where the acquired land is located.
  - Organise consultations on compensation, support and resettlement plans in the form of direct meetings with people in the area where land is acquired;
  - Publicly post up the plan for compensation, support and resettlement at the headquarters of the commune-level People's Committee, at the common place of the residential area where the acquired land is located.

Note: The consultation must be documented and certified by the representative of the commune-level People's Committee, the representative of the commune-level Vietnam Fatherland Front Committee, and the representatives of those whose land is acquired. The consultation documentation must specify the numbers of opinions for, against and other opinions regarding the plans for the compensation, support and resettlement plan; coordinate with the commune-level People's Committee of the locality where the acquired land is located to hold a dialogue in case of disagreement on the compensation, support and resettlement plan; complete the plan and submit it to the competent authority.

- Prepare a plan and the competent authority shall appraise the compensation, support and resettlement plan before submitting it to the competent People's Committee for decision on land acquisition.

Step 3: Issue a decision on land acquisition, approve and implement the compensation, support and resettlement plan

- Issue decision:
  - Provincial-level People's Committees shall issue decisions on land acquisition in case of land acquisition from organisations, religious establishments, oversea Vietnamese, foreign organisations with diplomatic functions, and enterprises with foreign investment capital; or acquiring agricultural land belonging to the public land fund of communes, wards and townships.
  - The district-level People's Committee shall issue a decision on land acquisition in the case of land acquisition from households, individuals and communities.
- Posting and disseminating the decision approving the compensation, support and resettlement plan:

- Disseminate and publicly post up the decision approving the plan for compensation, support and resettlement at the office of the commune-level People's Committee and at the common space of the residential area where the acquired land is located;
- Send the decision on compensation, support and resettlement to each person whose land is acquired, clearly stating the compensation, support, arrangement of house or resettlement land (if any), time and location points for payment of compensation and support; time for allocating houses or land for resettlement (if any) and time for handing over acquired land to organisations in charge of compensation and ground clearance.

- Implement the compensation, support and resettlement plan according to the approved plan:
  - Within 30 days from the effective date of implementation of the decision on land acquisition of a competent state agency, the agency or organisation responsible for compensation must pay compensation and support to people whose land is acquired.
  - In case the agency or organisation responsible for compensation is late in payment, when paying compensation and support to people whose land is acquired, in addition to compensation and support according to the compensation, support and rehabilitation plan, If the person whose land is acquired is approved by a competent authority, the person whose land is acquired will also be paid an additional amount equal to the late payment interest rate according to the provisions of the Tax Administration Law calculated on the amount of late payment and the delay time.
  - In case the person whose land is acquired does not receive compensation or support according to the compensation, support and resettlement plan approved by a competent authority, the compensation and support money will be deposited into the custody account of the owner. State Treasury.

Note: In case land users whose land is to be acquired fail to hand over the land to the organisation in charge of compensation and ground clearance, the commune level People's Committee and Vietnam Fatherland Front in the locality and the organisation in charge of compensation and ground clearance shall mobilize and persuade the land users to hand over. In case the land users fail to comply with the decision even after the mobilisation and persuasion, the chairperson of the district-level People's Committee shall issue a decision on enforcement of land recovery and organize the enforcement in accordance with Article 71 of the Land Law 2013.

3.2.6 National Regulations on Electricity

Law 28/2004/QH11 of the National Assembly dated 3 December 2004. This Law prescribes the electricity development planning and investment; electricity saving; electricity markets; rights and obligations of organizations and individuals conducting electricity activities and using electricity; protection of electric equipment and facilities, electricity works and electric safety.

Decision No. 428/QD-TTg of the Prime Minister dated 18 March 2016 of the Prime Minister on approving the adjustment of the national electricity development planning phase 2011-2020 with a vision to 2030 (Revised Power Master Plan VII).

Decision No. 37/2011/QD-TTg of the Prime Minister dated 29 June 2011 of the Prime Minister Prime Minister on the mechanism to support the development of wind power projects in Vietnam.

Decision No. 39/2018/QD-TTg of the Prime Minister dated 10 September 2018 of the Prime Minister. This Decision amend and supplement a number of articles of Decision No 37/2011/QD-TTg dated 29 June 2011 of the Prime Minister on the mechanism supporting the development of wind power projects in Vietnam.

Decree No. 14/2014/ND-CP dated 26 February 2014 on stipulating in detail the implementation of electricity law regarding electricity safety.

Circular 43/2013/TT-BCT of the Ministry of Industry and Trade on promulgate regulations on the content, order and procedures for formulation, appraisal, approval and regulation on adjustment of electricity development planning.

Circular 02/2019/TT-BCT of the Ministry of Industry and Trade on 15 January 2019 on regulations on implementation of wind power project development and standard power purchase agreement for projects wind power projects.

3.2.7 National Regulations on Grievances

Law on Grievance No.02/2011/QH13 issued by the National Assembly on 11 November 2011 and effective from 1 July 2012 provides the framework for grievances and the settlement of grievances and the settlement of grievances related to disciplinary decisions against cadres or civil servants, and reception of citizens, management and supervision of complaint settlement work. In general, the raising of grievances and settlement of grievances must comply with the law and ensure objectiveness, publicity, democracy and timeliness

Circular No. 07/2014/TT-TTCP issued by the Government Inspectorate on 31 October 2014 and effective from 15 December 2014 prescribes the process of receiving, categorization, investigation and resolving community grievances

Law on Administrative Procedures No.93/2015/QH13 issued by the National Assembly on 25 November 2015 and effective from 1 July 2016 prescribes fundamental principles in administrative procedures, tasks, powers and responsibilities of procedure-conducting agencies and persons, rights and obligations of procedure participants and related agencies, organizations and individuals, order and procedures for instituting lawsuits, settling administrative cases, executing administrative judgments and settling complaints and denunciations in administrative procedures, and

Civil Procedure Code 2015 issued by the National Assembly on 25 November 2015 and effective from 1 July 2016 provides for the basic principles in civil proceedings, the order, and procedures for initiating lawsuits at People's Court to settle cases of civil, marriage and family, business, trade and labour including grievances on environmental pollution between individuals and organizations.

3.2.8 National regulations on Occupational Health and Safety (OHS)

The Constitution 2013 of the National Assembly dated 28 November 2013.

Labor Code No.45/2019/QH14 issued by the National Assembly on 20 November 2019. The Labor Code sets forth labor standards; rights, obligations and responsibilities of employees, employers, internal representative organizations of employees, representative organizations of employers in labor relations and other relations directly related to labor relations; and state management of labor.

Law No. 84/2015/QH13 issued by the National Assembly on June 25, 2015 on occupational safety and hygiene. This Law deals with occupational hygiene and safety assurance; policies and benefits for victims of occupational accidents and occupational diseases; rights and obligations of organizations or individuals relating to occupational hygiene and safety and the roles of regulatory agencies in occupational hygiene and safety.

Decree 88/2020/ND-CP issued by the Government on 28 July 2020 on elaborating some articles of the law on occupational safety and health on compulsory insurance for occupational accidents and occupational diseases.

Circular No. 13/2020/TT-BLDTBXH issued by the Ministry of Labor, War-Invalids, and Social Affairs on guiding collection, storage, consolidation, provision and publicizing and assessment of occupational accidents and technical difficulties causing serious loss of occupational safety and hygiene.

Circular No. 11/2020/TT-BLDTBXH issued by the Ministry of Labor, War-Invalids, and Social Affairs on 12 November 2020 on promulgating list of arduous hazardous and dangerous occupations and works and extremely hazardous and dangerous occupations and works.

Circular No. 06/2020/TT-BLĐTBXH issued by the Ministry of Labor, War-Invalids, and Social Affairs on 20 August 2020 on promulgation of list of occupations bound by strict requirements for occupational safety and health.

Decree No. 58/2020/ND-CP issued by the Government on 27 May 2020 on regulating rates of compulsory insurance contributions to occupational accident and disease benefit fund.

Circular No. 36/2019/TT-BLDTBXH issued by the Ministry of Labor, War-Invalids, and Social Affairs on promulgating the list of machinery, equipment, material and substances subject to strict occupational safety and health requirements.

QCVN 03: 2019/BYT National Technical Regulation on Permissible Exposure Limit Value of 50 chemicals at the Workplace.

QCVN 02: 2019/BYT National Technical Regulation on Dust - Permissible Exposure Limit Value of Dust at the Workplace. The national technical regulation was included in the Circular 02/2019/TT-BYT issued by the Ministry of Health on 21 March 2019.

Circular No. 26/2017/TT-BLDTBXH issued by the Ministry of Labor, War-Invalids, and Social Affairs on 20 September 2017 guidelines for statutory insurance for occupational accidents and diseases.

QCVN 29:2016/BLĐTBXH National technical regulation on safe work for Cranes.

Circular No: 19/2016/TT-BYT issued by the Ministry of Health on 30 June 2016 on guidelines for occupational health and safety management.

QCVN 22:2016/BYT National Technical Regulation on Lighting - Permissible Levels of Lighting in the Workplace.

Law No: 68/2006/QH11 issued by the National Assembly dated 29 June 2006 on standards and technical regulations.

QCVN 24:2016/BYT National Technical Regulation on Noise - Permissible Exposure Levels of Noise in the Workplace.

Decree No. 39/2016/ND-CP issued by the Government dated 15 May 2016 on detailing the implementation of some articles of the law on occupational safety and sanitation.

Decree No. 44/2016/ND-CP issued by the Government dated 15 May 2016 on details some articles of the law on occupational safety and sanitation, technical inspection of occupational safety, training of occupational safety and sanitation and monitoring of occupational environment.

3.2.9 National regulations on Chemicals

Law No. 06/2007/QH12 issued by the National Assembly on 21 November 2017 on Chemicals.

QCVN 05A:2020/BCT issued by the Ministry of Industry and Trade on 21 December 2020 on national technical regulation on safety in production, commerce, use, storage and transportation of hazardous chemicals.

Decree No. 113/2017/ND-CP issued by the Government on October 2017 on specifying and providing guidelines for implementation of certain articles of the law on chemicals.

Circular No. 32/2017/TT-BCT issued by the Ministry of Industry and Trade on 28 December 2017 on specifying and providing guidelines for implementation of certain articles of the law on chemicals and the government’s decree no.113/2017/ND-CP on October 092017 specifying and providing guidelines for implementation of certain articles of the law on chemicals.

3.2.10 National Regulations on Fire Prevention and Fire Fighting

Law No. 27/2001/QH10 issued by the National Assembly on 29 June 2001 on fire prevention and fighting

Circular No. 57/2015/TT-BCA issued by the Ministry of Public Security on 26 October 2015 on providing instructions on installation of fire prevention and fire fighting equipment into road vehicles.

Circular No. 148/2020/TT-BCA issued by the Ministry of Public Security on 31 December 2020 on amending some articles on Circular No. 57/2015/TT-BCA.

Decree No. 136/2020/ND-CP issued by the Government on 24 November 2020 on providing guideline for a number of articles of law on fire prevention and fighting and law on amendments to law on fire prevention and fighting

Decree No. 23/2018/ND-CP issued by the Government on 23 February 2018 on compulsory fire and explosion insurance.

Circular No. 57/2015/TT-BCA issued by the Ministry of Public Security on 26 October 2015 on providing instructions on installation of fire prevention and fire fitting equipment into road vehicles.

TCVN 3890: 2009 issued by the Ministry of Science and Technology Fire protection equipment for construction and building – Providing, installation, inspection, maintenance.

Directive No: 10/2008/CT-TTg issued by the Prime Minister on 14 March 2008 on strengthening the implementation of labour protection, occupational safety.

3.2.11 National Regulations on Labour Rights

National regulations on labour rights will include all the national regulations on occupational health and safety (details in Section 3.2.8) and the following regulations:

Decree No. 145/2020/ND-CP issued by the Government on 14 December 2020 on elaboration of some articles of the labor code on working conditions and labor relations.

Decree No. 135/2020/ND-CP issued by the Government on 18 November 2020 on the retirement age.

Decree No. 09/2020/TT-BLDTBXH issued by the Ministry of Labor, War-Invalids, and Social Affairs on 12 November 2020 on elaborating some articles of the labor code on minor workers.

Circular No. 10/2020/TT-BLDTBXH issued by the Ministry of Labor, War-Invalids, and Social Affairs on 12 November 2020 on elaborating and guiding certain articles of the labor code concerning employment contracts collective bargaining council and jobs with hazards to reproductive function and children raising.

Decree No.: 149/2018/ND-CP issued by the Government on 7 November 2018 on elaboration of clause 3 article 63 of the labor code regarding application of workplace democracy.

Law No. 12/2012/QH13 issued by the National Assembly on 20 June 2012 on trade union.

3.2.12 National Regulations on Ethnic Minorities

The Constitution 2013 of the National Assembly dated 28 November 2013.

Decree No. 33/2020/QD-TTg of the Prime Minister on 12 November 2020 on 12 November 2020 on the criterial for determination of ethnic minority areas and mountainous regions by development quality for the period of 2021-2025.

Resolution No. 88/2019/QH14 issued by the National Assembly on 18 November 2019 on approval of master plan for social economic development of ethnic minority and mountainous regions for 2021-2030 period.

Resolution No. 12/NQ-CP issued by the Government on 15 February 2020 on the implementation of resolution No. 88/2019/QH14.

Decree No. 05/2011/ND-CP issued by the Government on 14 January 2011 on the ethnic minorities work.

Decision No. 449/QD-TTg issued by the Prime Minister on 12 March 2013 on approving the ethnic minority affairs strategy through 2020.

Decision No. 1557/QD-TTg issued by the Prime Minister on 10 September 2015 on approving some targets for implementation of the millennium development goals for ethnic minorities associated with sustainable development goals after 2015.

Decision No. 2085/QD-TTg issued by the Prime Minister on 31 October 2016 on approving the policy to support the social economic development of ethnic minorities and mountainous areas for the 2017-2020 period.

Resolution No. 30a/2008/NQ-CP issued by the Prime Minister on 27 December 2008 on the support program for fast and sustainable poverty reduction in 61 poor districts.

Decision No.32/2016/QD-TTg issued by the Prime Minister on 8 August 2016 on promulgating policies to provide legal support for the poor and ethnic minorities at poor districts, communes, and villages in 2016-2020 period and provide legal support in complex and typical cases.

3.3 International Standards

3.3.1 Equator Principles IV (2020)

The Equator Principles is a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in project finance. The principles have been adopted by 118 financial institutions in 37 countries.

Equator Principles consists of 10 principles including:

- Principle 1: Review and Categorization
- 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
- Principle 10: Reporting and Transparency

Equator Principles IV requires projects in category A and B to have an Environment and Social Management Plan which address issues raised in the assessment process and incorporate actions required to comply with the applicable standards. Where the applicable standards are not met to the Equator Principles Financial Institution (EPFI)'s satisfaction, the client and the EPFI will agree to an Equator Principles Action Plan (EPAP). The EPAP is intended to outline gaps and commitments to meet EPFI requirements in line with the applicable standards.

Category A refers to projects that raised with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented.

Category B refers to 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.

3.3.2 AIIB's Environmental and Social Framework (2019)

The Asian Infrastructure Investment Bank's (AIIB) goal is to increase the pool of multilateral development support available to regional economies for infrastructure development and improvement. It cooperates closely with other multilateral development banks and bilateral development organizations; and its financing complements and supplements their efforts. Although AIIB has released the 2021 Environmental and Social Framework (ESF), it only applies to all Projects that are included in AIIB's investment pipeline on or after October 1, 2021; therefore the 2019 Framework remains valid and applicable to the Project.

The purposes of the AIIB's environmental and social framework are:

- To address environmental and social risks and impacts involving any projects' activities or financial recipients from the bank.
- To provide a robust structure for managing operational and reputational risks of the Bank and its shareholders in relation to projects' environmental and social risks and impacts.
- To ensure the environmental and social soundness and sustainability of projects.
- To support the integration of environmental and social aspects of projects into the decision making process by all parties.
- To provide a mechanism for addressing environmental and social risks and impacts in project identification, preparation and implementation.
- To identify and manage environmental and social risks and impacts of projects, including those of climate change.
- To provide a framework for public consultation and disclosure of environmental and social information in relation to projects.
- To improve development effectiveness and impact to increase results on the ground both short- and long-term.
- To support Clients, through Bank financing of projects, to implement their obligations under national environmental and social legislation (including under international agreements adopted by the member) governing these projects.
- To facilitate cooperation on environmental and social matters with development partners.

The AIIB's environmental and social standards include three standards including environmental and social assessment and management, involuntary resettlement, and indigenous people.

AIIB's Environmental and Social Policy (ESP) identifies four categories of projects as follows:

- Category A includes projects that are is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented.
- Category B includes projects that have a limited number of potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are limited to the Project area; and can be successfully managed using good practice in an operational setting.
- Category C includes projects are likely to have minimal or no adverse environmental and social impacts.
- Category FI includes projects which receives funding from the financing structure involves the provision of funds to or through a financial intermediary (FI), whereby the Bank delegates to the FI the decision-making on the use of the Bank funds, including the selection, appraisal, approval and monitoring of Bank-financed subprojects.

AIIB's ESP also sets out 12 requirements for each project including:

- Screening and Categorization
- Environmental and Social Due Diligence
- Environmental and Social Assessment
- Assessment Documentation and Instruments
- Environmental and Social Management Plan
- Environmental and Social Management Framework
- Special Circumstances
- Use of Country and Cooperate system
- Information Disclosure
- Consultation
- Monitoring and Reporting
- Grievances

The AIIB's environmental and social standards (ESS) include three standards including environmental and social assessment and management, involuntary resettlement, and indigenous people. Gender equality and human rights which are also two important aspects of the framework are integrated in the ESSs.

ESS 1: Environmental and Social Assessment and Management

The purpose of the standard is to ensure the environmental and social soundness and sustainability of projects and to support the integration of environmental and social considerations into the project decision-making process and implementation. ESS 1 is applied for projects which are likely to have adverse environmental risks and impacts or social risks and impacts (or both). It provides for both quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during the course of project implementation.

ESS 1 contains of four sections. Section A sets out general requirements for assessing and managing environmental and social risks under the Project; Sections B, C and D set out more detailed requirements for, respectively: environmental aspects, social aspects, and working conditions and community health and safety aspects of such assessment and management.

ESS 2: Involuntary Resettlement

Involuntary Resettlement covers physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land or access to land and natural resources; loss of assets or access to assets, income sources or means of livelihood) as a result of: (a) involuntary acquisition of land; or (b) involuntary restrictions on land use or on access to legally designated parks and protected areas. The objective of the ESS 2 is to avoid or minimize as much as possible Involuntary Resettlement. In case Involuntary Resettlement is not avoidable, projects should enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-Project levels.

ESS 3: Indigenous Peoples

The ESS 3 takes into account Indigenous People in the projects' design and implementation to foster full respect for their identity, dignity, human rights, economies and cultures, as defined by the Indigenous Peoples themselves. This will ensure that they receive culturally appropriate social and economic benefits, avoid adverse impacts as a result of projects, and participate actively in projects that affect them.

Gender Equality:

Gender equality is a part of successful and sustainable economic development and there is the need for inclusiveness and gender responsiveness in the Projects which are supported by AIIB. Identifying

potential gender-specific opportunities as well as gender-specific adverse risks and impacts under their Projects and developing mitigation measures to avoid or reduce such impacts and risks are highly appreciated. It is also important to enhance the design of the Projects in an inclusive and gender-responsive manner to promote equality of opportunity and women's socioeconomic empowerment, particularly with respect to access to finance, services and employment, and otherwise to promote positive impacts on women's economic status, with particular regard to financial resources and property ownership and control.

Human rights:

Human right is a very important part in AIIB. The Bank considers human rights inclusion means empowering people to participate in, and benefit from, the development process in a manner consistent with local conditions. ESS 2 and 3 address the involuntary resettlement and indigenous peoples which are parts of the human rights.

3.4 International Conventions

3.4.1 The Kyoto Protocol on Climate Change

Vietnam became a signatory to the United Nation Frameworks Convention on Climate Change in 1998 with full accession in 2002. This obligates Vietnam to assure that future development in the country meets the conditions of the Convention. Relevant to this project are the requirements associated with the potential generation of greenhouse gas. Further conditions of relevance include:

- Enhancement of energy efficiency in relevant sectors
- Protection and enhancement of sinks and reservoirs of GHG
- Promotion of sustainable forest management practices, afforestation, and reforestation
- Promotion of sustainable forms of agriculture
- Implementation of measures to limit and/or reduce emissions of GHG, and
- Limitation and/or reduction in methane emissions.

In 2015, at the 21st Conference of parties in Paris, 196 parties including Vietnam adopted the Paris Agreement. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. To achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by the mid-century. This agreement works on a 5-year cycle of increasingly ambitious climate action carried out by countries. The Prime Minister issued *Decision No. 2053/QD-TTg* dated 28 October 2016 declaring Vietnam's action plan to implement the Paris Agreement on Climate Change. Vietnam has submitted the first updated nationally determined contribution (NDC) in July 2020.

3.4.2 The United Nations Convention on Biodiversity 1992

This Convention seeks to conserve biodiversity and promote its sustainable use. It requires the identification and monitoring of the biodiversity in an area, and area and adopting the necessary conservation measure. Vietnam became party to this Convention on 16 November 1994.

3.4.3 The Basel Convention 1989

This was developed under the auspices of the United Nations Environmental Programme (UNEP) in response to the growing worldwide awareness of the problem of international traffic in hazardous waste. The Basel Convention 1989 is the first and foremost global environmental treaty that strictly regulates the trans-boundary movement of hazardous wastes. It obligates parties to ensure environmentally sound management, especially during the disposal process.

The objectives of the Convention are to:

- Ensure that waste is disposed of as near as possible to the place or source of its generation
- Reduce trans-boundary waste and where it cannot be avoided, to be disposed of in an environmentally sound and efficient manner, and
- Provide assistance to developing countries in the management and the generation of hazardous waste.
- The Convention places a ban on the export of hazardous waste from the Organisation for Economic Cooperation and Development (OECD) countries to non-OECD countries.
- Vietnam participated in the Basel Convention on 13th March 1995 and this convention entered into force for Vietnam on 11th June 1995.

3.4.4 International Union for Conservation of Natural and Natural Resources, Red List of Threatened Species

The IUCN Red List was founded in 1964 to provide a comprehensive inventory of the global conservation status of biological species; and to set precise to evaluate the extinction risk of thousands of species and subspecies. These criteria are applicable to all species and all regions of the world. Following the guidelines of the IUCN Red List; Vietnam's Red List was produced in 1992, updated in 2007, and has been an effective guideline for the conservation of extinction vulnerable species in Vietnam.

3.4.5 The United Nations Declaration on the Rights of Indigenous Peoples

The United Nations Declaration on the Rights of Indigenous Peoples was adopted on 13 September 2007. Currently, the Declaration is the most comprehensive international instrument on the rights of indigenous peoples. It establishes a universal framework of minimum standards for the survival, dignity, and well-being of the indigenous peoples of the world and it elaborates on existing human rights standards and fundamental freedoms as they apply to the specific situation of indigenous peoples.

3.4.6 The International Labour Organization – International Labour Standards

The international labour standards developed and adopted by The International Labour Organization (ILO) sets out basic principles and rights at work. They are conventions which are legally binding international treaties that may be ratified by member states. The six fundamental Conventions of the ILO which Vietnam has ratified are as follows:

C111 - Discrimination (Employment and Occupation) Convention, 1958 - Convention concerning Discrimination in Respect of Employment and Occupation

C138 - Minimum Age Convention, 1973 - Convention concerning Minimum Age for Admission to Employment

C182 - Worst Forms of Child Labour Convention, 1999 - Convention concerning the Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour

C029 - Forced Labour Convention, 1930 - Convention concerning Forced or Compulsory Labour

C098 - Right to Organise and Collective Bargaining Convention, 1949 - Convention concerning the Application of the Principle(s) of the Right to Organise and to Bargain Collectively

C100 - Equal Remuneration Convention, 1951 - Convention concerning Equal Remuneration for Men and Women Workers for Work of Equal Value.

Vietnam has been a member of the ILO since 1994. Since then, labour management regulations in Vietnam have also been developed, updated, and issued to ensure alignment with the requirements of the above convention. Therefore, local regulations on labour management, together with the above conventions, are requirements applicable to a project developed in Vietnam.

3.5 Project Standards

According to the AIIB EHS Framework, pollution prevention and control technologies and practices for the Project will be consistent with international good practice such as the World Bank Group's Environmental, Health and Safety Guideline. The following sections present the details of those standards applicable to this ESIA.

3.5.1 Ambient Air Quality

Emissions of air pollutants can occur from a wide variety of activities during the construction, operation, and decommissioning phases of a project. These activities can be categorized based on the spatial characteristic of the source including point sources, fugitive sources, and mobile sources and, further, by process, such as combustion, materials storage, or other industry sector-specific processes. Where possible, facilities and projects should avoid, minimize, and control adverse impacts to human health, safety, and the environment from emissions to air. Where this is not possible, the generation and release of emissions of any type should be managed through a combination of:

- Energy use efficiency
- Process modification
- Selection of fuels or other materials, the processing of which may result in less polluting emissions
- Application of emissions control techniques

The selected prevention and control techniques may include one or more methods of treatment depending on:

- Regulatory requirements
- Significance of the source
- Location of the emitting facility relative to other sources
- Location of sensitive receptors
- Existing ambient air quality, and potential for degradation of the airshed from a proposed project

Technical feasibility and cost effectiveness of the available options for prevention, control, and release of emissions

3.5.2 Noise

According to the IFC EHS Guideline, noise impacts should not exceed the levels presented in Table 3.1, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 3.1 Noise Level Guidelines

	One Hour L_{Aeq} (dBA)	
Receptor	Daytime (07.00-22.00)	Nighttime (22.00-07.00)
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Source: IFC EHS Guideline, 2007

Noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most

sensitive point of reception. The preferred method for controlling noise from stationary sources is to implement noise control measures at source. Methods for prevention and control of sources of noise emissions depend on the source and proximity of receptors.

3.5.3 Domestic Wastewater

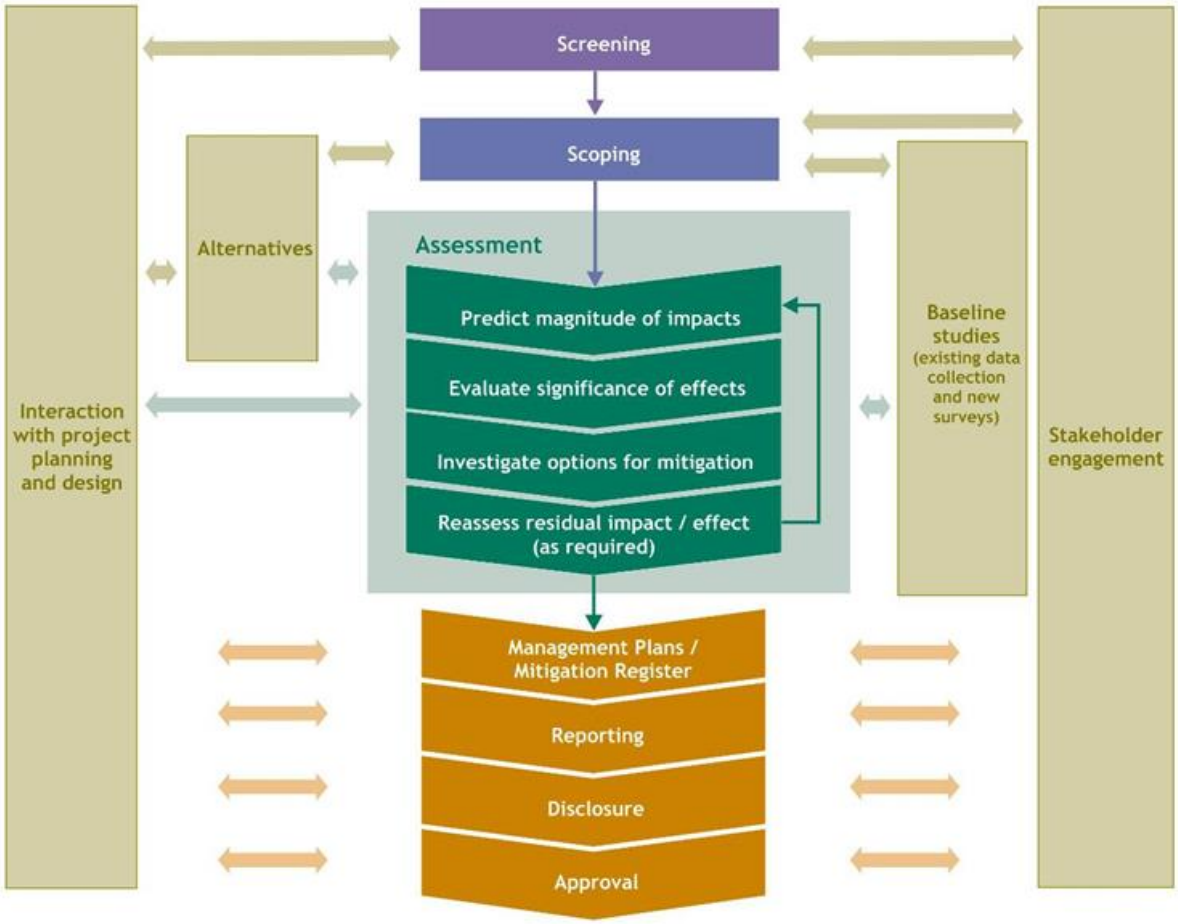
Projects with the potential to generate process wastewater, sanitary (domestic) sewage, or stormwater should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment. In the context of their overall ESHS management system, facilities should:

- Understand the quality, quantity, frequency and sources of liquid effluents in its installations. This includes knowledge about the locations, routes and integrity of internal drainage systems and discharge points
- Plan and implement the segregation of liquid effluents principally along industrial, utility, sanitary, and stormwater categories, in order to limit the volume of water requiring specialized treatment. Characteristics of individual streams may also be used for source segregation.
- Identify opportunities to prevent or reduce wastewater pollution through such measures as recycle/reuse within their facility, input substitution, or process modification (e.g. change of technology or operating conditions/modes).
- Assess compliance of their wastewater discharges with the applicable: (i) discharge standard (if the wastewater is discharged to a surface water or sewer), and (ii) water quality standard for a specific reuse (e.g. if the wastewater is reused for irrigation).

4. IMPACT ASSESSMENT METHODOLOGY

4.1 Introduction

This section presents the methodology used to conduct this ESIA, which follows the approach illustrated in Figure 4.1. This ESIA has been undertaken following a systematic process that evaluates the potential impacts the Project could have on aspects of the physical, biological, social/socio – economic and cultural environment. It identifies preliminary measures that the Project will take to avoid, minimise/ reduce, mitigate, offset, or compensate for potential adverse impacts. And this ESIA identifies measures to enhance potential positive impacts where possible.



Source: ERM 2019

Figure 4.1 Process for an ESIA Development

This section also details the methodology used for the collection and analysis of primary and secondary data used in this report. Primary and secondary information from the Project owner, government sources, non – governmental organisation (NGOs) and other Project – related stakeholders have been collected to support the preparation of this report.

4.2 Screening

At the initial stage of this ESIA, preliminary information was provided to aid in the determination of what legal and other requirements should be applied to the Project. This step was completed utilizing a high – level description of the Project and its associated facilities.

4.3 Scoping

Scoping has been undertaken to delineate the potential Area of Influence for the Project (and thus the appropriate Study Area) and to identify potential interactions between the Project and resources/ receptors in the Area of Influence. It also helps in developing and selecting alternatives to proposed actions and in identifying the issues to be considered in this ESIA.

The content of this ESIA report has been prepared according to the output from the scoping process, which is further detailed in Chapter 5.

4.4 Project Description

In order to set out the scope of the Project features and activities, with particular reference to the aspects which have the potential to impact the environment, a Project Description has been prepared. Details of the Project facilities' design characteristics, as well as planned and possibly unplanned Project activities, are provided in Chapter 2 of this ESIA report.

4.5 Baseline Conditions

To provide the 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 presented. The baseline includes information on all resources/ receptors that were identified during scoping as having a potential to be significantly affected by the Project.

The baseline characterisation is reported in Chapter 7, Chapter 8 and Chapter 9 of this Report.

4.6 Stakeholder Engagement

An effective ESIA process requires engagement with relevant stakeholders throughout the key stages. This assists in first mapping the relevant stakeholders, then understanding stakeholder view on the Project and in identifying issues that should be taken into account in the prediction and evaluation of the impact.

Details of the Stakeholder Engagement activities undertaken for the Project to date are presented in Chapter 6 of this report.

4.7 Impact Assessment (IA)

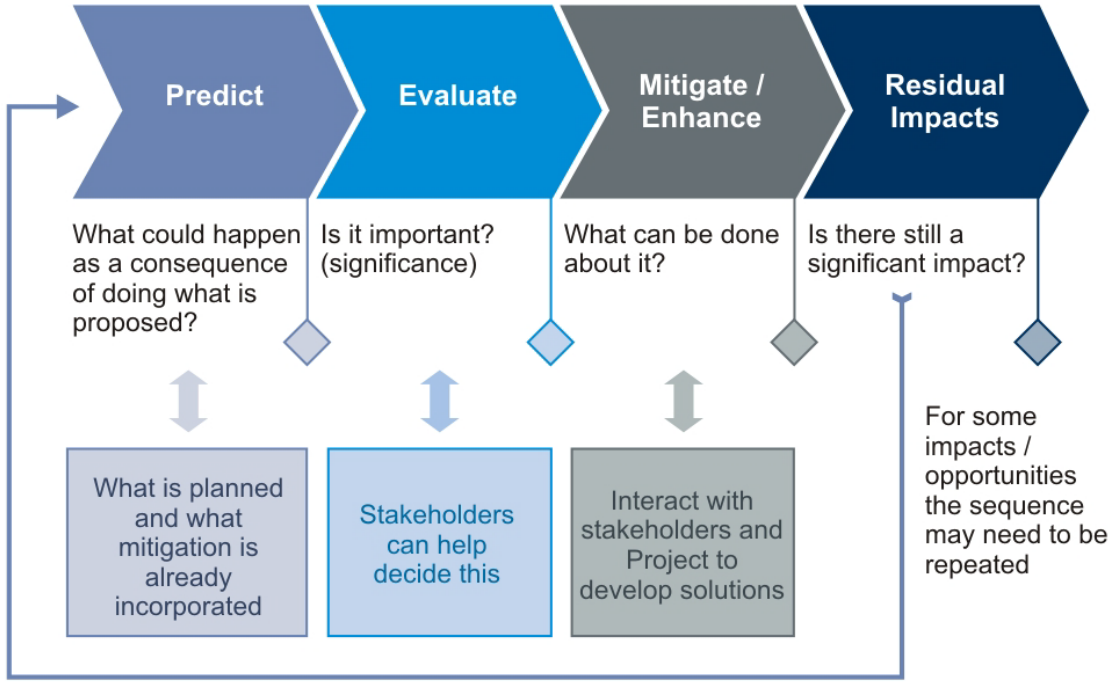
Impact identification and assessment starts with scoping and continues throughout the remaining of the ESIA process. The main ESIA steps are summarised below and comprise of:

Potential Impact Identification: 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.

Management and Mitigation Enhancement Measure: to identify appropriate and justified measures to mitigate potential negative impacts and enhance potential positive impacts, and

Residual Impact Evaluation: to evaluate the significance of potential impacts assuming effective implementation of mitigation and enhancement measures.



Source: ERM 2021

Figure 4.2 IA Process

4.7.1 Prediction of Impacts

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 during the scoping phase, the impacts to the various resources/ receptors are elaborated and evaluated. The diverse range of potential impacts considered in the ESIA Process typically results in a wide range of prediction methods being used, including quantitative, semi – quantitative, and qualitative techniques.

4.7.2 Evaluation of Environmental and Social Impacts

Once the identification of potential impacts is completed, each potential impact is described in terms of its various relevant characteristics (e.g. type, scale, duration, frequency, extent). The terminologies and designations used to describe impact characteristic are shown in Table 4.1.

Table 4.1 Impact Characteristic Terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the potential impact to the Project (in terms of cause and effect).	Direct Indirect Induced
Extent	The “reach” of the potential impact (e.g., confined to a small area around the Project footprint, projected for several kilometres, etc.).	Local Regional International
Duration	The time period over which a resource / receptor is potentially affected.	Temporary Short-term Long-term

Characteristic	Definition	Designations
Scale	The size of the potential impact (e.g. the size of the area with the potential to be damaged or impacted, the fraction of a resource that could potentially be lost or affected, etc.)	[no fixed designations; intended to be a numerical value or a qualitative description of "intensity"]
Frequency	A measure of the constancy or periodicity of the potential impact.	[no fixed designations; intended to be a numerical value or a qualitative description]

The definitions for the type designations are shown in Table 4.2. Definitions for the other designations are resource/ receptor-specific and are discussed in the resource/ receptor-specific IA chapters presented later in this ESIA.

Table 4.2 Impact Type Definitions

Type	Definition
Direct	Potential impacts that result from a direct interaction between the Project and a resource/receptor (e.g. between occupation of a plot of land and the habitats which are affected).
Indirect	Potential impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g. viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).
Induced	Potential impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g. influx of camp followers resulting from the importation of a large Project workforce).

The above characteristics and definitions apply to Planned and Unplanned events. An additional characteristic that pertains only to unplanned events is *likelihood.* The *likelihood* of an unplanned events occurring is designated using a qualitative scale, as described in Table 4.3.

Table 4.3 Definitions for Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions.
Possible	The event is likely to occur at some time during normal operating conditions.
Likely	The event will occur during normal operating conditions (i.e., it is essentially inevitable).

Once impact characteristics are defined, the next step in the IA phase is to assign each potential impact a 'magnitude'. Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent;
- Duration;
- Scale;
- Frequency; and
- Likelihood (for unplanned event).

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the potential impact. The magnitude designations themselves are universally consistent, but the definitions for these designations vary depending on the resource/receptor. The universal magnitude designations are:

- Positive;
- Negligible;
- Small;
- Medium; and
- Large.

In the case of a potential *positive* impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the purpose of the ESIA to indicate that the Project is expected to result in a potential *positive* impact, without characterising the exact degree of positive change likely to occur.

In the case of potential impacts resulting from unplanned events, the same resource/receptor-specific approach to concluding a magnitude designation is utilised. However, the '*likelihood* factor is considered, together with the other impact characteristics, when assigning a magnitude designation.

In addition to characterising the magnitude of impact, the other principal impact evaluation step is definition of the sensitivity/vulnerability/importance of the impacted resource/receptor. There are a range of factors to be taken into account when defining the sensitivity/vulnerability/importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors may also be considered, such as legal protection, government policy, stakeholder views and economic value. As in the case of magnitude, the sensitivity/vulnerability/importance designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor basis. The sensitivity/vulnerability/importance designations used herein for all resources/receptors are:

- Low;
- Medium; and
- High.

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterised, the significance can be assigned to each impact. Impact significance is designated using the matrix shown in Table 4.4**.**

Table 4.4 Impact Significance

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

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/importance designations that enter into the matrix. The context for what the various impact significance ratings signify is presented in the box below.

It is important to note that impact prediction and evaluation take into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the ESIA Process). This helps avoid a situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

Context of Impact Significance

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/vulnerability/importance. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its' effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of ESIA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there maybe be major residual impacts after all practicable mitigation options have been exhausted (i.e., ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholder to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

4.7.3 Identification of Mitigation and Enhancement Measures

Once the significance of a potential impact has been characterised, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this ESIA, ERM has adopted the following Mitigation Hierarchy:

- **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; and
- **Compensate in Kind, Compensate Through Other Means**: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).

The priority in mitigation is to first apply mitigation measures to the source of the potential impact (i.e., to avoid or reduce the magnitude of the potential impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or

offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

4.7.4 Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the next step in the ESIA process is to assign residual impact significance. This is essentially a repeat of the IA steps discussed above, considering the implementation of the proposed mitigation and enhancement measures.

4.7.5 Management, Monitoring and Audit

The final stage of the ESIA process is defining the basic management and monitoring measures that are needed to identify whether: a) impacts or their associated project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

A Register of Commitments, which is a summary of all actors of the Project proponent has committed to executing, with respect to the environmental, social, and health performance for the Project, is also included as a part of this Report. The Register of Commitments includes mitigation measures, compensatory measures ad offsets, and management and monitoring activities.

4.8 Cumulative Impacts

In order to gain an understanding of the Project's overall contribution to impacts, a cumulative impact assessment (CIA) was undertaken. Whilst total cumulative impacts due to multiple projects within a given area should be identified within government – led spatial planning efforts, the Project owner needs to determine the degree to which it is contributing to these overall cumulative impacts. In this regard, the objectives of the CIA are twofold:

- Determine if the cumulative impacts caused by the Project and other existing or predictable future projects would threaten the sustainability of valuable environmental component (VEC) in the area, and
- Develop mitigation measures to prevent unacceptable conditions of VECs. The measures could include additional mitigation measures for the Project and also additional mitigation measures for other existing or predictable future projects in the area.

The ESIA and CIA are prepared based on similar logical framework, analytical process and tools. Unlike the ESIA that centres on the Project as a source of impacts, the CIA focuses on VECs under influence from different project. In a CIA, the overall resulting condition of the VEC and its related viability are assessed.

Examples of cumulative impacts include: incremental contribution of gaseous emissions to an airshed; reduction of water flows in a watershed due to multiple withdrawals; increases in sediment loads to a watershed; interference with migratory routes or wildlife movement; or more traffic congestion and accidents due to increases in vehicular traffic on community roadways.

5. ESIA SCREENING AND SCOPING

Screening and scoping form the basis of identifying important environmental and social impacts to be assessed in the ESIA report. Ideally, these processes serve to eliminate detailed assessment of impacts which are deemed unlikely to be of significance or can be easily addressed through implementation of appropriate management or mitigation measures.

5.1 Objective

In accordance with Vietnam regulations on environment protection, the Project has been identified in the category of wind power projects which are not required to conduct the environmental impact assessment (also known as local EIA). Similarly, the Project has also been granted permission to be exempted from developing an environmental project plan (EPP). This ESIA report has therefore been developed to meet international standards requirements to identify, assess and manage environmental and social impacts and risks associated with the Project[2], which would typically be.

In regard to this Project, this primarily applies to the following:

- Biodiversity and noise assessment
- Assessment of wind farm specific concerns such as shadow flicker and blade throw
- Social impact assessment including economic displacement by land acquisition, ecosystem services and community health and safety
- Consultation with key stakeholders of the Project before and during the construction phase and during operation
- Consideration of cumulative impacts, associated facilities and unplanned events; and
- Consideration of impacts on indigenous peoples (IP) and cultural heritage.

5.2 Screening Results

5.2.1 Project categorisation per AIIB's Environmental and Social Framework

In accordance with AIIB Environmental and Social Framework (2019), the fact that AIIB has requested the Client to prepare this ESIA report including an Environmental and Social Management Plan (ESMP) has, by definition, placed this project in Category A:

> "For Category A Projects, the ESIA report or other environmental and social assessment report includes an ESMP or ESMPF (or both)."[3]

The AIIB framework defines a Category A project as "likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented. These impacts may

[2] Number 27 Appendix II, Section 3 from the appendixes enclosed to Decree 40/2019/ND-CP - Amendment to Decrees on Guidelines for the Law on Environmental Protection: Requirements of local EIA are applied to wind power projects with area of and above 200ha. Requirements of EPP are applied to wind power projects with area in the range of 50 ha to 200 ha. Because the total land use area of the entire project including Ia Pech Wind Power Project – 15,595 ha and Ia Pech 2 Wind Power Project – 14,6058 ha is under the regulated range above, the Project was exempted from having to carry out both EIA and EPP.

[3] AIIB Environmental and Social Framework March 2019, https://www.aiib.org/en/policies-strategies/_download/environment-framework/Final-ESF-Mar-14-2019-Final-P-PDF.pdf, Page 16

affect an area larger than the sites or facilities subject to physical works and may be temporary or permanent in nature."[4]

5.2.2 Indigenous Peoples Screening

Objectives

There are 54 ethnic groups in Vietnam. The Kinh is the largest ethnic group with more than 82 million people (85.3% of the national population) while the other 53 ethnic groups make up 14,7% of the population and are identified as "ethnic minorities". The highest density of these ethnic minorities' population is in the Northern Midlands and Mountains and the Central Highland (Tay Nguyen). Central Highland provinces including Gia Lai, Kon Tum, Dak Lak, Dak Nong and Lam Dong are a collectively mountainous area where ethnic minorities constitute about 38% of the regional population.[5] Even though the economy in the region has been growing rapidly, 35.5% of ethnic minorities' population in the Central Highland is poor and near poor.[6]

In Gia Lai, there are 43 ethnic minorities that account for 46% of the total province's population. Gia Rai (or J Rai) ethnic group has the highest population in Gia Lai province with 459,738 people (90% of the total number of Gia Rai people in Vietnam, 66% of Gia Lai province's ethnic minorities' population and more than 30% of the province's general population).[7]

According to the baseline data provided by Ia Grai District People's Committee on the district's ethnic minority population, there are 18 groups of ethnic minorities currently residing in the district and around the project area. There groups are Gia Rai (other writing variations of their name such as J Rai, J'Rai or Jarai), Tày, Thái, Hoa, Khmer, Mường, Nùng, H Mông, Dao, Ê-đê, Ba-na, Xơ-đăng, Chăm, Sán Dìu, Hre, X Tiêng, Bru-Vân Kiều and Thổ. Among these, Gia Rai is the only native ethnic group with the population of 48,000 people (45.28% of Ia Grai District population).

With the evident presence of ethnic minorities in the communities where the Project is located, the screening and consideration of such groups is necessary to "foster full respect for Indigenous Peoples' identity, dignity, human rights, economies and cultures, as defined by the Indigenous Peoples themselves".[8]

Scope and application

AIIB ESS 3 and IFC PS 7 share a similar definition of Indigenous Peoples (IP) as a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees:

(a) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;

(b) collective attachment to geographically distinct habitats or ancestral territories in the Project area and to the natural resources in these habitats and territories;

(c) customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture; and

[4] Ibid., Page 10

[5] Executive Summary, 2019 Vietnam Population and Housing Census Report, page 17

[6] 2019 Economic and social status of 53 ethnic minorities Report, page 49

[7] 2019 Vietnam Population and Housing Census Report, Table 2

[8] AIIB Environmental and Social Framework March 2019, Page 42

(d) a distinct language, often different from the official language of the country or region. In considering these characteristics, national legislation, customary law and any international conventions to which the country is a party may be taken into account.

AIIB ESS 3 specifically acknowledges that *"there is no universally accepted definition of Indigenous Peoples. Indigenous Peoples may be referred to in different countries by such terms as "indigenous ethnic minorities," "scheduled tribes," "first nations," or "tribal groups." As the applicability of such terminology varies widely from country to country, the Client may agree with the Bank on an alternative terminology for the Indigenous Peoples as appropriate to the circumstances of the Client."*[9]

The application of this definition to the context of Vietnam takes into account the following extract from Decree 05/2011/NĐ-CP dated 14 January 2011 on Ethnic Minorities Work, Article 4, Point 2 and 4:

> "2. Ethnic minority group means an ethnic group with a population smaller than that of the ethnic majority group within the territory of the Socialist Republic of Vietnam.
>
> 4. Ethnic minority area means an area in which different ethnic minority groups live together, forming a stable community in the territory of the Socialist Republic of Vietnam."

Therefore, the ethnic minorities residing in and around the project area would be classified as Indigenous Peoples against AIIB ESS 3 and IFC PS 7; however in this document, they would be referred to as ethnic minorities by the law of Vietnam. Moreover, this term is also used in uniform by other international organisations in Vietnam such as Asian Development Bank (ADB), all United Nations (UN) Agencies, and World Bank (WB), etc.

The IPs screening in Table 5.1 concludes that Gia Rai ethnic group fulfils all four characteristics of IPs against AIIB's ESS 3. As Gia Rai people form a large population in Ia Pech commune where all of the turbines are located and in other communes of Ia Grai District where the transmission line go through (Ia Kha Town, Ia Hrung and Ia Der communes), ERM would recommend that the Project consider Gia Rai people as IPs/Ethnic Minority and that AIIB's ESS 3 apply to them.

Table 5.1 Indigenous People Screening and Identification

Characteristics	Gia Rai
Self-Identification as members of a distinct indigenous cultural group and recognition of this identity by others	■ **Self-identification**: Gia Rai ethnic group is officially recognised as the native ethnic group that has settled in the Central Highland as the earliest record as in 11th century; before that they were grouped together with Ê đê ethnic group under the name Rang Đêy. Their ancestors are believed to have migrated from the South Central coastal area up to the highland, exploited the land and settled here. ■ **Recognition of this identity by others**: The Government of Vietnam, specifically the Committee for Ethnic Minority Affairs, identifies Gia Rai people as one of the ethnic groups, and other communities (i.e. the Kinh, the Bahnar, the Thai or the Hoa groups) in the Project Area accept them as a distinct ethnic group. ■ **Conclusion**: It could be confirmed that Gia Rai people obtain the characteristics of self-identification as a distinct ethnic group.
Collective Attachment to geographically distinct habitats or ancestral	■ **Collective attachment to geographically ancestral territories**: As one of the first ethnic groups to settle in Gia Lai, similarly to other ethnic minorities in the area, Gia Rai people's means of livelihood has been land-

[9] AIIB Environmental and Social Framework March 2019, Page 42

Characteristics	Gia Rai
territories in the Project area and to the natural resources in these habitats and territories	based from the very beginning of the settlement such as crops and rice farming. In the past, before being able to rely mainly on agriculture and husbandry for their livelihood, they used to depend on the forest for hunting and gathering as well. ■ **Collective attachment to the natural resources in these territories:** In the modern days, the forest still holds spiritual values to Gia Rai people. One of the ancient traditions that still remains to this day is the forest god worshiping ceremony which is organized in March every year, especially among communities of Gia Rai people residing in Ia Pech commune. Each element of the natural resources (sun, mountain, water, land or forest, etc.) has an assigned God which is collective called Giàng. ■ **Conclusion**: Gia Rai people have collective attachment to the project area and the natural resources of the forest.
Customary Institutions including customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture	■ **Customary cultural and social institution**: - **Social institution**: Gia Rai people have developed a society with a matrilineal kinship system (also known as the matriarchy system). The matriarchy system of Gia Rai people (quite similar to other ethnic minorities in the Central Highland) has three main distinct traits: wealth and power are held by women, which means the men would have no right to inheritance; marriage is initiated by the woman's family and the man moves in with the in-laws after the wedding; and the children carry the mother's family name. - **Cultural institution**: ▪ Housing: A typical house of Gia Rai people would be built on stilts with the main entry door facing north. The main materials of these houses would normally be found in the environmental surroundings of their living area such as straws, bamboos, woods or leaves, etc. ▪ Clothing: Gia Rai people have their own traditional clothing which is mostly self-supplied thanks to the highly skilled women in weaving and crafting. Men wear white loincloths with multi-coloured stripes with patterned edges and tassels on both ends. Their shirts are normally black with short sleeves with patterns running along both hems resembling a poncho. Women wear indigo skirts with patterned hemlines. The skirts are worn as a wrap. Their blouses are short, tight-fitting and long-sleeved. ▪ Musical instruments as an Intangible Cultural Heritage of Humanity: Gia Rai is one of the ethnic minority groups of the Central Highland that have an inseparable tie to the Gong Culture (Văn hóa Cồng Chiêng) proclaimed by UNESCO in 2005[10]. ■ **Customary political institution**: Gia Rai people organize themselves by village which is headed by a chief and a band of credible elders. The members of each village must follow the will of the chief and the credible elders. Each village is marked by a communal house (nhà Rông) with a

[10] Intergovernmental Committee For The Safeguarding of Intangible Cultural Heritage, Annex, page 3

Characteristics	Gia Rai
	distinct architecture; its roof is of great height to show the power and strength of the village. ■ **Conclusion**: The abovementioned customary institutions mark great different and distinction from the mainstream society.
Distinct Language that is often different from the official language of the country or region. In considering these characteristics, national legislation, customary law and any international conventions to which the country is a party may be taken into account	■ Gia Rai people's language belongs to the Malayo-Polynesian language family. According to Vietnam Committee for Ethnic Minority Affairs, Gia Rai people have their own writing system. The language and its writing have been used in community activities as well as in radio and television programs for a long time. It is also taught alongside with Vietnamese at local schools where there is a high percentage of Gia Rai students. ■ **Conclusion**: The language of Gia Rai people is considered to be a distinct language, which is different form the official language in Vietnam.

5.3 Scoping

5.3.1 Scope of the Assessment

This section aims to identify and assess the key environmental and social risks and impacts of the project through a scoping process.

- Scoping is a process by which potential interactions between the Project and resources/receptors within the project area examined and prioritised.
- Resources/receptors that are likely to give rise to significant environmental and/or social effects will be 'scoped in' whilst others will be 'scoped out'.

The aim is to focus the assessment on those that have a reasonable potential to experience significant impacts, which the Project Developer should seek to avoid through the Project design. Scoping also aims to identify key data gaps and ways to fill those gaps.

Based on ERM's initial understanding of the site, primary and secondary baseline data review, activities (both planned and unplanned) associated with the Project and associated facilities during construction and operation phases have been considered with respect to their potential to interact with environmental and social resources/receptors. The following section details the methodology and results.

5.3.2 Scoping Methodology

The scoping process was conducted as the following steps:

- Identifying the project elements and footprint from a basic set of the project information provided by the Client; the result of this step was the preliminary mapping of the potential Area of Influence (AoI) by the Project activities;
- Through a scoping visit to the project site: gathering essential documents from the Client, collecting the local authority's general perception of the project and identifying potential sensitive receptors of the project impacts;
- From first-hand information collected through the above two steps, mapping potential interactions between Project activities and environmental and socio-economic resources by the Scoping Matrix (Table 5.2);

- Taking into consideration the information gathered on the extent and nature of Project activities, and the existing condition/ sensitivities of the resources, the aforementioned interactions in the third step have ranked in terms of their likelihood in causing significant impacts.

The scoping exercise was intended to ensure that the impact assessment focuses on those issues that are the most important for the project design, decision-making and stakeholders' interests.

5.3.3 Project Area of Influence (AOI)

The Area of Influence (AOI) varies depending on the nature of the Project and receptor. Under definition of AIIB's ESF, an AOI includes the area likely to be affected by the Project, including all its ancillary aspects, such as power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas, and construction camps, as well as unplanned developments induced by the Project (e.g., spontaneous settlement, logging or shifting agriculture along access roads).[11]

For this Project, the appropriate AOI has been extended to cover construction and operation of the Project facilities as discussed in Section 2.4. It should be noted that the AOI for a particular resource/receptor may vary depending on the nature of the change caused by the Project activities and the type of effect being considered, but in each case it is defined as including the entire area likely to experience significant impacts. As such, the AOI will be discussed in terms of the specific environmental/ social aspects (e.g., biodiversity, social, noise) being impacted.

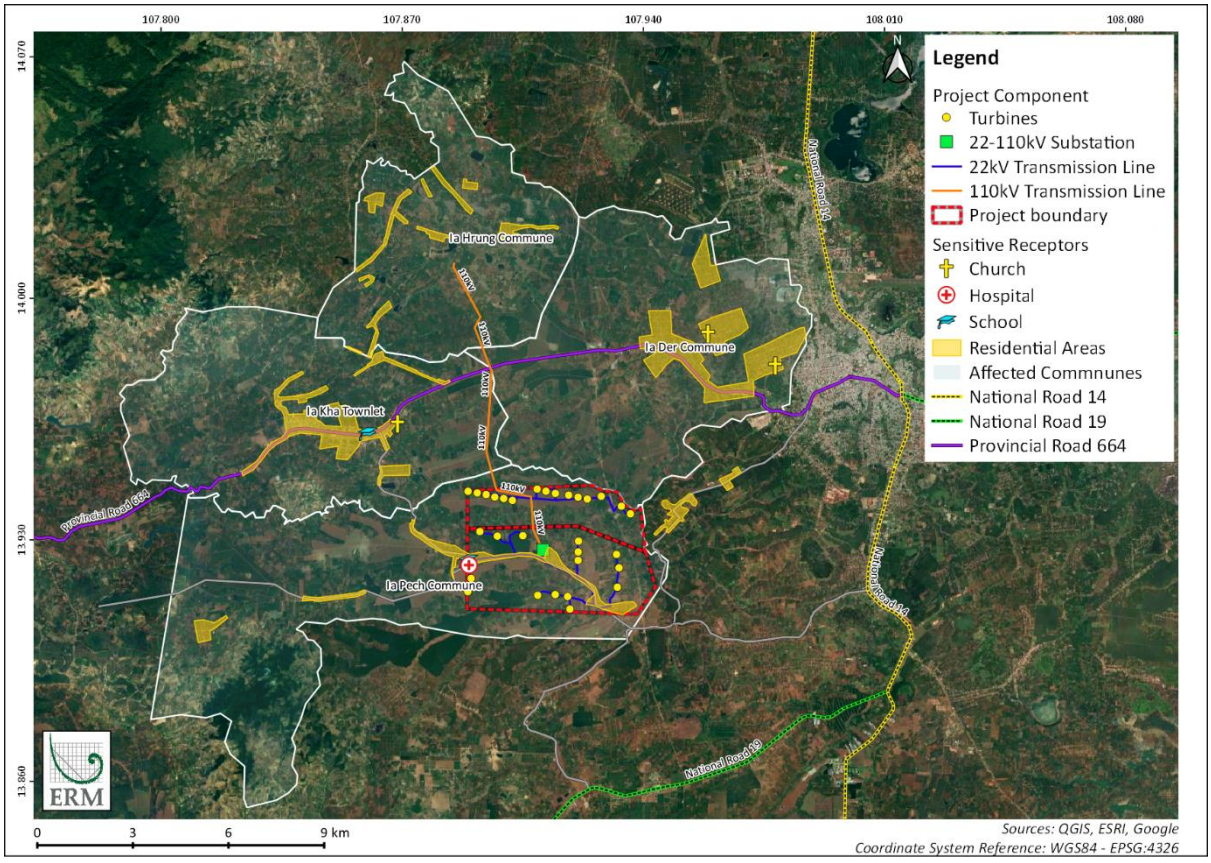


Figure 5.1 Sensitive Social and Environmental Receptors

5.3.4 Scoping Matrix

Following the determination of AOI, the scoping matrix is used as a tool to support a methodological identification of potential interactions of each Project activity and the resources/receptors within the AOI.

[11] Ibid. page 52

It consists of a list of Project activities during the construction and operation phases, which may give rise to significant impacts. These are set against a list of environmental and social resources/receptors within the AOI with potential to interact.

Entries in the matrix cells are coloured to indicate whether:

- An interaction is not reasonably expected (white);
- An interaction with positive impact expected (green);
- An interaction is reasonably possible but none of the resulting impacts are likely to lead to significant effects (grey); or
- The interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is significant (black).

All potential interactions, regardless of probability of occurrence, are considered at this stage. Those cells that are coloured white are ‘scoped out’ of further consideration in the IA. Interactions marked as grey are also ‘scoped out’ with supporting reasons to justify the decision. Those interactions that are shaded black are retained for further consideration in the IA process.

Table 5.2 Scoping Matrix

PROJECT PHASES AND ACTIVITIES	ENVIRONMENTAL						SOCIAL								
	Air Quality	Noise and Vibration	Hydrology, Soils and Erosion	Freshwater Quality	Terrestrial Fauna and Flora	Avifauna	Livelihoods	Land use	Infrastructure and Public Services	Community Health and Safety	Land Traffic	Tourism	Visual Amenity	Cultural Heritage	Economy and Employment
PRE-CONSTRUCTION AND CONSTRUCTION															
Land acquisition							■	■							
Labour influx									■	■	■				■
General construction activities															■
Land Preparation and civil works	■	■	■	■	■		■			■					
Substation, transmission line and laydown area and office construction	■	■		■	■		■	■			■		■		
Construction of turbine foundation	■	■	■	■	■		■	■			■				
Construction Water Use			■						■						
Transportation of equipment, workers and materials	■	■							■	■	■				
Waste and wastewater management from construction activities and from workers' activities				■	■					■					
Hazardous materials storage and handling				■	■					■					
OPERATION															
Labour influx															■

PROJECT PHASES AND ACTIVITIES	ENVIRONMENTAL						SOCIAL								
	Air Quality	Noise and Vibration	Hydrology, Soils and Erosion	Freshwater Quality	Terrestrial Fauna and Flora	Avifauna	Livelihoods	Land use	Infrastructure and Public Services	Community Health and Safety	Land Traffic	Tourism	Visual Amenity	Cultural Heritage	Economy and Employment
WTG operation (including shadow flicker and noise) and inspection and maintenance		■				■	▒			■			■		
Waste, emissions (including electromagnetic interference) and discharge generation, handling and disposal							▒			■					
Presence of the turbines/project												▒	■		■
UNPLANNED EVENTS															
Fire and explosion, including Unexploded Ordnance (UXO)	▒			▒	▒					▒					
Spillage of fuel, oil, chemicals and hazardous materials				▒	▒										
Vehicle/vessel accident	▒									■	■				
Blade throw										■					

Key

Scoped Out
Scoped Out or integrated with other major interactions
Further Consideration in Impact Assessment
Interaction likely to lead to Potential Positive Impacts

6. STAKEHOLDER ENGAGEMENT

6.1 Stakeholder Analysis

6.1.1 Stakeholder Identification

During the recent stakeholder engagement as part of the ESIA and ESMP process, a list of stakeholders was developed by taking into account the following considerations:

- Individuals, groups or organisations potentially have interest on or affected by impacts[12] of Project's activities during its life cycle; and
- Vulnerable groups[13] requiring special engagement efforts.

6.1.2 Stakeholder Categorisation

Stakeholders are categorised into following groups:

- **Local communities** includes communities living within or surrounding the Project area. These communities may be affected by or potentially have interest on the Project's impacts;
- **Government and local government bodies** includes government agencies involved in appraisal and approval during the project's development. In addition, the units participating in the consultation are also considered as a stakeholder of the project;
- **Economically Interested Parties and Business Partners** includes individuals or organizations that have financial influence and are involved in the decision-making process of the project;
- **Contractors and suppliers** includes individuals or organizations employed by the Project Owner to provide services and products;
- **Neighbour Private Sector Bodies** includes neighbouring private projects in the same commune or district as the Project. This group is considered as a stakeholder not only because of the potential contribution to cumulative impacts, but also because they are taken into account as a community that may have concerns related to Project activities;

[12] Refer to Chapter 10, 11, 12, and 13 of ESIA report

[13] Vulnerable households are defined as meeting at least one of the following criteria:

- Poor or near-poor households certified by the Government;
- Female-headed households;
- Households with orphans or abandoned children;
- Households with an elderly person above the age of 60 living alone;
- Households with an elderly person from 80 years old without social welfare or insurance;
- Households with a physically disabled member;
- Households with a mentally disabled member incapable of work;
- Households with a member getting chronic diseases and unable to work;
- Households with a single parent under the disadvantaged household category and raising children under the age of 16 or children aged 16-18 and attending school; and
- Households with an illiterate breadwinner.

- **Academic Groups** includes individuals or organisations that will participate in project reviews or consultation during the project development;
- **Non-Governmental Organisations (NGOs):** including non-governmental organisations that might be interested in the project development and its potential impacts. They may be representative and accountable NGOs as well as community-based organisations who have expertise valuable to effective stakeholder engagement. For example, they can be sources of local knowledge, sounding boards for project design and mitigation measures, links helping the Project Owner to connect with sensitive groups, and partners in planning, implementing and monitoring various project-related programs;
- **Media** includes media that have reported on the Project or likely have an interest on Project's activities in future.

6.1.3 Stakeholder Mapping

After stakeholders had been identified and grouped, concerns related to the Project also integrated. These concerns including:

- Environmental – regarding the alteration of current environmental baseline conditions such as emissions and local air quality, elevated noise/disturbance levels, damage to and depletion of ecological systems, generation and disposal of waste, impacts on the aesthetic value of the environment and changes in resources availability;
- Health and Safety – about community health and safety, labour safety, right of way, blade throw, visual amenity and shadow flicker impacts;
- Social – about land acquisition, livelihoods, employment of temporary/local/foreign workforce, agricultural activities, migrants, religious sensitivity, gender equality, indigenous peoples, utility requirements, infrastructure requirements, and supply of materials; and
- Technical – related to feasibility, project design, transmission line route, emergency preparedness and response, knowledge sharing, and project management.

To define stakeholder relationships, vulnerability, interest in and influence on Project activities, stakeholders were assessed and mapped. Mapping was done according to influence, interest, and the degree of potential impact based on the stakeholder mapping matrix as demonstrated in Figure 6.1. Since the interest and influence of the stakeholder and list of stakeholders will be changed over the course of Project development, the stakeholder analysis should be updated to reflect the change.

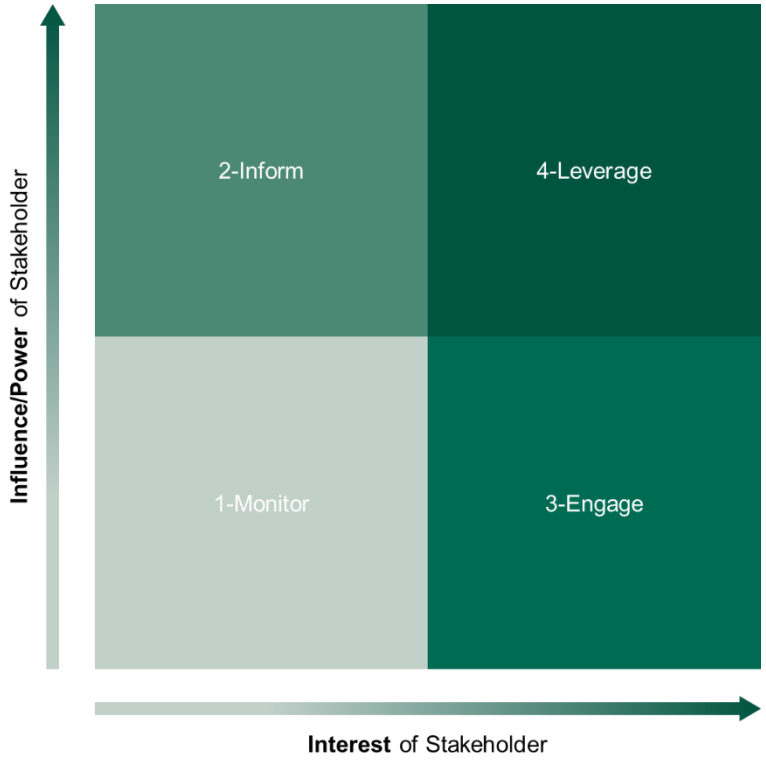


Figure 6.1 Stakeholder Mapping Matrix

The stakeholder mapping matrix is a tool which assists in identifying where stakeholders stand depending on their level of influence and interest. The influence and interest of stakeholders can be classified as low or high.

Levels of influence and interest of each stakeholder based on the mapping matrix are illustrated in Figure 6.1. They can be summarised as follows:

1. **Monitor**: low influence and low interest. Typically, this stakeholders include those who have limited interest and influence on the Project including the media and non-governmental organisations (NGOs).
2. **Inform**: high influence and low interest. From an impact assessment perspective, these are stakeholders that have the potential to influence Project outcomes but may not have a specific interest in impact assessment related issues. Stakeholders in this group should be kept informed on the progress of the Project development and usually include statutory consultees.
3. **Engage**: low influence and high interest. These stakeholders are also important and include those that are not adversely affected, but whose interests determine them as stakeholders. As such, these stakeholders should be kept engaged and the Project Owner should maintain an open channel of communications with them throughout Project phases.
4. **Leverage**: high influence and high interest. This group of stakeholders is often the most important to the Project as they have the ability to influence Project outcomes and also have a high level of interest in aspects of Project's impacts. Stakeholders in this group should be engaged throughout the ESIA, and for many of these stakeholders beyond the ESIA and during construction and operation stages of the Project. This group of stakeholders would typically include statutory approval bodies and affected communities.

The results of stakeholder identification and categorisation are summarised in Table 6.1. This table will be updated during the Project's life cycle depending on Stakeholder Mapping Matrix via timelines.

Table 6.1 Stakeholder Analysis (at the time of reporting)

Categories	Stakeholders	Concerns				Influence	Interest	Level of Influence and Interest
		Environmental	Health & Safety	Social	Technical			
Local communities	Vulnerable group - People under vulnerable condition potentially receives more significant impacts from the Project activities (e.g. land acquisition, agriculture disturbance) than the others	×	×	×	×	High	High	4-Leverage
	Economically displaced communities due to the Project land acquisition in: ■ Nang Long – Osơr, O Gia, and Sát Tâu village of Ia Pech commune for the turbine area, transmission line, access road and substation ■ Other communes including Ia Hrung, Ia Kha and Ia Der for transmission line	×	×	×	×	High	High	
	Communities in Ia Pech, Ia Hrung, Ia Kha and Ia Der communes who living nearby the Project's components (turbine, transmission line, access road and substation) and may be affected by the other Project activities	×	×	×	×	High	High	
Government and local government bodies	Vietnam National Authorities							
	Ministry of Industry and Trade	×	×	×	×	High	Low	2-Inform
	China Embassy		×	×		Low	Low	1-Monitor
	Gia Lai Provincial Authorities							
	Gia Lai Province People's Committee (PPC)	×	×	×	×	High	High	4-Leverage

Categories	Stakeholders	Concerns				Influence	Interest	Level of Influence and Interest
		Environmental	Health & Safety	Social	Technical			
	Department of Natural Resources and Environment (DoNRE)	×	×	×	×	High	High	
	Department of Labour, Invalid and Social Affairs (DoLISA)		×	×		High	High	
	Department of Construction (DoC)	×	×	×	×	Low	Low	3-Engage
	Department of Operations		×	×	×	High	Low	2-Inform
	Department of Industry and Trade (DoIT)	×		×	×	High	Low	
	Department of Transport		×	×	×	High	Low	
	Department of Planning and Investment (DoPI)	×	×	×	×	High	Low	
	Department of Agriculture and Rural Development (DARD)	×		×	×	High	Low	
	Department of Finance (DoF)	×	×	×	×	Low	Low	
	Department of Health (DoH)	×	×	×		Low	Low	
	Committee for Ethnic Minority Affairs[14] (CEMA)			×		Low	Low	

[14] There are 18 ethnic minorities in Ia Grai district and surrounding Project area including J Rai (accounting for 45.28%), Tay, Thai, Hoa, Kho-me, Muong, Nung, H Mong, Dao, E-de, Ba-na, Xo-dang, Cham, San Diu, Hre, Xtieng, Bru-Van Kieu and Tho

Categories	Stakeholders	Concerns				Influence	Interest	Level of Influence and Interest
		Environmental	Health & Safety	Social	Technical			
	District Authorities							
	Ia Grai District People's Committee (DPC) including divisions within the DPC	×	×	×	×	High	High	4-Leverage
	Fatherland Front Committee of Ia Grai district	×	×	×	×	High	High	
	Land Fund Development Center of Ia Grai district			×	×	High	High	
	Committee for Ethnic Minority Affairs at district level			×		High	High	
	Communal Authorities							
	Ia Pech commune People's Committee	×	×	×	×	High	High	4-Leverage
	Ia Hrung, Ia Kha and Ia Der communes People's Committee	×	×	×	×	High	High	
	Fatherland Front Committee of Ia Pech, Ia Hrung, Ia Kha and Ia Der communes	×	×	×	×	High	High	
	Community Unions (i.e., Farmers' Union, Women's Union, Youth Union)	×	×	×		Low	High	3-Engage
Economically Interested Parties and Business Partners	Central Power Corporation (EVNCPC)				×	High	High	4-Leverage
	National Load Dispatch Center (EVNNLDC)				×	High	High	
	Electricity Power Trading Company (EVNEPTC)				×	High	High	

Categories	Stakeholders	Concerns				Influence	Interest	Level of Influence and Interest
		Environmental	Health & Safety	Social	Technical			
	Potential Shareholders	×	×	×	×	High	High	
	Asian Infrastructure Investment Bank	×	×	×	×	High	High	
	Development Bank of Singapore (DBS Bank) and other lenders	×	×	×	×	High	High	
	Vietnam Electricity (EVN)				×	Low	High	3-Engage
Contractors/consultant and suppliers	Vinteg Company	×	×	×	×	High	High	4-Leverage
	Power Engineering Consulting Joint Stock Company 1 (PECC1)	×	×	×	×	High	High	
	Golden Sea Surveying Technology Co., Ltd	×			×	Low	High	3-Engage
	Thanh Dat Power Construction Designing Consulting Co., Ltd	×			×	Low	High	
	Vietnam Power Resource Partners Corporation (Vietnam PRP)	×	×	×	×	Low	High	
	Power Engineering Consulting Joint Stock Company 5 (PECC5)	×	×	×	×	Low	High	
	Power Construction Corporation of China	×	×		×	Low	High	
	Black and Veatch Singapore Pte. Ltd	×	×		×	Low	High	
	Thanh Dat Power Construction Designing Consulting Co., Ltd	×	×		×	Low	High	

Categories	Stakeholders	Concerns				Influence	Interest	Level of Influence and Interest
		Environmental	Health & Safety	Social	Technical			
	China Energy Engineering Group Anhui No.1 Electric Power Construction Co. Ltd	×	×		×	Low	High	
	Zhejiang Windey Co., Ltd				×	Low	High	
	Other EPC and O&M contractors and suppliers[15]	×	×		×	Low	High	
Neighbour Private Sector Bodies	Other neighbouring business (e.g. factories, wind power plants, hydropower plants, solar power plants, etc.)[16]	-	-	-	-	-	-	-
Non-Governmental Organisations (NGOs)[17]	Other NGOs[18] that might be interested in the project development and its potential impacts	-	-	-	-	-	-	-
Media	National media (e.g. nongnghiep, nhadautu, tapchicongthuong, baotainguyenmoitruong, tuoitre, thanhnien, phapluat newspapers)	×	×	×	×	High	Low	2-Inform
	Provincial media (e.g. baogialai newspaper)	×	×	×	×	High	Low	

[15] Not identified during the ESIA reporting

[16] Not identified during the ESIA reporting

[17] They are may be representative and accountable NGOs and community-based organisations who have expertise valuable to effective stakeholder engagement. For example, they can be sources of local knowledge, sounding boards for project design and mitigation measures, links helping the project owner to connect with sensitive groups, and partners in planning, implementing and monitoring various project-related programs

[18] List some of the existing NGOs in Gia Lai province is presented in Appendix A

6.1.4 Stakeholder Engagement Strategy

Based on the results of stakeholder analysis, the stakeholder engagement process will be structured and implemented based on the level of influence and interest as illustrated in Figure 6.2.

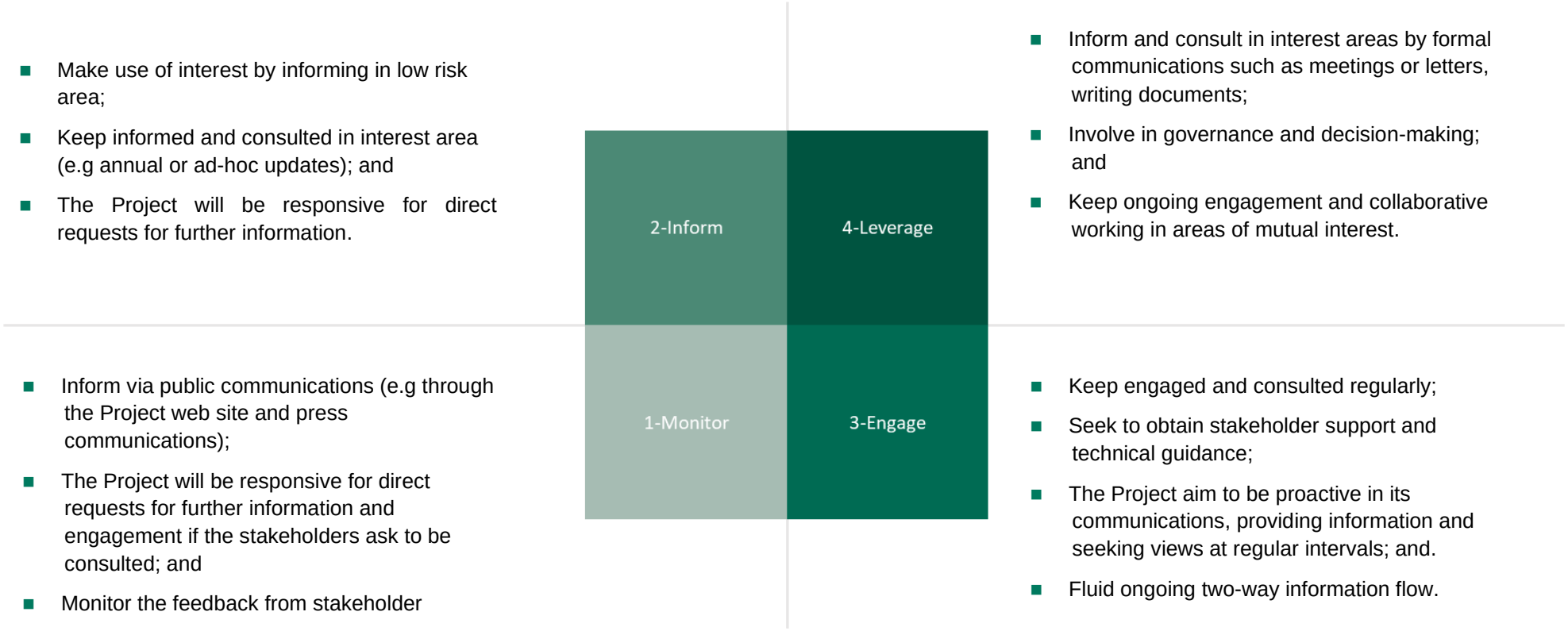


Figure 6.2 Stakeholder Engagement Strategies

6.1.5 Stakeholder Engagement to Date

During the ESIA process, the Project representatives and consultants have conducted intensive engagements with local authorities and communities, particularly IPs and vulnerable groups, via multiple approaches and methods, including:

- Meetings and semi-structured interviews with local authorities;
- Key informant interviews (KIIs);
- Focus group discussions (FGDs); and
- Household interviews.

Table 6.2 Stakeholder Engagements by Geographical Location and Approach

Level of Administration			Number of Engagements			
District	Commune	Village	Interviews with local authorities	KIIs	FGDs	Household Interviews
Ia Grai			1	-	-	-
	Ia Pech		1	1	-	-
		Nang Long - Osơr	-	2	3	41
		O Gia	-	1	-	7
		Sát Tâu	-	1	1	15
Total			2	5	4	63

Source: Socio-economic survey conducted by ERM, May and August 2021

6.1.5.1 Engagement with Local Authorities during Scoping Site Visit

In May 2021, the Project Owner and the Project's Consultant - ERM Vietnam Company Limited (ERM), have conducted meetings with regulatory bodies from the district and commune levels during scoping site visit. Table 6.3 summarizes topics discussed in the engagement of the Project Owner, ERM and authorities. Figure 6.3 including photos taken from meetings with authorities.

Table 6.3 Authorities Engagement during Scoping Site Visit

Regulatory body	Organizations	Meeting Date	Topics discussed in the meetings
District level	Ia Grai District People's Committee (DPC) including: ■ Ethnic Minority Committee ■ Division of Natural Resources and Environment; and ■ Land Acquisition and Compensation Councial	26th May 2021	■ Update about Project progress and current status of the ESIA; ■ Obtain up to date socio-economic data such as infrastructure and public services, health, livelihoods, and employment of people in the district ; ■ Acquire their initiatives on the proposed Social Management Plan; and ■ Collect feedbacks including concerns and recommendations about the Project development.
Commune Level	Ia Pech commune People's Committee (CPC)	27th May 2021	■ Update about Project progress and current status of the ESIA; ■ Obtain up to date socio-economic data such as infrastructure and public services, health, livelihoods, and employment of people in the commune ; ■ Acquire their initiatives on the proposed Social Management Plan; and ■ Collect feedbacks including concerns and recommendations about the Project development.

Meeting with Ia Grai District People's Committee on 26th May 2021

Meeting with Ia Pech Commune People's Committee on 27th May 2021

Figure 6.3 Photos Taken in Meetings with Authorities

6.1.5.2 Engagement with Local Communities

As stated in Table 6.2, the Project Owner and ERM arranged multiple engagement activities at the local community level from 29th to 31st August 2021 to collect the updated socio-economic baseline data and local communities' opinions and concerns on the development of the Project. Intending to achieve objective information, the consultations were in the form of focus group discussions, key informant interviews, and household surveys as discussed below.

6.1.5.2.1 Focus Group Discussions

Focus group discussion is applied to observe a process of interaction among a group of members having similar livelihood profiles, gender, etc. with the purpose of obtaining their orally expressed views, opinions, experiences, and attitudes towards many issues raised during the conversation. Data collected depends on type of groups as follows:

- For group having the same livelihood profiles, data obtained will give an insight on their livelihoods, customs, culture, dependence on natural resources, accessibility to public services and opinions or concerns about the Project; and
- Regarding the discussions conducted for women, ethnic minority, and vulnerable people group, separately, deeper understanding about their role, equality as well as governmental special supporting policies for them were achieved.

A total of 24 people participated in four FGDs in Ia Pech commune of Ia Grai district. Table 6.4 described the number of participants together with topics discussed. Due to baseline survey conducted remotely, there are no photos taken for the focus group discussions.

Table 6.4 Summary of Participants Attended in FGDs

Ia Pech Commune	Group	No. of participants			Ethnicity		Topics covered in focus group discussions
		Male	Female	Total	Kinh	Gia Rai	
Nang Long O Sor	Women group	-	6	6	-	6	Each group will have different question design, in general, the following information was collected: ■ Livelihoods; ■ Education background (i.e. education level of members in the surveyed households); ■ Health status/profile and health care practice; ■ Income and expenditures; ■ Potential impact due to the Project construction and operation activities; ■ Access to and availability of public facilities (i.e. electricity, water supply, etc.); ■ Acknowledge on the development of the Project and its engagement activities; and ■ Concerns as well as recommendations for the Project development.
	Ethnic minority group	5	-	5	-	5	
	Vulnerable people group	1	6	7	-	7	
Sat Tau	Agri-forestry group	6	-	6	4	2	
Total		**12**	**12**	**-**	**4**	**20**	

Source: Socio-economic survey conducted by ERM, August 2021

It can be seen from Table 6.4 that the proportion of male equal to this statistics of female with 50%. Each discussion involved a heterogeneous group of five to seven people with distinctive backgrounds in terms of age, gender, and economic as well as social status in order to obtain an inclusive perspective and objective reporting.

6.1.5.2.2 Key Informant Interviews

Key Informant Interview is conducted with people who have important roles in society such as hamlet chiefs, quarter heads, medical station heads, etc. or representatives for people potentially affected by the Project to obtain information related to livelihood, culture, health, accessibility to infrastructure as well as social order situation. In addition, this engagement also aims to get opinions about the role of genders, the status of ethnic minorities, and vulnerable people in the local community.

Five people have been involved in 5 key informant interviews in Ia Pech commune of Ia Grai district. The number of participants together with topics discussed are presented in Table 6.5. Due to the interviews were conducted via phone, no photos were taken.

Table 6.5 Summary of Key Informant Interviews

Level of Administration	Key Informant	Total No. of participants	Topics covered in key informant interviews
Ia Pech commune	Deputy chairwoman of Ia Pech Commune People's Committee	1	Each group will have different question design, in general, the following information was collected: ■ Health status/profile and health care practice; ■ Livelihoods; ■ Income and expenditures; ■ Potential impact due to the Project construction and operation activities; ■ Access to and availability of public facilities (i.e. electricity, water supply, etc.); and ■ Acknowledge on the development of the Project and its engagement activities; and ■ Workers rights and child labor status; ■ Concerns as well as recommendations for the Project development.
Nang Long O Sor	Party cell secretary	1	
	Influential individual in ethnic minority village	1	
Sat Tau	Village head	1	
O Gia	Former village head	1	
Total		**5**	

Source: Socio-economic survey conducted by ERM, August 2021

6.1.5.2.3 Household Surveys

Household surveys provided a wider range of more detailed information on the population of 63 households in Ia Pech commune, Ia Grai district where the Project components are located, and/or its potential impact on local communities. It is noted that there are 23 households affected by land acquisition for the Project. Hence, 23 affected households have been involved in the surveys.

Primary data from the 63 household surveys (including 23 AHs) were used to integrate the socio-economic baseline and stakeholder engagement (Section 6) of the ESIA report.

Topics of engagement from household surveys are summarised in Table 6.6. Due to baseline survey conducted remotely, there are no photos taken for the household surveys.

Table 6.6 Summary of Household Surveys

Ia Pech Commune	No. of household surveys	No. of surveyed household's population (people)			Topics covered in household surveys
		Male	Female	Total	The questionnaire of the household interview was designed to collect the following: ■ Family status and demographics; ■ Education background (i.e. education level of members in the surveyed households); ■ Occupation, livelihood, and status; ■ Health profile of household members being interviewed; ■ Economic conditions (i.e. condition of household assets and utilities, income and expenditure [seasonal income is also accounted for]); ■ Current condition of local public services and infrastructure including road, electricity and water supply, waste management, market, education and healthcare, as well as the household's access to such services; ■ Vulnerability status (i.e. people who may be more adversely affected by the Project by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage, or social status); and ■ Acknowledge, concerns and recommendations about the Project's activities.
Nang Long O Sor	41	102	88	190	
Sat Tau	7	17	18	35	
O Gia	15	32	33	65	
Total	**63**	**151**	**139**	**290**	

Source: Socio-economic survey conducted by ERM, August 2021

6.1.5.2.4 Perceptions of Local Communities

It can be seen from the household surveys that 98% of the respondents were aware of the Project. Of which, nearly half of them discerned the Project less than six months ago, while 35% told that they have known about the Project for six to twelve months. The Project has been acknowledged by other 16% of the surveyed households for more than one year ago.

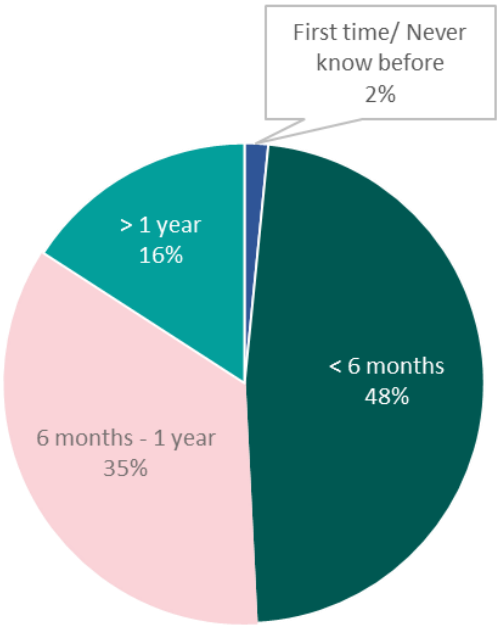


Figure 6.4 Awareness of Local Communities about the Project

The two information channels for the surveyed people to be aware of the Project are via word-of-mouth from their relatives, friends and neighbours with 46.7%, and followed by official information from the Project staff with 40.3%. Meanwhile, about one-fourth of interviewees recognised the Project by observing the Project construction activities occur in the locality, and around 10% get the news from local authorities. It is noted that one people could be informed about the Project presence from more than one channel of information.

Figure 6.5 Channels for Receiving the Project Information

When the respondents were asked if they know about the grievance mechanism of the Project, most of them said no with 70%, while the remains confirmed that they heard about it before.

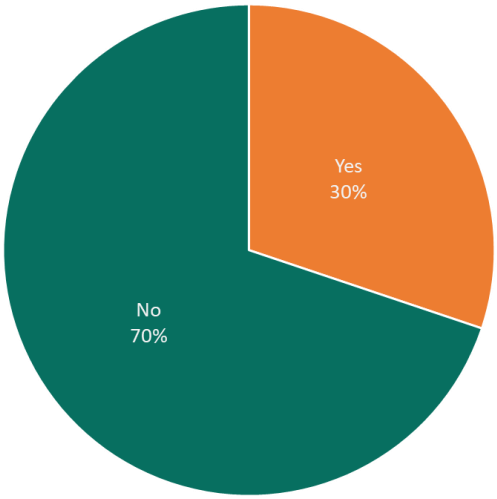


Figure 6.6 Acknowledgement of Local Communities on the Project's grievance Mechanism

6.1.5.2.5 Consultations of the Project

Of 63 surveyed respondents, only seven people or 11.1% participated in the public consultation. On the other hand, most of the respondents (76% or 48 households) wanted to attend the consultation but did not hear about it, while a small number heard about the consultation but could not attend (3.2%) or did not want to attend (3.2%), and 4.7% did not know and did not wish to participate in the consultation either.

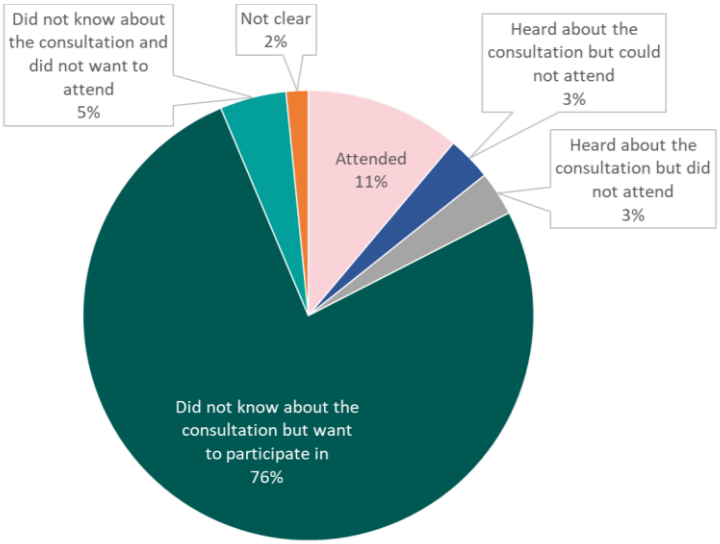


Figure 6.7 Participation in Public Consultations

Among seven people participating in the consultation, 72% finding the information about the Project insufficient and expecting more information to be provided. The two remaining groups share 14% each, responded that (1) the information sufficient and they are happy to receive more if any, and (2) do not want more information although they do not think they have enough information about the Project.

The further information that the respondent expected to receive, including:

- what happens to the village/commune when the project starts;
- project impacts on the environment;
- project impacts on community health;
- mitigation measures for negative impact; and
- project implementation time;

Additionally, extra information is supposed to be provided via public consultation, face to face meeting and local authorities. The following figures (Figure 6.8 and Figure 6.9) indicate the statistics related to information and channels providing data of the Project in details.

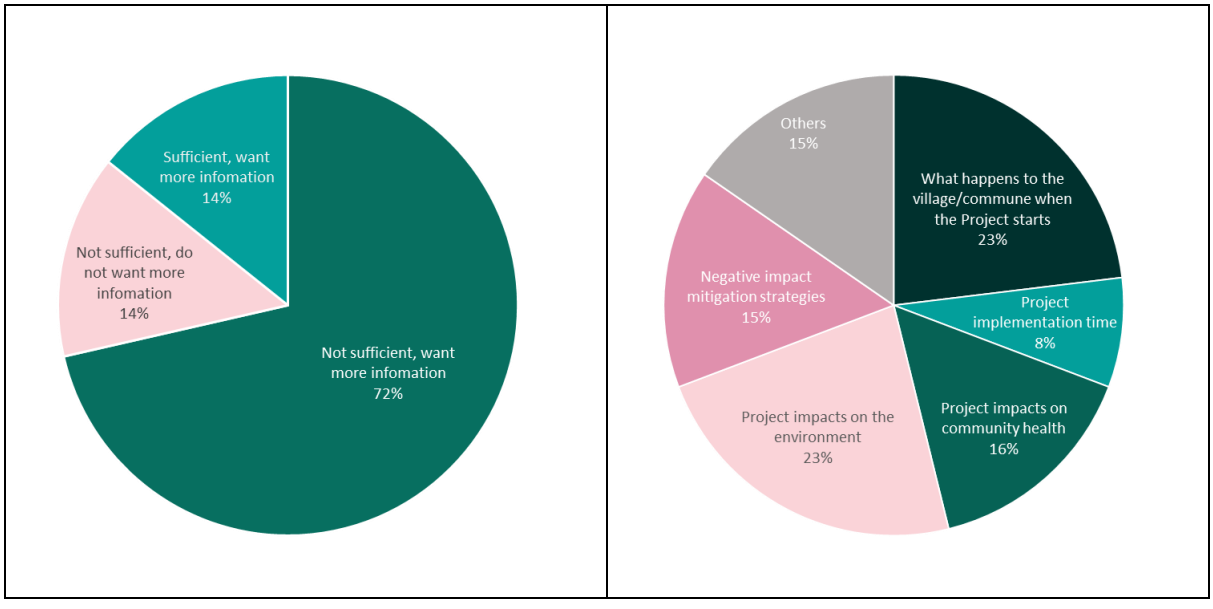


Figure 6.8 Information about the Project

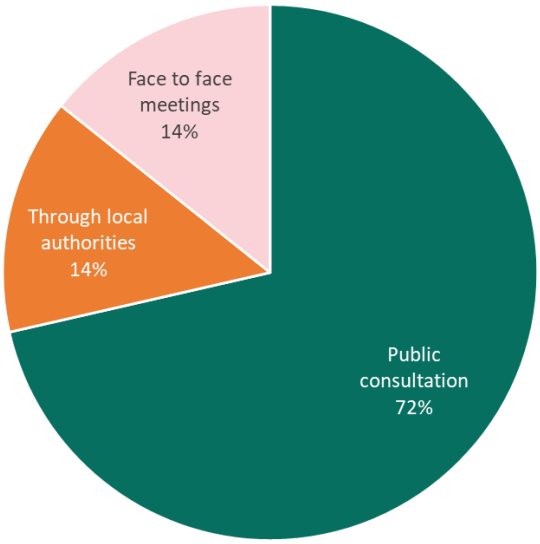


Figure 6.9 Provision of Information

6.1.5.3 Feedback from the Interviewed Authorities and Communities

During engagement conducted with authorities and communities, lots of feedbacks including concerns as well as recommendations were collected. This feedbacks are described in the following section.

6.1.5.3.1 Authorities

No.	Feedbacks obtained from organizations	Criteria			
		Environmental	Health & Safety	Social	Technical
Ia Grai District People's Committee					
1	The Project is recommended to ensure 300m safety zone for residential area		×	×	×
Ia Pech commune People's Committee					
1	There are complaints arising from local communities about noise generation and car speed		×	×	
2	The PC mentioned that local people raised concerns about turbine No. 18 and its location is under negotiation with Ministry of Industry and Trade				×
3	The Project Owner is requested to recruit local people for project in construction and operation process.			×	
4	It can be seen that intra-communal road will be affected during construction phase, the Project Owner is supposed to maintain them whenever construction phase end		×	×	×
5	The Project Owner is recommended to support community development (such as constructing house of gratitude, communal house, etc.)			×	

6.1.5.3.2 Local Communities

No.	Feedbacks obtained from group discussions	Criteria			
		Environmental	Health & Safety	Social	Technical
Focus Group Discussion					
1	Women have concerns about the Project implementation including environment pollution, noise pollution, traffic safety to children who go schooling every day, and road degradation		×	×	×
2	Local people are concerned about large circulation of big trucks in the local roads and threats to safety due to the construction of high wind turbines		×	×	×
3	They are concerned about risks to local safety, traffic accidents due to large circulation of big trucks, and negative impacts to crop production		×	×	
4	Their main concerns include threat to social security due to the influx of workers and risks to air and noise pollution during the Project construction and operation process		×	×	
5	A public consultation should be organised with local villagers' participation to dissemination the Project information and address local concerns, for example, compensation to households affected by transmission lines.			×	
6	The Project Owner is supposed to support road and school facilities improvements (e.g. school yards, tables and chairs, teaching and learning equipment)			×	
7	The Project Owner is expected to bring more employment opportunities for the locals			×	
8	The Project Owner is requested to complete compensation before the commencement of the Project construction			×	
Key Informant Interviews					
1	Land acquisition (e.g production land loss, compensation price) due to the Project construction or access road building			×	
2	Road degradation due to large circulation of construction materials		×	×	
3	The project implementation may affect water source and crop production		×	×	
4	Establishment of a common cultural house contribute to enhance community cohesion.			×	
5	Unemployment exists in the young people group			×	
6	Health insurance card is not granted to local villagers since mid-2021. A few number of villagers self-pay health insurance fees		×	×	
7	Support on agricultural businesses (seedlings) and training on agricultural production techniques			×	
8	Traditional instrument preservation (gongs)			×	

No.	Feedbacks obtained from group discussions	Criteria			
		Environmental	Health & Safety	Social	Technical
9	It is necessary to have public consultation through face-to-face meetings and through local radio system to disseminate the Project information, especially using Gia Rai language when necessary			×	
10	Rural road to the village is in degradation that needs to be improved			×	
11	Lack of lighting system in the main rural road			×	
12	Households in remote areas needs to be supported with direct electricity supply			×	
13	Improving school facilities in kindergarten and primary schools			×	
14	Applying school tuition fee reduction to local pupils			×	
15	The project is expected to contribute to socio-economic development of the commune and provide employment opportunities for the locals.			×	
16	The influx of migrant workers with high skills is believed to help change local awareness on skill development.			×	
Household surveys					
1	Loss of income source and means of livelihood			×	
2	Loss of agricultural assets			×	
3	Loss of crops, plants and fixed assets			×	
4	Fear of relocation			×	
5	Affecting their life safety (due to construction activities and increase in traffic density)		×	×	
6	Impacts on local public infrastructure		×	×	
7	Noise generation	×		×	
8	Impacts on environment (air, soil and water pollution)	×	×	×	
10	Health impact		×	×	
11	Electric shock/thunder		×	×	×
12	Unsatisfactory compensation			×	
13	Impacts on resident's houses		×	×	

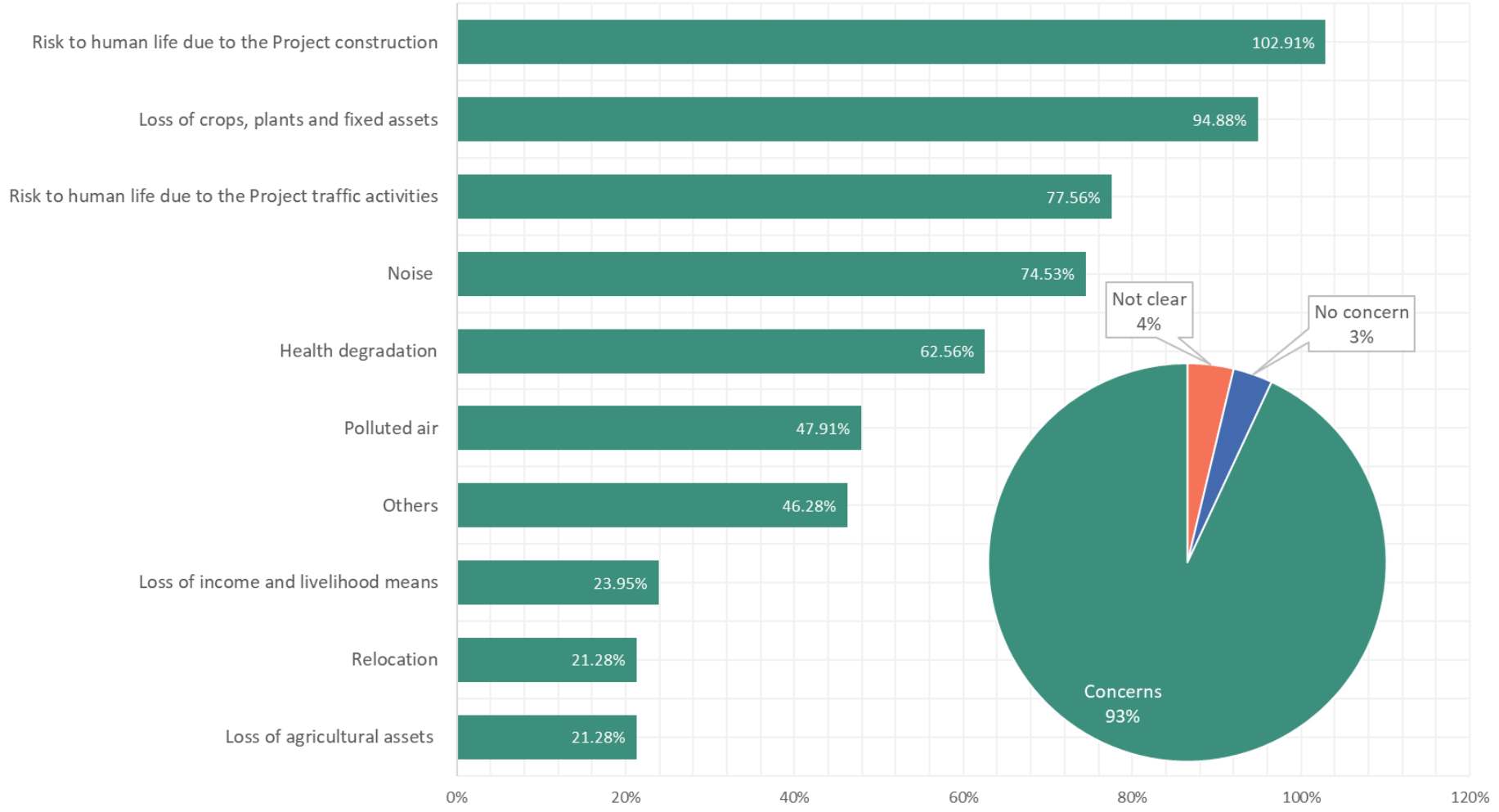


Figure 6.10 Statistics of Feedback Collected from Household Surveys

Figure 6.10 illustrated statistics of feedbacks collected from household surveys. Among the opinions collected from 63 households, concerns accounted for the largest proportion of 93%, followed by no concerns with only 4%. The number of people who have no concerns slightly higher than the number of people not sure about the impacts with 3%.

Among the concerns obtained from surveyed households, the one related to loss of income crops, plants and fixed assets and risk to human life due to the Project construction accounts for the same statistic of 14%. Followed by the worries of noise generation and risk to human life due to the Project traffic activities with 13% and 12%, respectively. Meanwhile, 11% of concerns belong to health degradation and polluted air received 9% of the votes. Additionally, less than 5% of response belong to the following matters:

- Relocation
- Loss of income and livelihood means
- Loss of agricultural assets
- Source of water
- Electric shock/thunder
- Impacts on resident's house
- Unfair compensation
- Impacts on local public infrastructure

6.1.6 Incorporating Stakeholder's Feedback into ESIA

The key issues identified through stakeholder engagement during the ESIA process were:

- Project impact to local livelihood and income generating activities;
- Project land acquisition compensation payment and community development due to land acquisition process, and
- Environment, health, and safety issues: environmental mitigation and management measures for noise, dust, waste, emission, worker influx, and traffic safety

Based on the performed interviews and observations during the site visit, these above mentioned issues are recognised as key concerns and therefore required to be taken into account within the environmental and social impact assessments. The assessment to abovementioned issues will be included as follow:

- Key social issues will be included in Social Impact Assessment of the ESIA.
- EHS issues, particularly those pertaining to noise, traffic and worker management, will be assessed quantitatively within the ESIA and appropriate mitigation measures developed.
- Stakeholder perception survey will be conducted again during the construction phase by the Project Owner to listen to the stakeholders' concern.

The outcomes of these assessments, alongside project management issues will be incorporated throughout the Environmental and Social Management Plan (ESMP), the Stakeholder Engagement Plan (SEP), and Grievance Procedure. Suggestions from the stakeholders on mitigation measures for environmental impacts will be incorporated into the Environmental and Social Management Plan, where appropriate.

7. ENVIRONMENTAL BASELINE

7.1 Introduction

This section provides an overview of environmental baseline conditions within the Project area and its surroundings, including topography and geology conditions, hydrology, climate and meteorology, noise and terrestrial biodiversity.

The objective of this section is to outline the existing environmental conditions in the Project area. This information is used to assess potential impacts caused by the Project in both construction and operation phases and identify mitigation measures and/or monitoring programs to reduce adverse impacts.

Information in this chapter is primarily based on studies undertaken for the Feasibility Study Report (Gia Lai FS, 2020) and a desktop review of reliable information sources such as Gia Lai Province Portal (Gia Lai Province Portal, 2021) as well as the additional physical, noise, avifauna and terrestrial fauna and flora baseline studies undertaken in 2021 by ERM during the ESIA preparation process.

7.2 Climate and Meteorology

This section provides an overview of climate and meteorology conditions including temperature, relative humidity, rainfall, evaporation, sun hours, wind regime, and natural hazards in Gia Lai Province where the Project is located.

Gia Lai Province experiences a tropical monsoon plateau climate, with two distinct seasons; the rainy season lasting from May to October and dry season from November to April. In Gia Lai Province, the rainy season is cloudy while the dry season is mostly hot, and humid. The location of meteorological and hydrological stations surrounding the Project Area are shown in Figure 7.1.

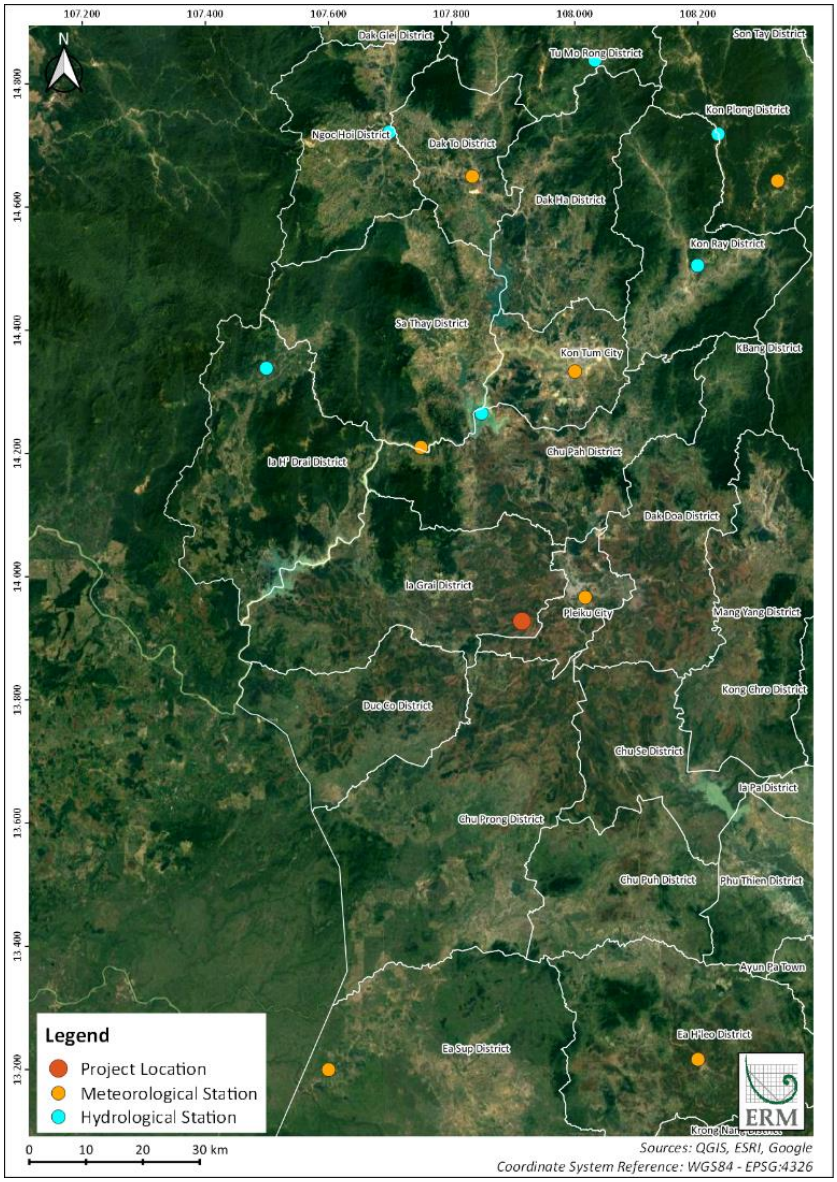


Figure 7.1 Meteorological and Hydrological Stations Surrounding the Project Area

7.2.1 Temperature

Being located on a plateau with an average altitude of 700m - 800m above sea level, temperatures recorded at Pleiku Meteorological Station (MS) as well as in the project area are relatively low. The average monthly temperature recorded at Pleiku MS ranges from 19.5 - 24.3ºC. The average temperature increases gradually from January and reaches a maximum of 24.3ºC in April, then slowly decreases from May to December to reaches the minimum temperature of 19.5ºC in January. The monthly temperature difference between the dry season and the rainy season is significant (see Table 7.1).

Table 7.1 Temperature Records at Pleiku Meteorological Station (1996 – 2018)

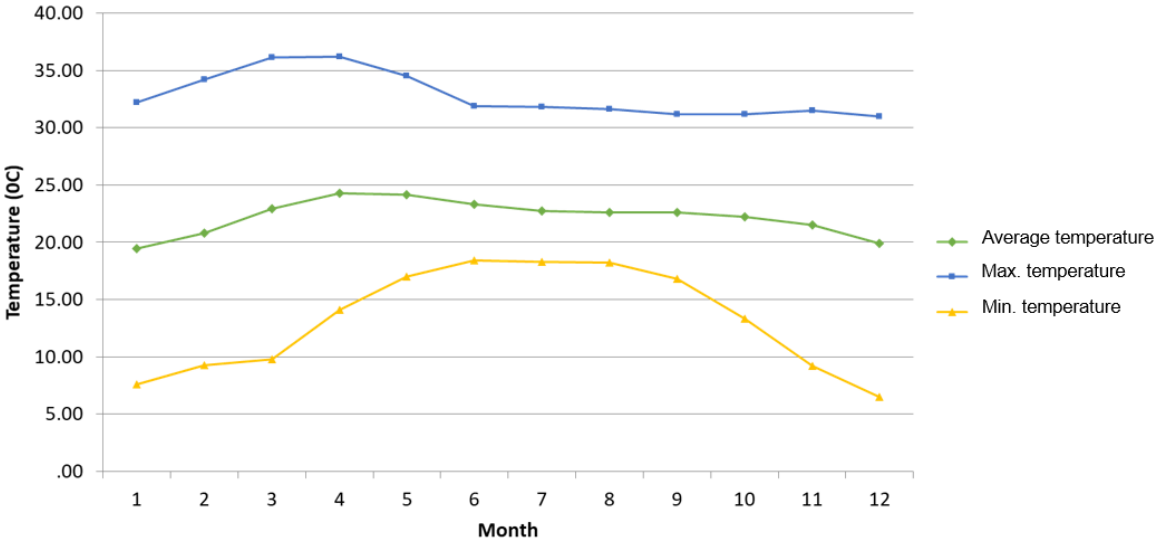
Month[19]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	19.5	20.8	22.9	24.3	24.2	23.3	22.7	22.6	22.7	22.3	21.5	20.0	22.2

[19] Light grey color code represents for dry season; whereas the white region demonstrate the rainy season.

Month[19]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Max	32.2	34.2	36.1	36.2	34.5	31.9	31.8	31.6	31.2	31.2	31.5	31.0	36.2
Min	7.6	9.3	9.8	14.1	17.0	18.4	18.3	18.2	16.8	13.3	9.2	6.5	6.5

Source: Meteorological and Hydrological Documentation Centre, cited in FS Report 2020

The temperature difference between months of the year is from 0.1ºC to 2.1ºC. The temperature difference between the warmest and the coldest month is 4.9ºC. The average annual temperature recorded at Pleiku MS is 22.2ºC. During the year, the highest temperature usually occurs in April and May, the lowest temperature falls in December and January. The absolute highest and lowest temperatures observed at Pleiku MS are 36.2ºC and 6.5ºC, respectively (see Figure 7.2).



Source: Meteorological and Hydrological Documentation Centre, cited in FS Report 2020

Figure 7.2 Annual Temperature Variation at Pleiku Meteorological Station

7.2.2 Precipitation

The climate of Gia Lai Province as well as the Project area is divided into two distinct seasons, the dry and rainy seasons. The dry season occurs from November to April while the rainy season starts from May to October. The province is divided into two regions, the Western and Eastern Truong Son Regions characterised by two distinct rainfall patterns. The average rainfall ranges from 2,200 mm to 2,500 mm in the Western Truong Son Region, and from 1,200 mm to 1,700 mm in the Eastern Truong Son Region. Pleiku MS recorded an annual rainfall of 2,146.3 mm (see Table 7.2).

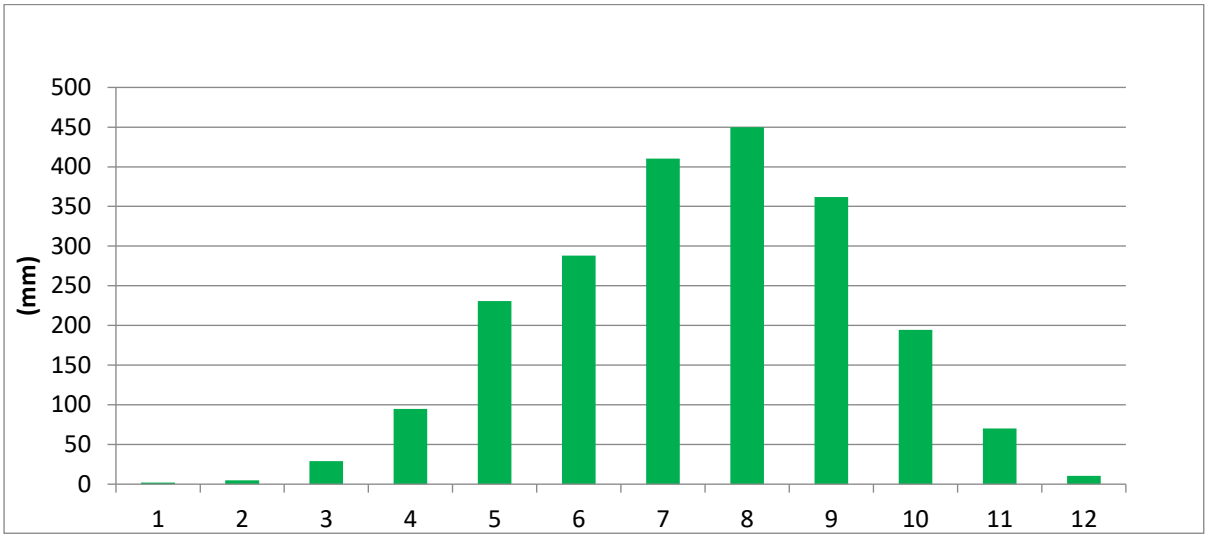
Table 7.2 Monthly and Annual Average Rainfall at Pleiku and Chu Se Meteorological Stations

Station	Month (mm)												Year (mm)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pleiku	1.8	4.8	28.9	94.7	230.9	287.9	410.2	449.8	361.9	196.6	70.2	10.6	2,146.3
Chu Se	0.4	0.0	8.3	73.7	234.7	226.2	321.1	337.7	320.8	168.8	76.9	7.6	1,776.2

Source: FS Report, 2020

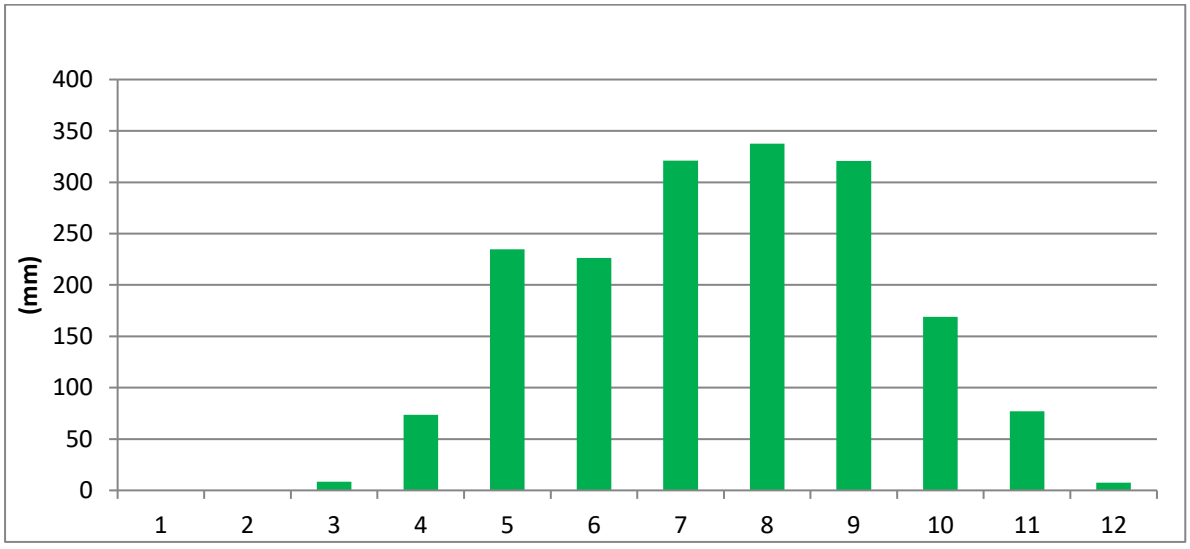
Rainfall not only varies in space but also strongly in time, whereby the difference in rainfall between the rainy season and the dry season is quite large. The average total annual rainfall in 6 months of the rainy

season ranges from 1,609.3 mm to 2,005.5 mm, accounting for 89.9% to 93.4% of the total annual rainfall. Meanwhile, the total rainfall in the 6 months of dry season ranges from 140.9 mm to 215.4 mm, accounting for 6.6% to 10.1% of the total annual rainfall. It can be seen that the total annual rainfall is concentrated mainly in the rainy season while the rainfall in the dry season is very low, so water shortages and droughts often occur in the dry season in parts of Gia Lai as well as in the whole Highlands region. The total number of rainy days in a year at Pleiku MS and Chu Se MS is 159 days and 96.7 days respectively, where the highest number of rainy days is in the western part of the province (see Figure 7.3 and Figure 7.4).



Source: Meteorological and Hydrological Documentation Centre, cited in FS Report 2020

Figure 7.3 Annual Variation of Rainfall at Pleiku Meteorological Station



Source: Meteorological and Hydrological Documentation Centre, cited in FS Report 2020

Figure 7.4 Annual Variation of Rainfall at Chu Se Meteorological Station

7.2.3 Relative Humidity

The average monthly relative humidity ranges from 74-91%, and the annual average relative humidity is 83.0%. The period with the lowest humidity is usually in February and March; about 74% to 75%. This is the peak dry season of the Central Highlands as well as the Project area. The period of highest humidity falls in the rainy season months from July to September, ranging from 91% to 92%. Humidity

between months varies between 1-3%. However, during transition months between the dry and rainy seasons, the variation in relative humidity increases, ranging between 3 – 7%. The average annual relative humidity is 83%.

The lowest relative humidity in most months of the year is below 50%, except in June, when the humidity is over 50%. The lowest humidity recorded at Pleiku MS is 16%, in March. The monthly average and minimum monthly relative humidity monitoring results in the period from 1996 to 2018 are presented in Table 7.3.

Table 7.3 Minimum and Average Monthly Humidity at Pleiku Station (1996-2018)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Monthly average (%)	78	75	74	77	84	89	91	92	91	86	83	80	83
Min (%)	19	19	16	26	36	52	48	49	47	36	37	28	16

Source: Meteorological and Hydrological Documentation Centre, cited in FS Report 2018

7.2.4 Evaporation

Total annual evaporation recorded at Pleiku MS is relatively stable, ranging between 1180 and 1200 mm. Annual evaporation during the dry season ranges from 77.4 to 123.0mm. The month with the highest total evaporation is March, with about 123.0 mm. In the rainy season, the total evaporation decreases significantly, ranging from 40.6 to 79.9mm. The month with the lowest total evaporation is August with about 40.6mm. The distribution of total monthly average evaporation at Pleiku MS in the period from 1996 to 2018 is shown in Table 7.4.

Table 7.4 Total Monthly Evaporation at Pleiku MS (1996-2018)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Evaporation (mm)	90.9	100.8	123.0	108.1	79.9	56.7	45.1	40.6	42.7	54.0	64.7	77.4	884.0

Source: Meteorological and Hydrological Documentation Centre, cited in FS Report 2018

7.2.5 Sunshine Hours

Sunshine hours are closely related to solar radiation and is directly influenced by the amount of clouds. The number of sunshine hours depends on the topography, whereby hills and mountains, and high shielding structures make the total number of sunshine hours decrease. Total annual sunshine hours recorded at Pleiku MS are about 2,369.2 hours. In the dry season, the number of sunshine hours is higher than that of the rainy season, ranging from 215.8 to 261.5 hours. The two months with the most sunshine are from January to March with the number of sunshine hours ranging from 249.3 to 261.5 hours/month, or about 8.4 - 8.9 hours of sunshine/day. The months with the lowest number of sunshine hours are August and September, with only 129.2 - 134.0 hours of sunshine, about 4.2 to 4.5 hours of sunshine per day (see Table 7.5).

Table 7.5 Total Average Sunshine Hours at Pleiku MS (1996-2018)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Total sunshine hour (h)	258.5	249.3	261.5	236.6	204.9	164.3	139.4	129.2	134.0	177.4	198.3	215.8	2369.2

Source: Meteorological and Hydrological Documentation Centre, cited in FS Report 2018

7.2.6 Wind Regime

7.2.6.1 Wind Regime in Gia Lai Province

According to the wind monitoring results for Pleiku MS, wind regime in the region every year is characterized by two main systems: the winter monsoon with prevailing wind directions being East and Northeast. And a northeast wind blowing from the southwest edge of the Western Pacific subtropical high pressure circulation.

According to statistics, wind direction recorded at Pleiku MS from October to April is mainly east and northeast, at a frequency of 15.0 - 55.8%. April is characterized by the meeting of both western and eastern systems, with the cold high pressure weakening and the western hot low pressure developing to the east to prevail, pushing back the subtropical high pressure to the West - East. During this period, the wind at Pleiku MS gradually changes from East, Northeast to West with a frequency of about 15.0% (see Table 7.6).

Table 7.6 Wind Direction and Frequency Monthly at Pleiku Station during 1996-2018

Direction	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
N	2.4	1.7	1.9	1.9	2.2	1.1	1.3	1.1	2.3	4.0	4.3	4.8
NE	31.0	18.9	15.8	12.6	7.9	2.7	2.0	2.1	5.3	24.5	41.0	45.1
E	55.8	54.1	48.9	34.0	14.6	4.3	2.1	3.2	8.1	28.8	38.1	46.2
SE	6.2	7.0	9.6	7.5	4.5	1.8	1.2	2.0	3.6	5.5	2.5	3.0
S	0.8	1.4	2.2	2.4	2.0	1.0	1.1	1.0	2.0	2.0	0.6	0.6
SW	0.9	2.2	4.7	8.9	16.4	23.4	23.7	25.1	19.8	7.3	0.9	0.5
W	1.8	3.7	9.0	15.0	36.3	56.3	62.2	61.0	37.7	7.6	1.5	0.3
NW	1.2	1.5	3.1	4.6	5.0	4.0	5.4	4.9	5.0	3.1	1.3	0.5

Source: Meteorological and Hydrological Documentation Centre, cited in FS Report 2018

Table 7.7 Prevailing Wind Direction and Frequency of Occurrence in the Month

Month	Direction	Frequency (%)
Jan	NE, E	31.0 - 55.8
Feb	NE, E	18,9 - 54.1
Mar	NE, E	15,8 - 48.9
Apr	W, E	15.0 - 34.0
May	W	36.3
Jun	SW, W	23.4 – 56.3
Jul	SW, W	23.7 – 62.2
Aug	SW, W	25,1 – 61,0
Sep	SW, W	19,8 – 37,7
Oct	NE, E	24,5 – 28,8
Nov	E, NE	38,1 – 41,0

Month	Direction	Frequency (%)
Dec	NE, E	45,1 – 46,2

Source: Meteorological and Hydrological Documentation Centre, cited in FS Report 2018

The average annual wind speed recorded at Pleiku MS is about 2.6m/s, fluctuating throughout the year betweeb 1.9 to 3.2m/s (see Table 7.8). In general, the average wind speed between months is relatively stable. Highest average wind speed are typically experienced during the northeast monsoon period (December to February) and the southwest monsoon period (July, August).

Table 7.8 Average Wind Speed at Pleiku MS (1996-2018)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Pleiku Station (m/s)	2.8	2.8	2.5	2.2	2.9	2.6	3.2	3.0	2.2	1.9	2.4	3.0	2.6

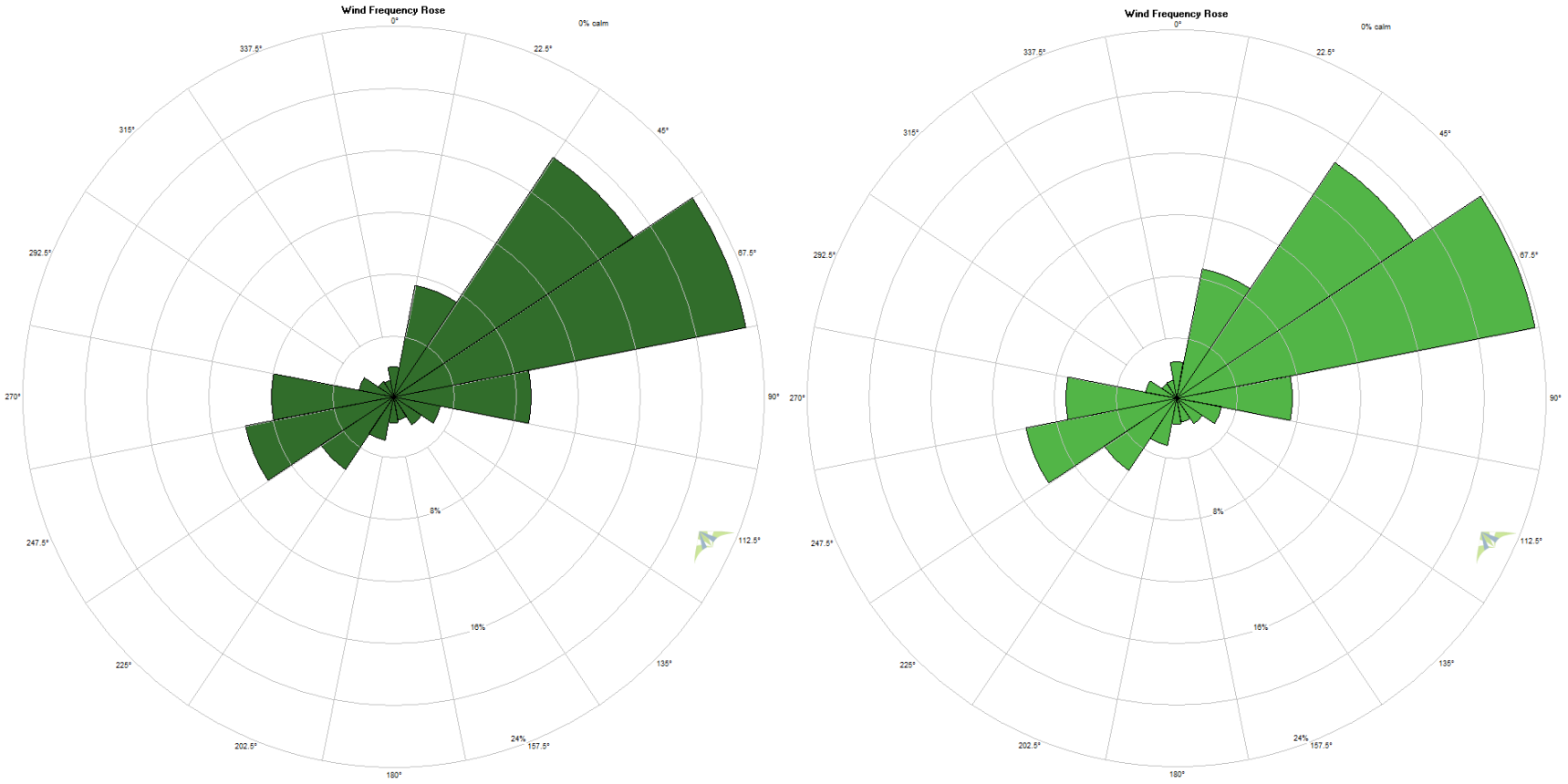
Source: Meteorological and Hydrological Documentation Centre, cited in FS Report 2018

7.2.6.2 Wind Regime in the Project Area

Wind patterns in the Project area are similar to those recorded at Pleiku MS, whereby:

- From October to April, winds are influenced by the Northeast monsoon; East (E) and Southeast (ESE) wind directions prevail during this time.

Between May and September, winds are influenced by the equatorial air originating from the North Indian Ocean, combined with Southern Hemisphere wind transported to the North by two currents; West (W) and Southwest (WSW) wind directions prevail during this time (see Figure 7.5).



(a) (b)

Source: Feasibility Study Report, 2021

Figure 7.5 Wind Rose at the Project Area: (a) at 116 m, and (b) at 96 m

According to the FS report (2020), wind speeds favourable to wind turbine electricity generation ($\bar{v} \geq 3$ m/s) at the height of 120m [20] accounted for 88.013% of measured time; and wind speeds of $\bar{v} \geq 6$ m/s at the height of 120m accounted for 52.814% of measured time (see Table 7.9).

Table 7.9 Frequency of Wind Direction at Different Heights at the Project Area

Wind speed level (m/s)	Frequency			
	120m_A[21]	**120m_B[21]**	**100m**	**80m**
0<v < 1	2.061	1.862	1.559	2.586
1≤v<2	3.435	3.508	3.461	3.289
2≤v<3	6.489	6.354	6.779	5.577
3≤v<4	10.691	10.833	11.266	9.359
4≤v<5	12.766	12.894	13.254	13.427
5≤v<6	11.742	11.773	12.038	14.835
6≤v<7	10.629	10.541	10.804	15.141
7≤v<8	10.384	10.229	11.317	13.675
8≤v<9	10.872	10.877	11.605	10.161
9≤v<10	9.764	9.698	9.395	6.191
10≤v<11	6.334	6.44	5.087	3.145
11≤v<12	2.857	2.926	1.955	1.531
12≤v<13	1.135	1.223	0.858	0.649
13≤v<14	0.462	0.493	0.374	0.24
14≤v<15	0.234	0.215	0.159	0.092
15≤v<16	0.095	0.084	0.062	0.053
16≤v<17	0.035	0.035	0.022	0.029
17≤v<18	0.011	0.013	0.004	0.006
18≤v<19	0.002	0.002	0	0.004
19≤v<20	0	0	0	0.004
20≤v<21	0	0	0	0
21≤v<22	0	0	0	0
22≤v<23	0	0	0	0
23≤v<24	0	0	0	0
24≤v<25	0	0	0	0
25≤v<26	0	0	0	0

[20] The wind velocity data measured at the height of 120m is preferable due to the relative similarity with the wind turbine's hub height used for this Project.

[21] Wind characteristics will be measured by two channels A and B at different height to monitor various wind parameters such as wind direction, wind speed, temperature, etc.

Wind speed level (m/s)	Frequency			
	120m_A[21]	120m_B[21]	100m	80m
26≤v<27	0	0	0	0
27≤v<28	0	0	0	0
Total	**100**	**100**	**100**	**100**

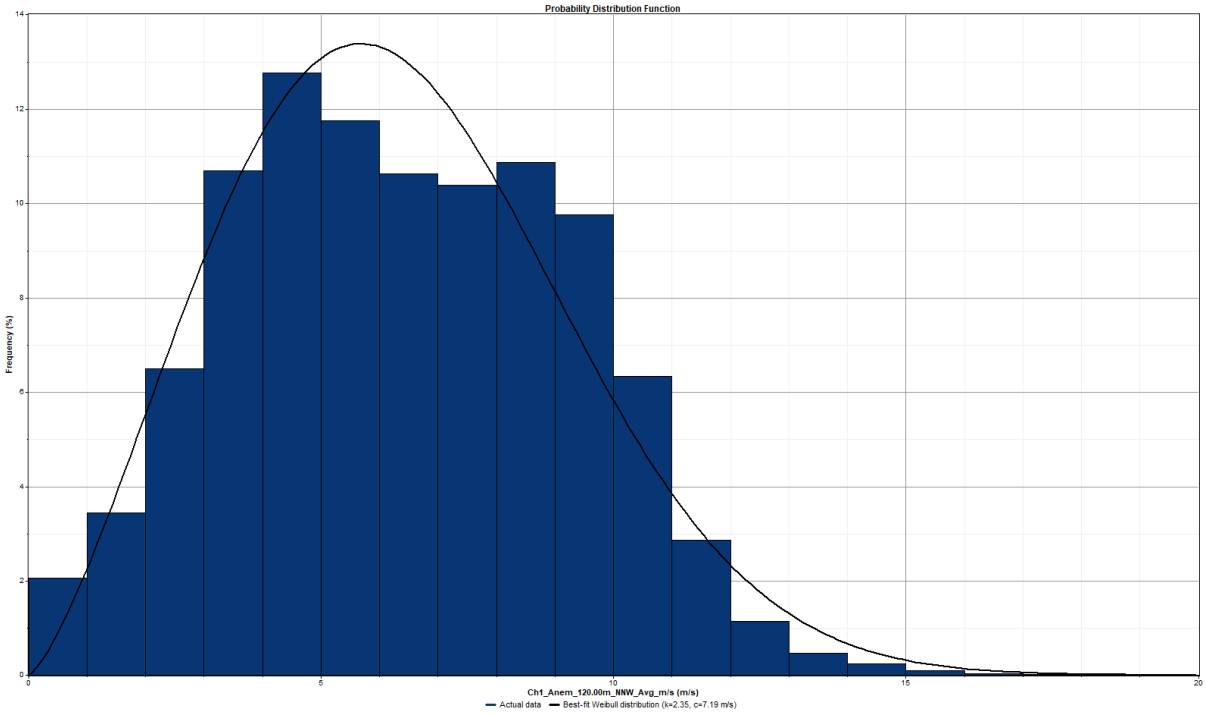


Figure 7.6 Distribution of Wind Frequency at 120m_A

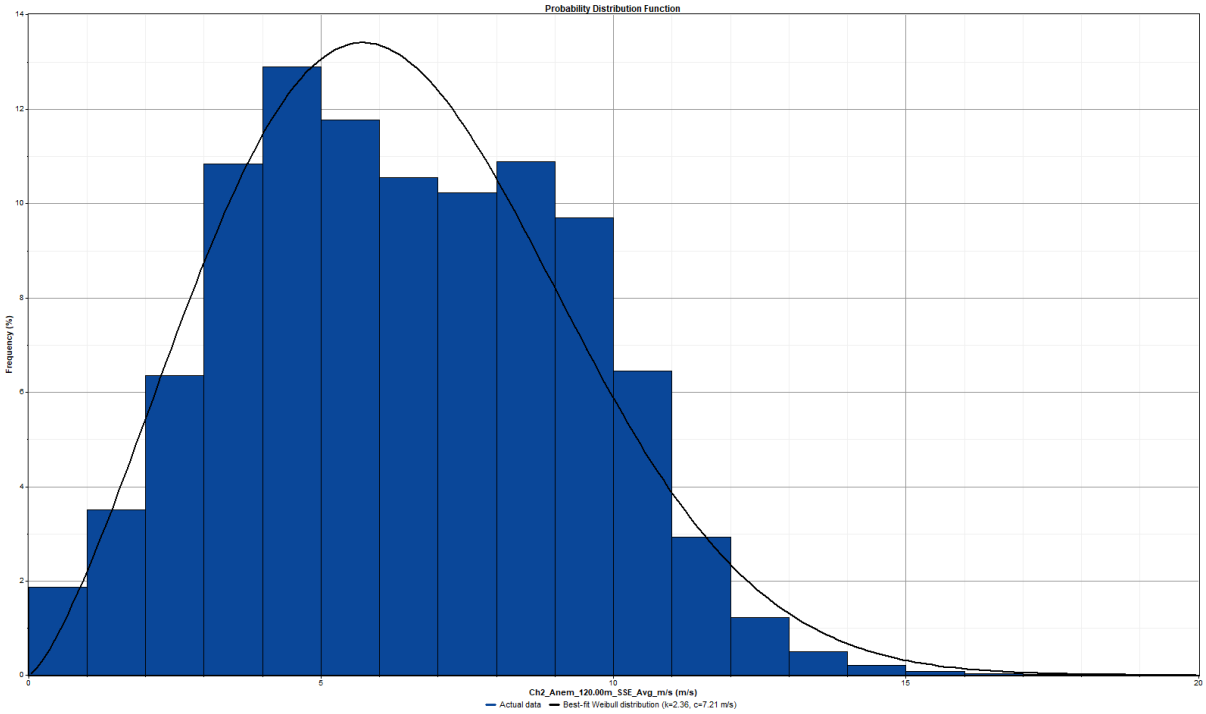


Figure 7.7 Distribution of Wind Frequency at 120m_B

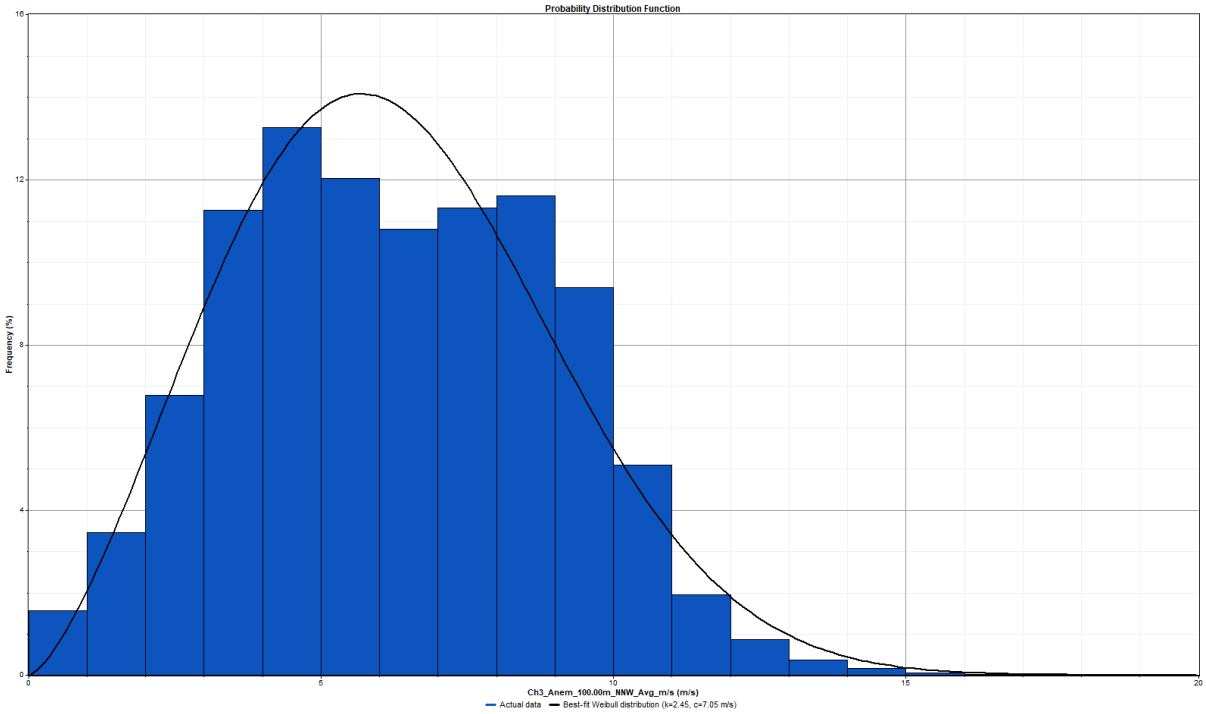


Figure 7.8 Distribution of Wind Frequency at 100m

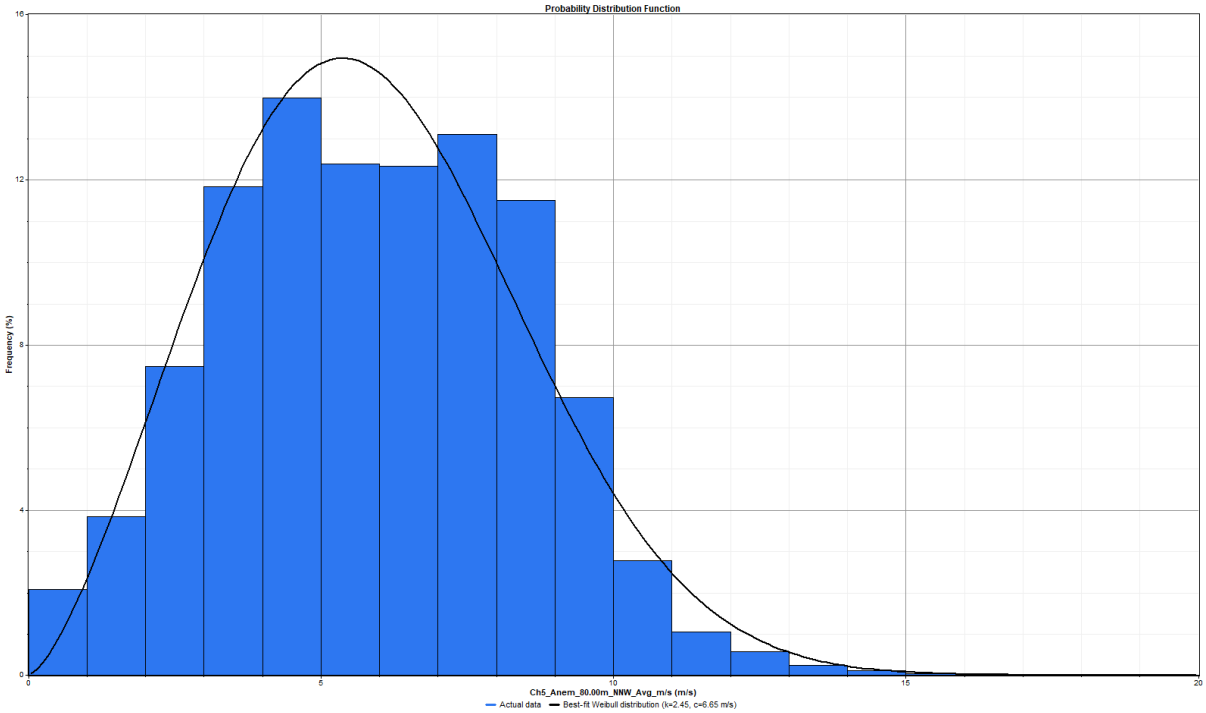


Figure 7.9 Distribution of Wind Frequency at 80m

Table 7.10 Wind Speed Characteristics at the Project Area

Channel	Ch1 120mA	Ch2 120m	Ch3 100mB	Ch4 100.m	Ch5 80m	Ch6 80m
Measurement height (m)	120	120	100	100	80	60
Mean wind speed (m/s)	6.395	6.409	6.265	6.215	5.916	5.538
MMM wind speed (m/s)	6.391	6.405	6.26	6.211	5.912	5.534
Median wind speed (m/s)	6.255	6.254	6.149	6.116	5.864	5.506
Min wind speed (m/s)	0.306	0.325	0.278	0.336	0.338	0.327
Max wind speed (m/s)	18.251	18.379	17.746	17.608	17.23	16.275
Weibull k	2.352	2.365	2.446	2.436	2.451	2.475
Weibull c (m/s)	7.193	7.213	7.051	6.991	6.651	6.224
Mean power density (W/m²)	233	234	214	209	179	146
MMM power density (W/m²)	233	234	214	209	179	146
Mean energy content	2,040	2,051	1,877	1,832	1,570	1,280
MMM energy content	2,037	2,048	1,874	1,830	1,568	1,278
Energy pattern factor	1.616	1.613	1.582	1.582	1.573	1.564
Possible records	45,215	45,215	45,215	45,215	45,215	45,215
Valid records	45,215	45,215	45,215	45,215	45,215	45,215
Data recovery rate (%)	100	100	100	100	100	100

Source: FS Report, 2018

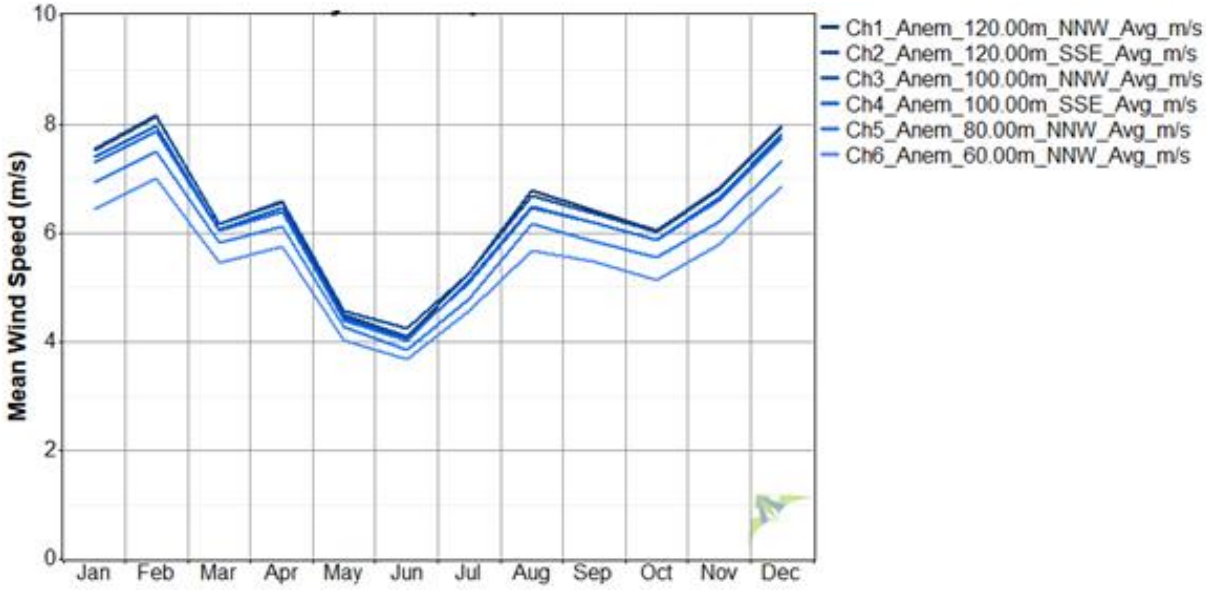


Figure 7.10 Monthly Wind Speed Profile

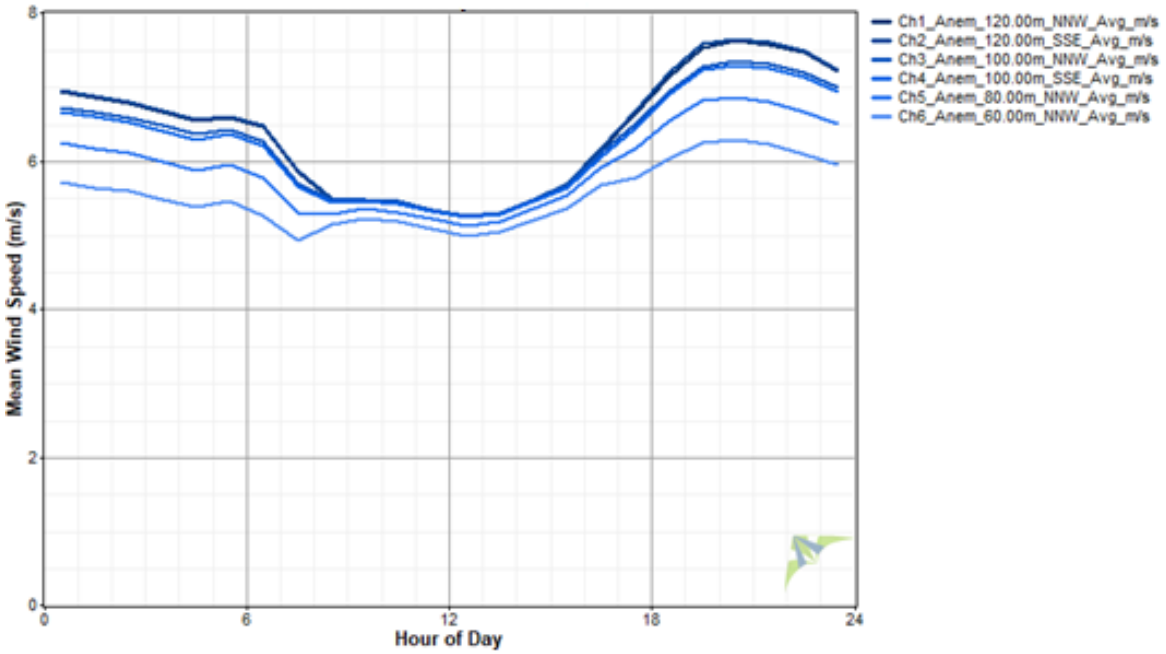


Figure 7.11 Diurnal Wind Speed Profile

The hourly average wind speed variation curve at the measured heights at Pleiku MS has a similar shape. The difference in the hourly average wind speed at different times of the day at the same altitude is relatively high, with a distinct increase between 18:00 and 7:00 (see Table 7.11).

Table 7.11 Average Wind Speed at Different Heights at Pleiku MS

Hours	Average wind speed (m/s) at different heights					
	120m	120m	100m	100m	80m	60m
00:00 - 01:00	6.93	6.95	6.73	6.66	6.24	5.71
01:00 - 02:00	6.86	6.88	6.66	6.60	6.17	5.64
02:00 - 03:00	6.78	6.79	6.59	6.53	6.11	5.59
03:00 - 04:00	6.66	6.68	6.48	6.41	5.98	5.47
04:00 - 05:00	6.54	6.55	6.36	6.29	5.86	5.38
05:00 - 06:00	6.59	6.60	6.43	6.37	5.95	5.46
06:00 - 07:00	6.46	6.48	6.27	6.20	5.77	5.26
07:00 - 08:00	5.86	5.87	5.70	5.65	5.29	4.93
08:00 - 09:00	5.48	5.49	5.47	5.44	5.29	5.14
09:00 - 10:00	5.47	5.46	5.48	5.45	5.35	5.23
10:00 - 11:00	5.45	5.44	5.45	5.42	5.31	5.17
11:00 - 12:00	5.34	5.33	5.35	5.32	5.21	5.08
12:00 - 13:00	5.25	5.24	5.26	5.23	5.12	4.99
13:00 - 14:00	5.29	5.28	5.30	5.27	5.18	5.05
14:00 - 15:00	5.48	5.48	5.48	5.45	5.35	5.20
15:00 - 16:00	5.70	5.70	5.68	5.64	5.53	5.36
16:00 - 17:00	6.15	6.16	6.11	6.05	5.91	5.67
17:00 - 18:00	6.64	6.67	6.49	6.45	6.18	5.77

Hours	Average wind speed (m/s) at different heights					
	120m	120m	100m	100m	80m	60m
18:00 - 19:00	7.14	7.19	6.93	6.89	6.54	6.03
19:00 - 20:00	7.54	7.59	7.28	7.23	6.82	6.25
20:00 - 21:00	7.62	7.65	7.36	7.30	6.87	6.29
21:00 - 22:00	7.58	7.60	7.32	7.25	6.80	6.22
22:00 - 23:00	7.46	7.48	7.20	7.13	6.65	6.08
23:00 - 24:00	7.22	7.24	7.00	6.93	6.50	5.95
Average	6.39	6.41	6.26	6.22	5.92	5.54

Source: FS Report, 2018

A summary of wind regime characteristics for the Project area is provided in Table 7.12.

Table 7.12 Summary of Typical Characteristics of Wind Regime at the Project Area

No.	Parameter	Value
1	Average annual wind speed at 120m	6.39 m/s
2	Frequency of wind direction at 120m	ENE ,SW,W
3	Frequency of wind speed that wind turbine starts generating electricity $\bar{v} \geq 3$ m/s at 120m	88.013%
4	Turbulent density (According to IEC 61400-1)	B
5	Statistical characteristics of wind data series at 120m height according to distribution function Weibull	k=2.78 A=7.41
6	Average energy density of wind directions at 1200m	258 W/m^2

Source: FS Report, 2020

7.2.7 Natural Hazards

7.2.7.1 Typhoons and Typhoon and Tropical Depressions

The Project area is mainly affected by rain, rather than storms and tropical depressions. Storms and tropical depressions lose their energy supply from sea when they enter the mainland. Due to the terrain and vegetation cover characteristics of the Project area, storms rapidly weakens on approach. The eastern and south-eastern districts of the province such as Ia Pa, Krong Pa, and Ayun Pa townships are more prone to storms and tropical depressions. Historically, storms associated with high winds and heavy rain in these districts have resulted in significant damage, namely Storm No. 12 on 3-4 November 2017; Storm No. 5 on 30-31 October 2019 and Storm No. 6 on 10-11 November 2019.

7.2.7.2 Floods

Floods associated with rivers in Gia Lai Province are typically observed from May to November, corresponding to the prevailing period of the southwest monsoon. In particular, flooding associated with the Ba river system usually starts from September and ends in December. The Central Highlands region in general and Gia Lai Province as well as Ia Grai, Chu Prong and other localities of the Province, are characterised by a system of undulating hills, rather sharp peaks and interspersed plateau steps, resulting in fragmented, dangerous and difficult to navigate terrain, with slopes above 20%. These topographical characteristics result in floods on upstream rivers to flow quickly, creating flash floods that cause serious flooding to the communes downstream of the rivers and streams. Although the Ba River does not traverse the Project area, flooding of the Ba River system has the potential to affect

tributaries in the vicinity of the Project area. Of particular note, the flood on 11 June 2018 caused flooding in many areas in the communes of Ia Puc, Ia Lau, Ia Pior, Ia Drang, Chu Prong district, causing significant damage to people's property and crops. Because the Project area is located on higher ground, upstream of some small rivers and streams, it is unlikely to be affected by flooding.

7.2.7.3 Extreme Weather

Like in other provinces in the region, thunderstorms in Gia Lai are mainly heat storms, occurring in the summer season (southwest monsoon period) when temperatures and humidity are high. Thunderstorms often occur in the afternoon, especially in the mountains, typically between 13:00 and 19:00. Thunderstorms are often accompanied by strong winds and, although not long, heavy rain. Sometimes strong thunderstorms cause hail, this phenomenon usually occurs in the early summer. Sometimes thunderstorms may be associated with whirlwinds, lightning and thunder.

Every year, the Pleiku plateau experiences about 60 to 65 days of thunderstorms. The number of thunderstorm days is distributed between March and October. The months of March, April and May are the months with the most thunderstorms in the Central Highlands because this is the time of changing seasons and also the period of strong activity of the southwest monsoon. For other months, the average number of thunderstorm ranges between 5 to 10 days/month. The months from November to January do not experience many, if any, thunderstorms.

Compared to other areas, the Ia Pech wind power Project area in particular has a high probability of thunderstorms compared to the national average. According to the map of lightning density of the Institute of Geophysics[22], the Project area experiences lightning 5.7 to 8.2 times/km^2. Lightning protection solutions for structures such as substations, residential areas are therefore required (see Figure 7.12).

[22] Referred to the Vietnam Technical Regulation *TCVN 9385:2012 – BS 6651:1999* on Protection of structure against lightning – Guide for design, inspection and maintenance, dated 2012 by the Ministry of Construction.

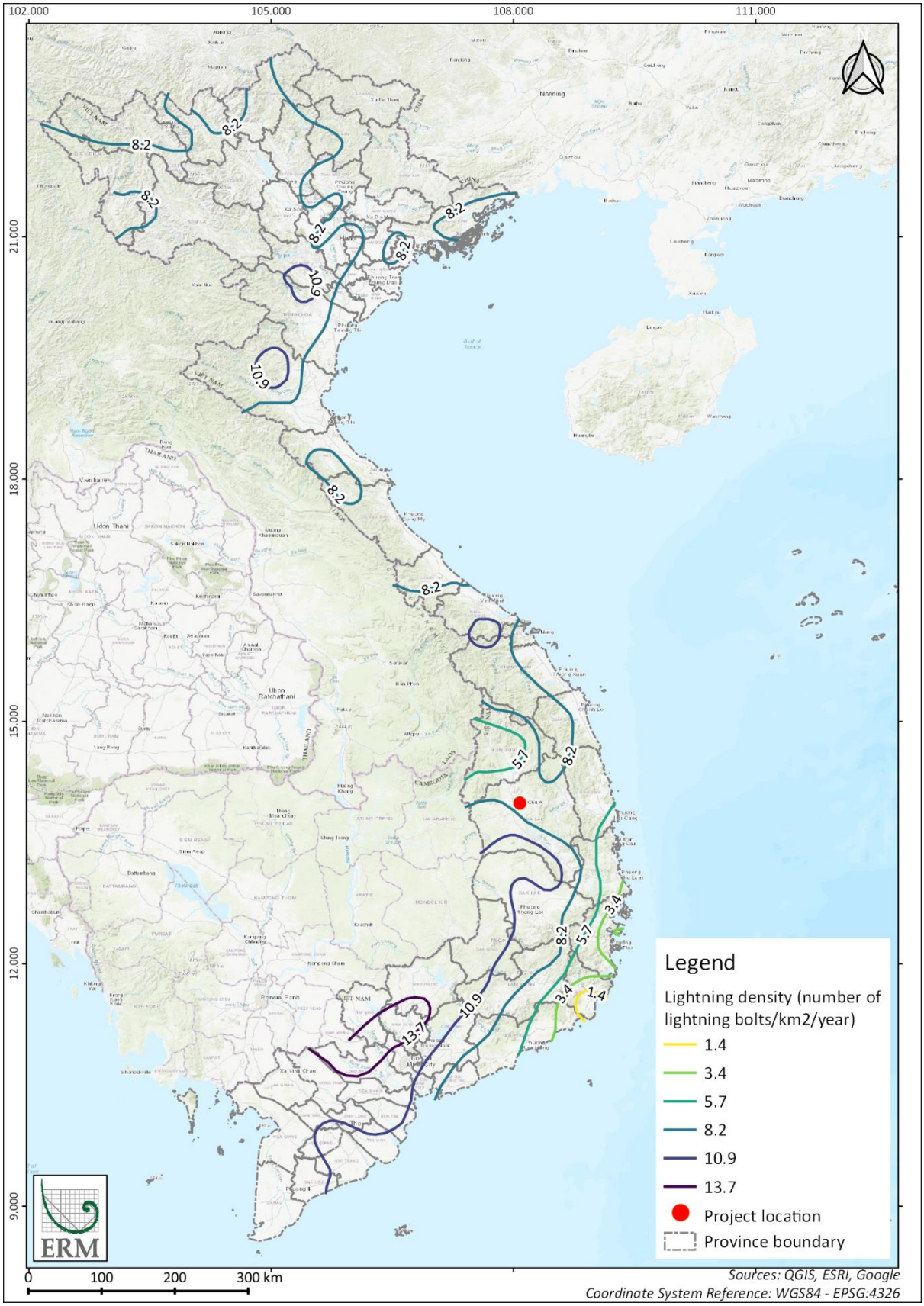


Figure 7.12 Annual Lightning Density

7.2.8 Topography

The Project area is characterised by the following geomorphological types:

- Eroded Terrain: Occupying a large area of the Project area, mainly concentrated in the area of large streams and a number of creeks and small streams. The terrain's surface is strongly dissected by streams and crevices. The terrain elevation is about 605m to 740m. The area's geology is mainly characterised by weathered basalt.
- Accumulation Terrain: Accumulation topography accounts for a small part of the Project area, mainly distributed in areas of large streams and creeks. The terrain surface is relatively flat. Terrain elevation varies from a few meters to several tens of meters. The area's geology is mainly loose sediments deposited during the Quaternary period (see Figure 7.13).

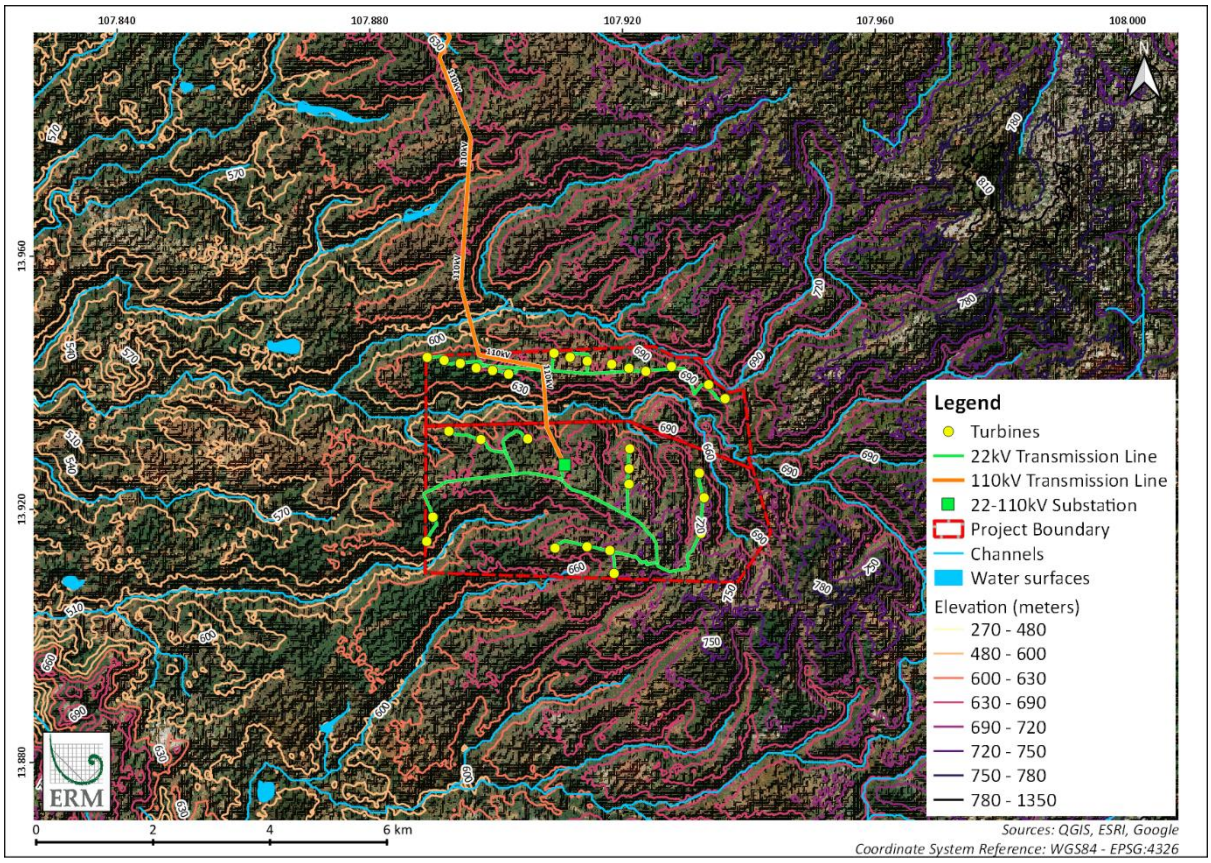


Figure 7.13 Topography and Drainage System in the Project's Area

7.2.9 Geological Condition

A geological survey was conducted as part of the Feasibility Study for Gia Lai Wind Farm Project. The results of the survey show that the Project area is composed of different layers of soil as follow:

- Layer 1. Remnant ridge layer (edQ): Composed of 10-20% red-brown laterite grits mixed with clay. Moist soil, hard to semi-hard plastic state.
- Layer 2. Intense weathering zone (IA1): Composed of 10-25% clay mixed with yellow-brown, gray-brown gravel. Moist soil, semi-hard state. Weathering products from basalt rock.
- Layer 3. Strongly weathered basalt rock (IA2) into clumps of clay, yellow-brown, gray-green clay mixed with low moisture soil, hard state. Rocks and stones account for 40-60%.
- Layer 4. Moderately weathered basalt (IB) red-brown, purple-brown, strongly fractured rock, wide fissure, clay adhesion. Medium hard rock

7.2.10 Hydrological Characteristics in the Project Area

Gia Lai Province is characterised by two major river systems, which are the Ba and Se San River Systems. The Ba River originates from the Ngoc Ro Mountain of the Truong Son Mountain Range, at an altitude of 1,549 m. The river flows through Gia Lai, Dak Lak, Phu Yen provinces to the East Sea via the Da Rang Estuary in Phu Yen Province. The Ba River is about 388 km long, with a catchment area of 13,417 km^2. The Ba River has five tributary rivers with over 500 km^2 of catchment area. In addition, Se San River with a total length of 237 km and an area of 11,450 km^2 is one of the major tributaries of Mekong River. Se San River originates from the North and Central Highlands of Vietnam where its upstream section abuts on the watershed between the East and the West of Truong Son Range, while the downstream section traaaverses deep gorges in the high mountains. However, the Project area is only characterised by a high density of small streams with no major river system traversing the Project area. The surface water bodies traversing the Project area is presented in Figure 7.14.

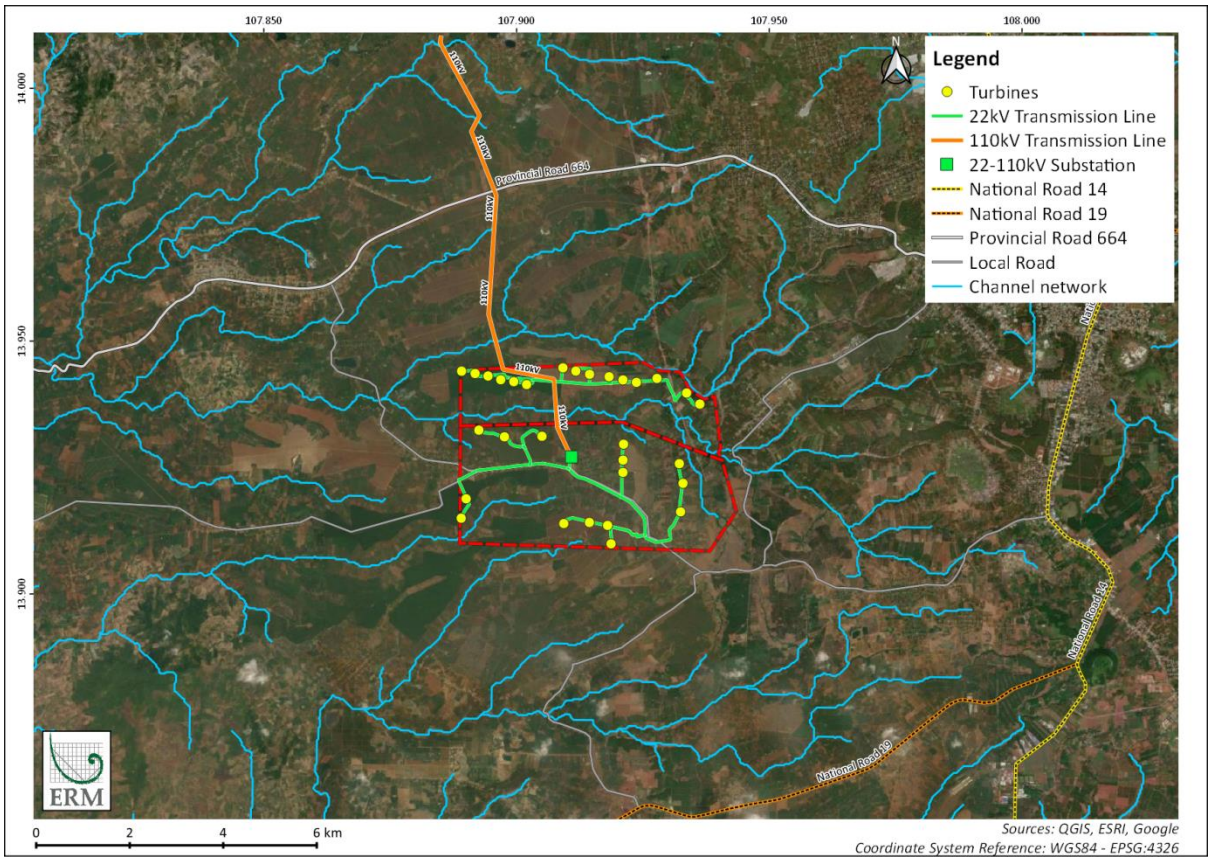


Figure 7.14 Water Bodies in the Project Area

7.3 Noise Baseline Condition

Background noise levels are typically influenced by external sound sources, including wind. As wind speed increases, background noise levels generally also increase as natural sources such as wind in trees begin to dominate. Noise levels can also change as propagation from other noise sources changes. The variation of background noise with wind speed is usually quite site-specific and related to various physical characteristics such as topographic shielding and the extent and height of exposed vegetation. In order to establish wind farm noise assessment criteria it is therefore usual to carry out background noise monitoring of the pre-existing environment as a function of wind speed.

The relative proximity of some receiver locations to one another and their similar wind exposure and surrounding environment meant that background noise monitoring could be conducted at three Noise Monitoring Locations (hereinafter referred to as “NMLs”) distributed evenly through the Project’s area which are representative of all of the locations where receivers were identified.

As mentioned in the EHS Guidelines for Wind Energy *"If the preliminary model suggests that turbine noise at all sensitive receptors is likely to be below an LA90 of 35dB at a wind speed of 10 m/s at 10 m height during day and night times, the this preliminary modelling is likely to be sufficient to assess noise impact; otherwise it is recommended that more detailed modelling be carried out, which may include background ambient noise measurements"*. Hence, the selection of the monitoring locations and monitoring procedure were implemented based on the IFC General EHS Guidelines – Noise Management. Noise measured was assessed against the IFC Criteria (See Table 7.13).

Table 7.13 IFC General EHS Guidelines on Noise Level

Receptor	On Hour L_{Aeq} (dBA)	
	Day time 7:00 – 22:00	Night time 22:00 – 7:00
Residential, Institutional, and educational	55	45

Source: IFC General EHS Guidelines – Noise Management, 2007

7.3.1 Noise Monitoring Locations

Background noise measurements have been carried out between 29 May 2021 and 2 June 2021 in Ia Pech commune, Ia Grai District, Gia Lai Province, at three representative monitoring locations (NML2 to NML4) the vicinity of the Project site (See Table 7.14 and Figure 7.15). Details of the noise monitoring points, noise measurement methodology, and equipment can be found in 0. The noise sampling points were selected based on some criteria:

- Densely populated areas (sensitive receptors) which are potentially affected by noise associated with the Project, located within the 2 km buffer area as specified by the IFC EHS Guidelines for Wind Energy[23], and
- Areas located away from significant noise sources such as construction sites, schools, and along main roads.

The location of NMLs and distance correlation between NMLs to wind turbines are presented in Table 7.14 and Figure 7.15.

Table 7.14 Summary of Noise Measurement Locations

No.	Site	Location	Nearest WTG	Distance from monitoring location to the nearest wind Turbine (m)	Coordinates (WGS84)
1	NML1	O So Hamlet, Ia Pech commune, Ia Grai District, Gia Lai Province	E15	1,950	13°54'31.0"N, 107°56'00.2"E
2	NML2	O Gia Hamlet, Ia Pech commune, Ia Grai District, Gia Lai Provine	E27	850	13°55'37.6"N; 107°54'42.2"E
3	NML3	Opech Hamlet, Ia Pech commune, Ia Grai District, Gia Lai Province	E29	1,200	13°55'44.6"N, 107°52'55.8"E

[23] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_policy_ehs-wind_energy

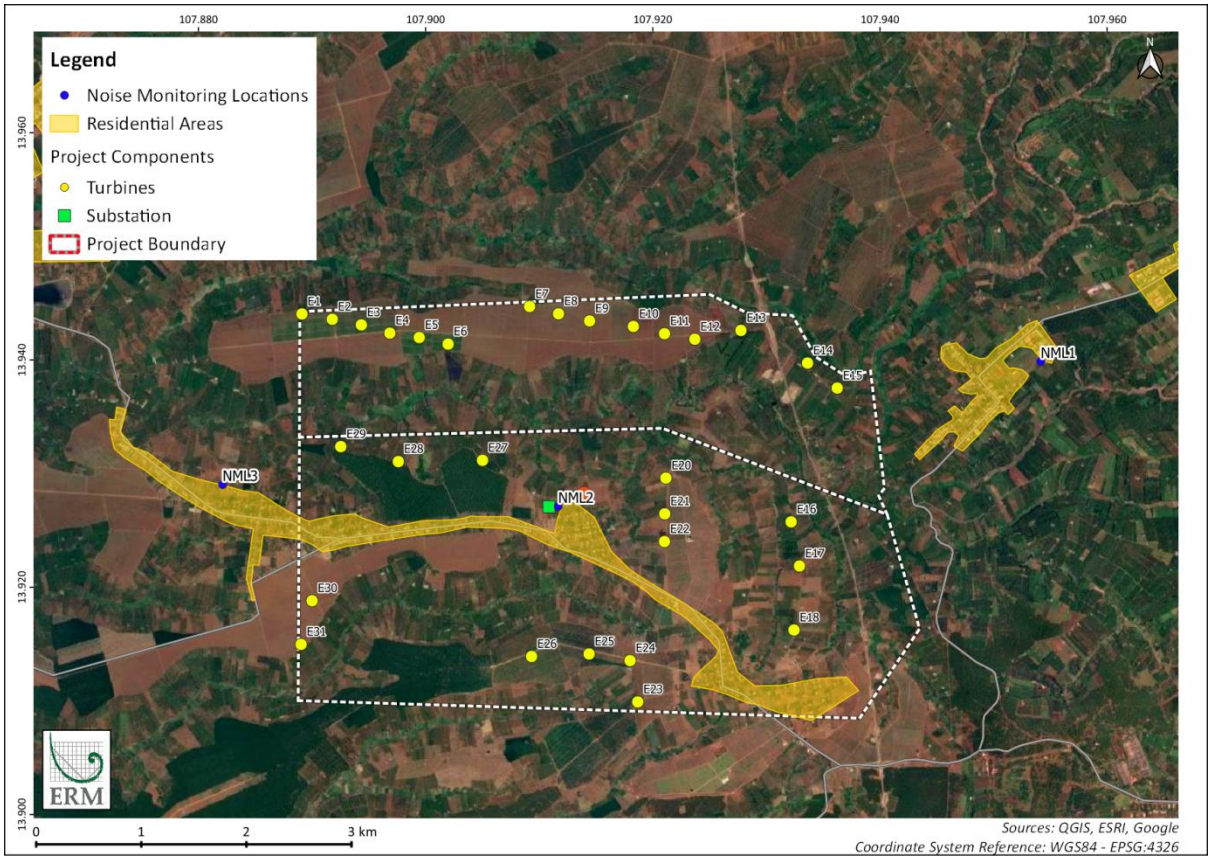


Figure 7.15 Noise Monitoring Locations

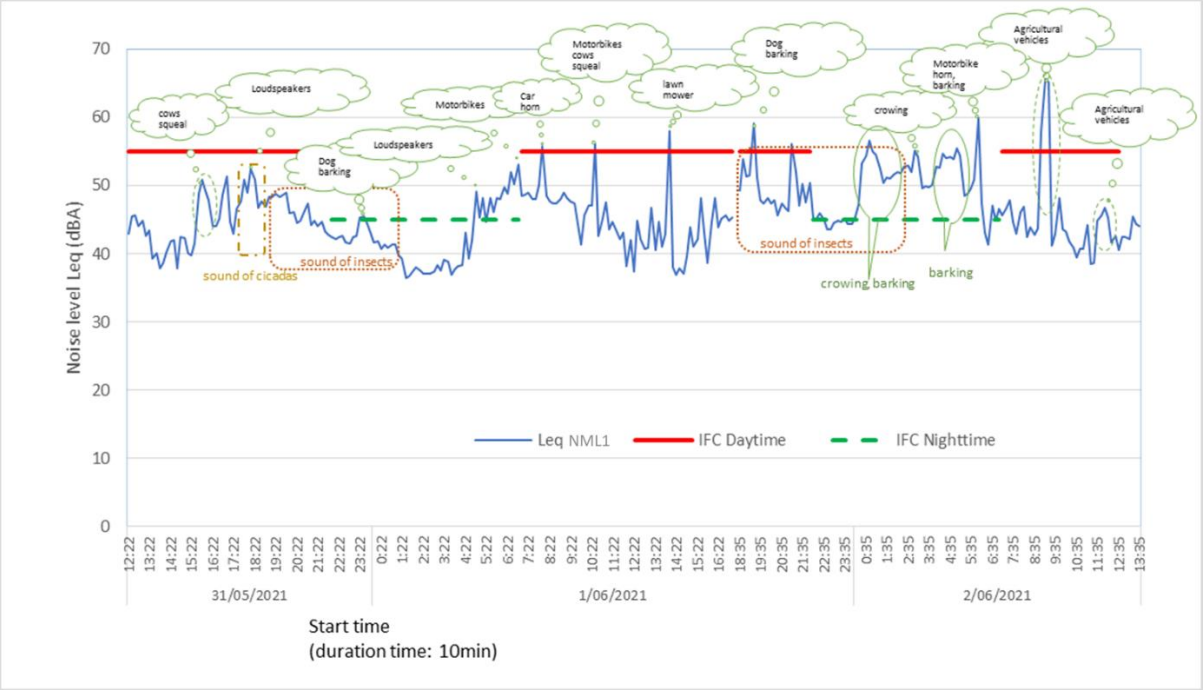
7.3.2 Noise Monitoring Procedure

The background noise measurements at the three monitoring locations were conducted based on IFC EHS Guidelines, with LA_{eq}, LA_{90} and LA_{10} (LA is sould level with A-weighted) noise levels measured within 48 hours at 10-minute intervals. Weather conditions (e.g. wind speeds), exciting industrial condition and noise contribution from other noise sources at the monitoring locations were recorded and used for noise analysis.

7.3.3 Noise Monitoring Results

7.3.3.1 Noise Monitoring Site NML1

- Noise levels (L_{eq}, 10 minutes) measured during daytime ranged between 36.9 – 65.7dBA. 4.4% of the measured values were higher than IFC's threshold (55 dBA for day time). On 25 May 2021, Noise levels (L_{eq}, 10 min) reached 65dBA in the time period 09:05 – 09:15 on 2 June 2021 due to noise from agriculture vehicles.
- 57% of the noise values measured during night time were higher than IFC's threshold (45dBA for night time). The highest noise level reached was 59.9 dBA, recorded in the time period 05:55 - 06:05 on 2 June 2 2021, due to motorbike horn and dog barking. The lowest noise level recorded was 36.4 dBA in the time period 00:50 - 01:00 on 1 June 2021.
- Above threshold noise levels at location NML1 was caused by motorbikes and agricultural vehicles passing by; however, levels were also affected by the sound of cicadas (17:40 – 18:40), loudspeakers and cow squealing. Other noise sources at location NML2 contributing to background noise included other insect sounds (19:20 – 3:00), and occasional dogs and roosters.

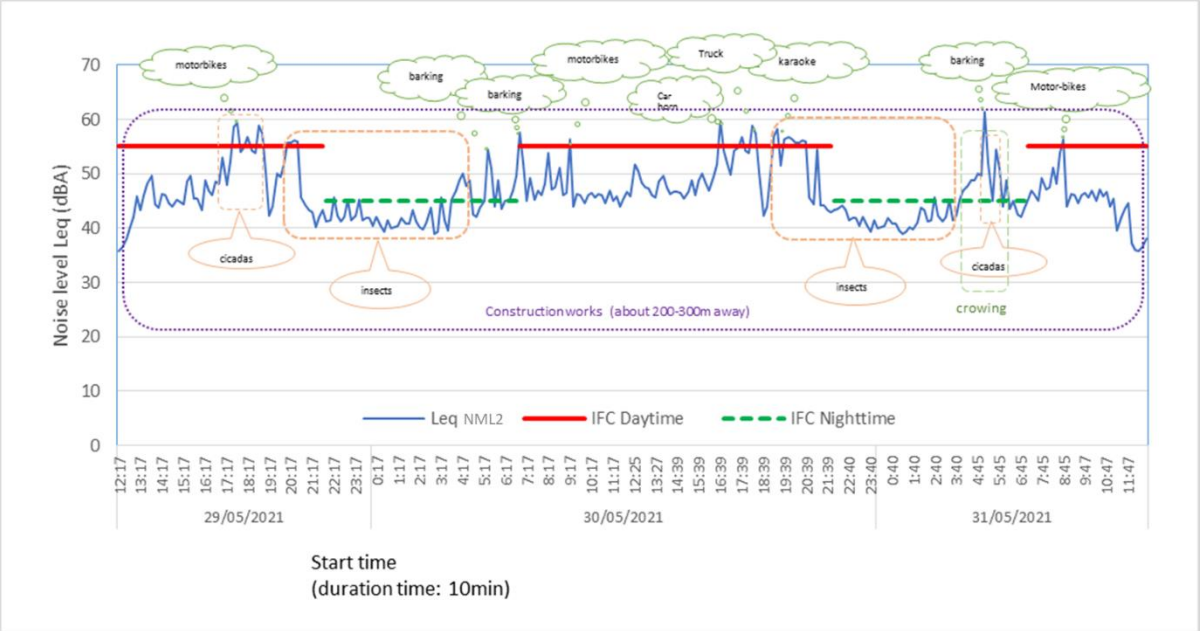


Source: IER, 2021

Figure 7.16 $L_{eq\ ,10min}$ (dBA) at Location NML1

7.3.3.2 Noise Monitoring Site NML2

- 13.9% of noise levels monitored during daytime were above IFC's threshold. The highest noise level measured was 59.6 dBA in the time period 4:39PM to 4:59 on 26 May 2021 due to noise from motorbike and cicadas. The lowest noise level recorded was 35.8 dBA in the time period 12:17 – 12:27 on 31 May 2021.
- 27.8% of noise levels during night time were above IFC's threshold, mainly due to insects, occasional barking dogs and crowing. The highest noise level measured was 61.4 dBA in the time period 5:05 – 5.15 on 31 May 2021 due to barking dogs, roosters and cicadas. The lowest noise level measured was 39dBA in the time period 1:10AM - 1:20AM on 31 May 2021.
- Noise levels at NML2 were often affected by noise from wind power operator construction, motorbikes, cicadas and other insects at night. There were also occasional noise sources such as agriculture vehicles, karaoke, dogs and roosters.

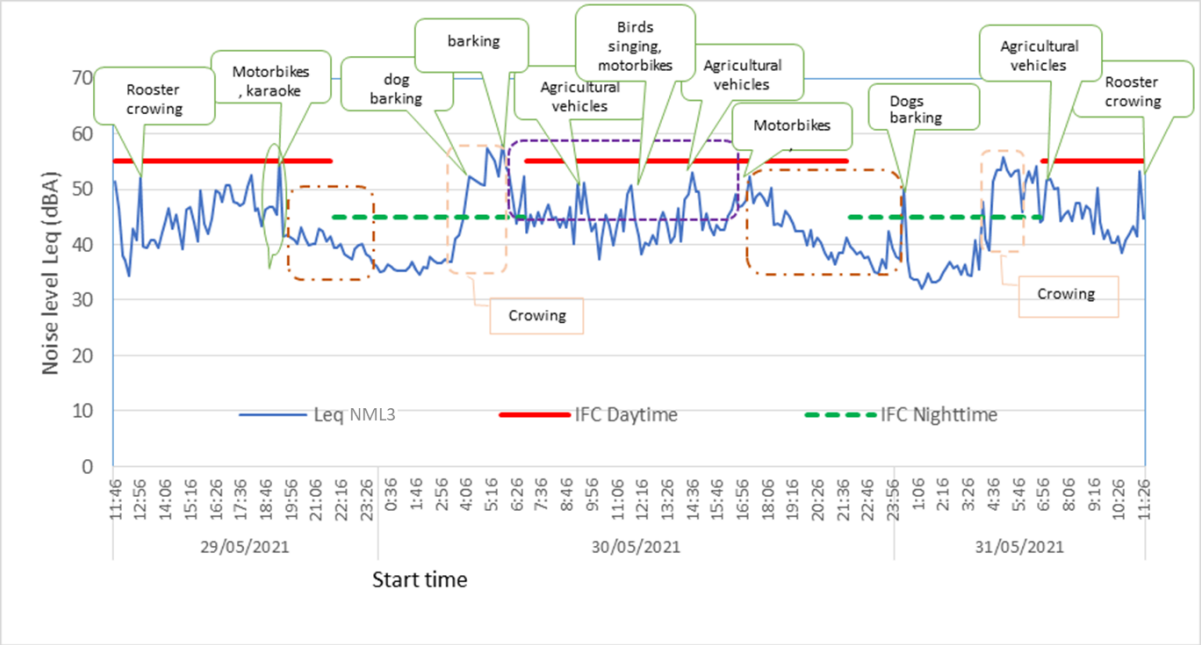


Source: IER, 2021

Figure 7.17 $L_{eq, 10min}$ (dBA) at Location NML2

7.3.3.3 Noise Monitoring Site NML3

- 99.44% of noise levels during day time were lower than IFC's limitation. The highest noise level measured was 55.8 dBA in the time period 7:26 - 7:36PM, on 29 May 2021 due to the noise of motorbikes and karaoke 300m away. This exceedance was the only record of exceedance of IFC's day time noise threshold. The lowest noise level measured was 34.4 dBA in the time period 12:26-12:36 on 29 May 2021.
- 28.7% of noise levels during night time exceeded IFC's threshold, mainly due to insect and dog barking. The highest measured noise level was 58 dBA at 5:46 – 5:56AM on 30 May 2021 due to dog barking. The lowest noise level measured was 32 dBA in the time period 1:16 – 1:26AM of 31 March 2021.
- In summary, NML3 was not only affected by noise from agricultural vehicles and motorbikes, but also other noise sources such as insects at night (6pm to 0am), in addition to significant contributions from dog barking and roosters in the early morning (4-6AM).



Source: IER, 2021

Figure 7.18 $L_{eq,10min}$ (dBA) at Location NML3

8. BIODIVERSITY BASELINE

This section presents the existing biodiversity values of the Project area and its vicinity, based on information collated from different methods, as detailed in Section 8.1. The objective of the biodiversity baseline is to identify and characterise the biodiversity receptors that can potentially be affected by the development of the Project. This section also provides an assessment on whether the Project area overlaps Critical Habitat. Critical Habitat is defined as an area having high biodiversity value according to the criteria set out within the International Financial Corporation's Performance Standard 6 (IFC PS6) and the associated Guidance Note 6 (GN6). Where a Project area overlaps with Critical Habitat, particular requirements are triggered in order for that project to comply with IFC PS6.

8.1 Methodology

The identification of protected areas and determination of the presence of species of conservation significance and associated critical, natural and modified habitats for terrestrial biodiversity has been undertaken in accordance with IFC Performance Standard 6 (PS6) and other associated international guidelines. The biodiversity baseline involves a four-step process including desktop review, identification of Area of Influence (AoI) set within relevant land and seascape, field surveys and critical habitat assessment (CHA).

8.1.1 Desktop Review

The desktop review involves gathering relevant information derived from relevant publications and online databases (including the Integrated Biodiversity Assessment Tool [IBAT]). Where possible, this information is then confirmed in consultation with relevant biodiversity stakeholders, including species specialists from the Center for Biodiversity Conservation and Endangered species (CBES[24]) and Centre for Natural Conservation (CCD[25]). The purpose of this process is to identify the existing biodiversity values within the Project AoI.

The desktop review enables the characterisation of the Ecoregion within which the Project area is located, as well as the identification of Important Conservation Areas, conservation significant species and invasive species with potential to be present within the Project AoI.

To conduct the assessment, several areas have been defined, as follows:

- The Project area is defined as the area within the Project boundary where Project activities take place.
- The Project footprint is defined as areas cleared for infrastructure development.
- Significant areas of conservation include Biosphere Reserves, World Heritage Sites, Ramsar sites, ASEAN Heritage Parks, Protected Areas and Key Biodiversity Areas within a 50 km radius of the Project area. The extent of this analysis is generated by the IBAT search engine and is used in this section to determine the proximity of conservation areas.
- The Project area of Influence (AoI) is the area outside of the project area where direct, indirect and induced effects may occur as a result of construction and/or operation of the project.
- Where a species is identified to have or is likely to have regular occurrence in the Project AoI, the Ecologically Appropriate Area of Analysis (EAAA) for that species is defined as required under IFC PS6. The EAAA is used to identify the presence of critical habitat for that species (through application of the IFC PS6 critical habitat thresholds outlined in the associated GN6 (2019).

[24] https://cbes.vn/

[25] https://ccd.org.vn/en/

The desktop review considered online sources, literature and environmental studies undertaken within 50 km radius of the Project area. IBAT was used as the main source for identifying the potential presence of globally threatened species and Important Conservation Areas. Additional sources used for screening included:

- NGO webpages and databases including those belonging to the World Wildlife Fund (WWF);
- BirdLife International;
- Circular 35/2018/TT-BTNMT that lists invasive/alien species in Vietnam;
- eBird;
- Global Biodiversity Information Facility (GBIF);
- Global Invasive Species Database (GSID)
- Vietnam Red Data Book (VRDB);
- International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (the 'IUCN Red List') and their profiles; and
- IUCN Red List of Ecosystems (although no assessments of threatened ecosystems has been completed by IUCN for Vietnam).

The data obtained during the desktop review was used to inform all steps of the CHA process.

8.1.2 Flora and Fauna Field Survey

Field biodiversity data was acquired using a combination of methods including flora and fauna baseline surveys, focused surveys by specialists if necessary, expert consultation, and interviews with local people. Information was gathered on species and their suitable habitats within the appropriate survey areas. Refer to Section 8.2.2 for detailed information on the field surveys undertaken.

8.1.3 Critical Habitat Assessment

According to IFC PS6, critical habitats are areas with high biodiversity value that include at least one or more of the following five values:

- Habitat of significant importance to Critically Endangered (CR) and/or Endangered[26] (EN) species;
- Habitat of significant importance to endemic and/or restricted-range species[27];
- Habitat supporting globally significant concentrations of migratory species and/or congregatory species;

[26] As listed on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. The determination of critical habitat based on other listings is as follows: (i) If the species is listed nationally / regionally as critically endangered or endangered, in countries that have adhered to IUCN guidance, the critical habitat determination will be made on a project by project basis in consultation with competent professionals; and (ii) in instances where nationally or regionally listed species' categorizations do not correspond well to those of the IUCN (e.g., some countries more generally list species as "protected" or "restricted"), an assessment will be conducted to determine the rationale and purpose of the listing. In this case, the critical habitat determination will be based on such an assessment

[27] According to IFC GN6, the term endemic is defined as restricted-range. Restricted range refers to a limited extent of occurrence (EOO). For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an EOO less than 50,000 square kilometers (km2). For marine systems, restricted-range species are provisionally being considered those with an EOO of less than 100,000 km2. For coastal, riverine, and other aquatic species in habitats that do not exceed 200 km width at any point (for example, rivers), restricted range is defined as having a global range of less than or equal to 500 km linear geographic span (i.e., the distance between occupied locations furthest apart).

- Highly threatened and/or unique ecosystems; and/or
- Areas associated with key evolutionary processes.

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. Critical habitats can therefore be a subset of both modified habitat and natural habitat.

CHA for the Project was undertaken against the criteria defined within IFC PS 6 GN6. This involved analysis of the desktop review data, habitat mapping outputs and field survey results. Critical Habitat criteria are defined in PS6 GN6, Paragraphs GN69 to 97. Table 8.1 provides details of the qualifying requirements for Criteria 1 to 5.

The five criteria are 'triggers' in that if an area meets any one of the criteria, it will be considered Critical Habitat irrespective of whether it fails to meet any other criterion. There is no one criterion that is more important than any other for qualifying as Critical Habitat or for determining compliance with PS 6. For ease of reference, these values are referred to as "critical habitat criteria" for the remainder of this document.

Table 8.1 Critical Habitat Criteria

Criteria	Thresholds
Criterion 1: Critically Endangered (CR)/ Endangered (EN)/Vulnerable (VU) species:	■ Areas that support globally-important concentrations of an IUCN Red-listed EN or CR species (0.5 % of the global population AND 5 reproductive units of a CR or EN species); ■ Areas that support globally-important concentrations of an IUCN Red-listed VU species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in (a); and/or ■ As appropriate, areas containing nationally/regionally-important concentrations of an IUCN Red-listed EN or CR species.
Criterion 2: Habitat of significant importance to endemic and/or restricted-range species;	■ Areas that regularly hold ≥ 10 % of the global population size AND ≥ 10 reproductive units of a species.
Criterion 3: Habitat supporting globally significant concentrations of migratory species and/or congregatory species;	■ Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 % of the global population of a migratory or congregatory species at any point of the species' lifecycle; and/or ■ Areas that predictably support ≥ 10 % of the global population of a species during periods of environmental stress.
Criterion 4: Highly threatened and/or unique ecosystems; and/or	■ Areas representing ≥ 5 % of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN; and/or ■ Other areas, not yet assessed by IUCN, but determined to be of high priority for conservation by regional or national systematic conservation planning.
Criterion 5: Areas associated with key evolutionary processes	■ Criterion 5 has no tiered system though IFC PS6 describes this Criterion to be one of the following: ■ Physical features of a landscape that might be associated with particular evolutionary processes (for example isolated areas, areas of high endemism, spatial heterogeneity, environmental gradients, edaphic interfaces, biological corridors or sites of demonstrated importance to climate change adaptation); and/or ■ Subpopulations 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.

Source: IFC (2019)

In accordance with IFC PS6, as part of the CHA clients should consider project-related impacts in the context of the wider landscape or seascape setting and for each species that regularly occurs within the AoI to identify the EAAA (see Figure 8.15). The EAAA should take into consideration the distribution of the species or ecosystems, ecological patterns, processes, features, and functions that are necessary for maintaining that species. The factors that were taken into consideration for the identification of the EAAA for the Project include surrounding environmental conditions, surrounding land uses, main habitat types for critical habitat candidate species and existing anthropogenic barriers such as roads and settlements. The EAAA selection also took into account the highly modified and homogenous nature of this heavily settled landscape.

In the absence of any clear landscape connectivity with other areas, the identification of the EAAA for the Project focused on the concept of home ranges; the extent to which species typical foraging or daily movement range will overlap with the Project, or habitats where staging migrant birds may rest and feed before passing through the Project area. Whilst these can vary between species, for volant animals a daily or nightly foraging range of up to 10km provides a reasonable and proportionate area over which to identify potential critical habitat triggers that may interact with the construction and operation of the wind farm. Where specific species have a longer foraging or travelling range this is taken into account when assessing that specific species in relation to the EAAA.

8.2 Baseline Results

8.2.1 Desktop Review Results

8.2.1.1 Ecoregion Description

According to Queiroz et al. (2013), Vietnam comprises a total of 14 World Wide Fund for nature (WWF)-identified terrestrial ecoregions. The Gia Lai Project lies within the Southeastern Indochina Dry Evergreen Forests [IM0210], which occupies an area of 124,320 km^2. This Ecoregion occurs in a broad band across northern and central Thailand into Laos, Cambodia, and Vietnam. Dry evergreen forest is more appropriately called semi-evergreen forest because a significant proportion of canopy tree species are deciduous at the height of the dry season. Semi-evergreen forest is the predominant forest cover in this ecoregion, but it often occurs in mosaics of deciduous dipterocarp or mixed deciduous forest communities. The distribution of dry semi-evergreen forest habitats is largely a function of gradients of soil moisture availability. This ecoregion occurs in humid and subhumid climatic regions where mean annual rainfall is generally between 1,200 and 2,000 mm, and a significant dry period of 3-6 months occurs each year. The canopy of semi-evergreen forests generally is multilayered and reaches about 30-40 m, with an open structure (WWF n.d.).

Much of the ecoregion has been significantly modified and the key threats to the Ecoregion are conversion to plantation, agriculture, wide scale hunting for the wildlife trade and legal and illegal logging.

The species of conservation significance existing within the Ecoregion is presented in Table 8.2.

Table 8.2 Endangered Species within the Ecoregion

No.	Scientific Name	Common Name	IUCN	VRDB	Class Name
1	*Pseudibis gigantea*	Giant Ibis	CR	NE	Aves
2	*Arborophila davidi*	Orange-necked Partridge	NT	EN	Aves
3	*Polyplectron germaini*	Polyplectron Germaini	NT	VU	Aves
4	*Pygathrix nemaeus*	Red-shanked Douc Langur	CR	EN	Mammalia

No.	Scientific Name	Common Name	IUCN	VRDB	Class Name

Notes: *VRDB: Vietnam Red Data Book; CR : Critically Endangered; EN : Endangered; VU : Vulnerable; NT: Near Threatened; NE: Not Evaluated*

8.2.1.2 Significant Areas of Conservation

Table 8.3 lists the significant areas of conservation within 50 km radius of the Project.

Table 8.3 Presence of Significant Areas of Conservation within 50 km Radius of the Project

Category	Presence
Biosphere Reserves	No
World Heritage Sites	No
Ramsar sites	No
ASEAN Heritage Parks	**Yes**
Nationally Protected Areas	**Yes**
Key Biodiversity Areas	**Yes**

8.2.1.2.1 ASEAN Heritage Parks

There are two ASEAN Heritage Parks present within the 50 km radius of the Project, namely the Chu Mom Ray National Park and Kon Ka Kinh National Park. They were both recognized as ASEAN Heritage Parks in 2012, as part of the program by ASEAN Center for Biodiversity aiming to promote conservation of natural resources and sustainable development such as tourism. Further biodiversity values of the two parks are presented in Table 8.4.

8.2.1.2.2 Nationally Protected Areas

There are four nationally protected areas that are situated within the vicinity of the Project Area (Figure 8.1). The list of spieces recorded in the protected area is presented in Appendix C.

Table 8.4 Protected Areas within 50km Radius of the Project Area

No.	Protected Area	Approximate Distance to Project (km)	Biodiversity values	Other information	References
1	Chu Mom Ray	46.2 km northeastern from turbine E1	■ The park harbours a rich biodiversity. There are about 1,494 flora species, 115 mammals, 272 birds, 62 reptiles and amphibians and 20 fishes found in Chu Mom Ray. Some endangered species that have been recorded within the park include Tiger *Panthera tigris* (IUCN EN; VRDB CR); Asian elephant *Elephas maximus* (IUCN EN; VRDB CR) ; Gaur *Bos gaurus* (IUCN VU ; VRDB EN), as well as Indochina-endemic species such as Germain's peacock pheasant *Polyplectron germaini* (IUCN NT; VRDB VU) and the Black-hooded laughingthrush *Garrulax millet* (IUCN LC; VRDB NE). ■ The two main forest types at Chu Mom Ray National Park are lowland evergreen forest, which is distributed below 1,000 m, and lower montane evergreen forest, which is distributed above this elevation. In addition, there are smaller areas of lowland semi-evergreen forest, distributed at elevations below 700 m. ■ The remainder of the national park supports a range of secondary vegetation types, including large areas of bamboo and a central area of grassland that developed following the wartime use of defoliants along the Ho Chi Minh Trail; this latter area has now become important for wild cattle grazing. ■ The most important conservation issues at Chu Mom Ray National Park are: – There is encroachment from villages bordering the national park – Hunting is taking place and non-timber forest products timber are extracted from the national park – The main road that cuts through the middle of the national park is being upgraded for use by rubber plantations in Mo Ray commune – The area was heavily bombed and sprayed with defoliants during the Second Indochina War – There is a significant threat of forest fire along the eastern edge of the national park, with the development of commercial pine and Acacia plantations	■ Country : Vietnam ■ Type: National Park & ASEAN Heritage Park ■ Area size: 562.37 km^2 ■ IUCN Management Category: II ■ Status year : 1995 ■ Management Authority: People's Committee of Kon Tum	(ACB n.d.; Jestrzemski et al. 2013; Le, Dang & Nguyen 2011)

No.	Protected Area	Approximate Distance to Project (km)	Biodiversity values	Other information	References
2	Chu Prong	41.2 km southeastern from turbine E23	■ There were 458 species of vascular plant were recorded at Chu Prong nature reserve. These include six globally threatened species: *Afzelia xylocarpa* (IUCN EN; VRDB EN), *Anisoptera costata* (IUCN EN; VRDB EN), Siamese Rosewood *Dalbergia cochinchinensis* (IUCN VU; VRDB EN), Tamalan *D. olivieri* (IUCN EN; VRDB EN), *Dipterocarpus alatus* (IUCN VU; VRDB NE) and White Meranti *Shorea roxburghii* (IUCN VU; VRDB NE). About 40 species of mammal, 171 species of bird, 36 species of reptile, 11 species amphibian and 11 species of fish were recorded at the proposed nature reserve. Some endangered species include Tiger, Gaur, Eld's Deer *Cervus eldii* (IUCN EN; VRDB NE) and Green Peafowl *Pavo muticus* (IUCN EN; VRDB EN). ■ There are four main vegetation types at the proposed nature reserve: lowland deciduous forest, lowland semi-evergreen forest, evergreen riverine forest and seasonally inundated grasslands. ■ Deciduous forest covers most of the proposed nature reserve below 400 m elevation. This forest type is characterised by an open canopy, with a maximum cover of 50 to 60%, a height of 10 to 20 m, and a simple botanical composition. This forest type is dominated by tree species in the Dipterocarpaceae, Combretaceae and Fabaceae families. ■ Semi-evergreen forest occurs at elevations above 400 m, and is typically stratified into four or five layers. The canopy layer is c.30 m high, and is dominated by the deciduous tree species *Lagerstroemia calyculata*. The sub-canopy is 10 to 20 m high, and is dominated by small and medium-sized evergreen trees. ■ Evergreen riverine forest occurs in narrow strips along major streams and rivers, and has a poorly defined vertical structure. These evergreen intrusions are dominated by moisture-loving tree species. Seasonally inundated grasslands occupy only a small area of the proposed nature reserve, yet are an important habitat type for large waterbirds and globally threatened mammals ■ Logging, hunting, fishing, forest fire and clearance of land for cultivation are all threats to the forest and wildlife at Chu Prong proposed nature reserve. Prior to	■ Country : Vietnam ■ Type: Proposed Nature Reserve ■ Area size: 501.04 km^2 ■ IUCN Management Category: Not reported ■ Status year : Not Reported ■ Management Authority: Not reported	(Tran et al. 2001)

No.	Protected Area	Approximate Distance to Project (km)	Biodiversity values	Other information	References
			1980, Chu Prong district was largely covered in undisturbed forest; however, the logging activities of the forest enterprise during period from 1977 to 1991 negatively affected the habitat and wildlife of the area.		
3	Kon Ka Kinh	44.1 km northwestern from turbine E15	■ The park harbours a rich biodiversity. There are about 652 flora species, 42 mammals, 160 birds, 41 reptiles and amphibians in Kon Ka Kinh. Endagered species include Black-shanked Douc langur *Pygathrix nemaeus* (IUCN CR; VRDB EN), Annamite Muntjac *Muntiacus truongsonensis* (IUCN DD; VRDB DD), *Afzelia xylocarpa* and *Dalbergia cochinchinensisi.* ■ Kon Ka Kinh National Park contains 33,565 ha of natural forest, equivalent to 80% of the total area of the national park. The national park supports a range of montane habitat types. Of particular importance are 2,000 ha of mixed coniferous and broadleaf forest containing Fujian Cypress *Fokienia hodginsii* (IUCN VU; VRDB EN). ■ Parts of Kon Ka Kinh National Park were previously managed by Dakrong, Krong Pa and Mang Yang I Forest Enterprises. An area of 8,247 ha, equivalent to 20% of the national park has been degraded by past commercial logging activities and continuing illegal timber extraction, while a further 12,286 ha, or 29% of the national park, has been cleared by commercial logging or shifting cultivation and now supports a range of secondary vegetation types. Although commercial logging activities in the national park have now ceased, exploitation of certain forest resources is still occurring at unsustainable levels. Potentially the most harmful activities, from a conservation perspective, are hunting and rattan collection. ■ Because of the low population density and large area of unused, fertile land, the buffer zone of Kon Ka Kinh National Park has been, and continues to be, a focus for spontaneous migration from other parts of Vietnam, particularly the northern provinces. Although only 301 people live within the boundaries of the national park, a total of 27,210 people inhabit the buffer zone. The inhabitants of the buffer zone consist of indigenous ethnic groups (principally Ba Na), who mainly practice shifting cultivation and exploitation of forest products; and in-	■ Country : Vietnam ■ Type: National Park & ASEAN Heritage Park ■ Area size: 420.57 km^2 ■ IUCN Management Category: II ■ Status year : 2014 ■ Management Authority: People's Committee of Gia Lai	(ACB n.d.; Dang, Le & Hoang 2013; Do 2013)

No.	Protected Area	Approximate Distance to Project (km)	Biodiversity values	Other information	References
			migrants from lowland areas, who mainly cultivate coffee or are involved in forestry activities.		
4	Bac Plei Ku	11.0 km northeastern from turbine E14	■ Bac Plei Ku is situated in the catchment of the Mekong River. The site comprises two areas of low mountains, separated by the valley of the Ia Tower river. It is not clear whether or not the proposed nature reserve includes Bien Ho lake, a natural freshwater lake formed by three or four extinct volcanic craters. The total area of this lake is 600 ha. ■ Bien Ho lake is known to support a rich freshwater fish fauna, including three endemic species of fish, and a variety of waterfowl. Apart from this, further information on the biodiversity values of the site is not available. ■ A total of 2,294 people live inside the proposed nature reserve, all of whom belong to the Ba Na ethnic group. A further 12,266 people live in the buffer zone, most of whom belong to the Kinh and Gia Rai ethnic groups. The biggest threats to biodiversity at the site to be hunting and other illegal exploitation of forest resources, and clearance of land for agriculture.	■ Country : Vietnam ■ Type: Nature Reserve ■ Area size: 129.41 km^2 ■ IUCN Management Category: Not reported ■ Status year : Not reported ■ Management Authority: People's Committee of Gia Lai	(Gia Lai Provincial FPD 2000)
5	Northeast Corridor	45.3 km eastern from turbine E31	■ Limited information about the forest types and other biodiversity values of this protected area found in the literature.	■ Country : Cambodia ■ Type: Biodiversity Corridor ■ Area size: 7576.61 km^2 ■ IUCN Management Category: VI ■ Status year : 2007 ■ Management Authority: Ministry of Environment	N/A

8.2.1.2.3 Key Biodiversity Areas

Two key biodiversity areas (KBAs) are shown within a 50 km radius of the Project area (Figure 8.1), four of which are also classified as Important Bird Areas (IBA). A summary of the areas is provided in Table 8.5.

Table 8.5 KBA within 50 km Radius of the Project

Name	Distance to the Project	Biodiversity values	Other Information	References
Kon Ka Kinh	44.1 km northwestern from turbine E15	■ The presence of Annamite Muntjac, endemic to Indochina has been recorded at Kon Ka Kinh in 1997. This is currently known from only a single other protected area in Vietnam. Three globally threatened primate species were recorded at Kon Ka Kinh: Stump-tailed Macaque Macaca arctiodes (IUCN VU; VRDB VU), Grey-shanked Douc Langur *Pygathrix nemaeus* cinereus (IUCN CR; VRDB CR) and Yellow-cheeked Crested Gibbon *Nomascus gabriellae* (IUCN EN; VRDB EN). In addition, a number of other species such as Asiatic Black Bear *Ursus thibetanus* (IUCN VU; VRDB EN) and Southern Serow *Naemorhedus sumatraensis* (IUCN VU; VRDB EN) and Chestnut-eared Laughingthrush *Garrulax konkakinhensis* (IUCN VU; VRDB NE) have also been recorded at Kon Ka Kinh. ■ The nature reserve supports a range of montane habitat types, with broadleaf evergreen forest the dominant vegetation type. The forest coverage is about 84% coverage and secondary shrubland coverage is about 16%.	■ Area: 420.57 km2 ■ Type: Important Bird Area ■ IBA criteria met: A1, A2, A3 ■ Year of most recent IBA criteria assessment: 2002	(Birdlife International 2021b; KBA n.d.)
Chu Prong	41.2 km southeastern from turbine E23	■ Seasonally inundated grasslands occupy only small area of the Chu Prong IBA, yet are an important habitat type because they support populations of large waterbirds and globally threatened mammals. The endemic Germain's Peacock Pheasant has been found in the IBA. The threatened primate species have been recorded at Chu Prong IBA included Pygmy Loris *Nycticebus pygmaeus* (IUCN EN; VRDB EN), Long-tailed Macaque *Macaca fascicularis* (IUCN VU; VRDB NE) and Black-shanked Douc Langur. Apart from these species, the Stump-tailed Macaque *Macaca arctoides* and Yellow-cheeked Crested Gibbons have been recorded in interviews with ethinic people living in the park. Eld's Deer, Gaur and Southern Serow have been also recorded at Chu Prong IBA. ■ Chu Prong proposed nature reserve supports four major habitat types: lowland deciduous forest, lowland semi-deciduous forest, evergreen riverine forest and seasonally inundated grassland. The last habitat type, although limited in area (about 10%), is of extremely high importance for populations of large waterbirds at the site. Forests account for 90% of the IBA.	■ Area: 501.04 km2 ■ Type: Important Bird Area ■ IBA criteria met: A1, A3 ■ Year of most recent IBA criteria assessment: 2002	(Birdlife International 2021a)

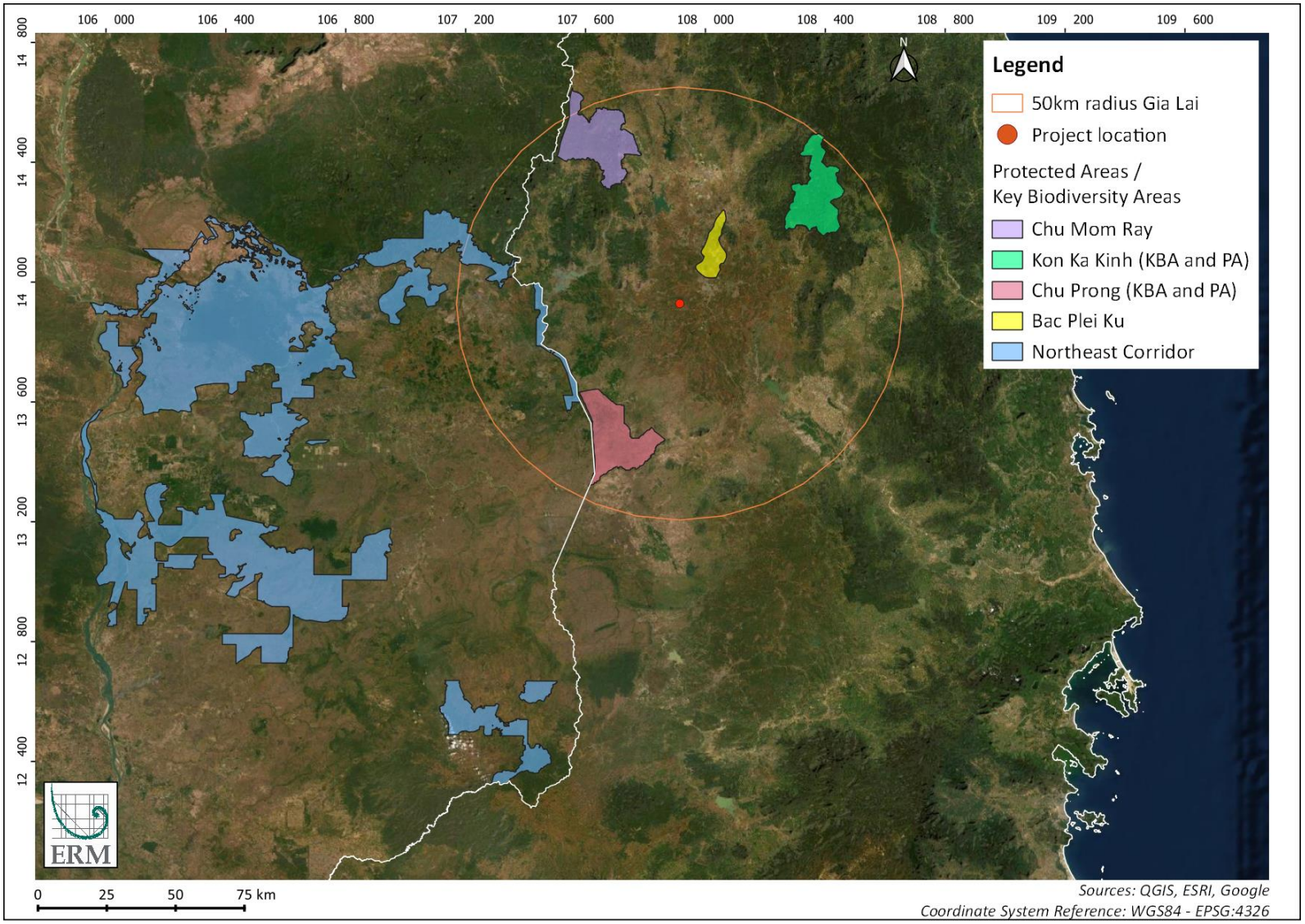


Figure 8.1 Protected Areas and KBAs within 50 km Radius of the Project

8.2.1.3 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, environmental harm or harm to human health. These species become naturalized in their introduced range, and often reproduce in large numbers and spread over a large area. This can result in competition and damage to native species. The Prime Minister of Vietnam has issued the Directive 42/CT-TTg[28] to strenghtened the managment and insepction of alien/invasive species. Gia Lai Province has also issued the Documentary 2450/UBND-NL to[29] implement the Directive 43/CT-TTg at the provincinal level.

According to the Global Invasive Species Database (GISD) (no date) and the Circular 35/2018/TT-BTNMT[30], a total of 197 invasive species have been identified in Vietnam, of which 181 species might occur within the Project area (see Appendix D). There are about 14 invasive species that were recorded in Gia Lai Province (Nguyen et al. 2020) (see Table 8.6).

Table 8.6 Invasive Species in Gia Lai Province

S/N	Class	Scientific Name	Common Name
1	PLANTS	*Eichhornia crassipes*	Common Water Hyacinth
2	PLANTS	*Mimosa pigra*	Black Mimosa
3	PLANTS	*Mimosa diplotricha*	Giant False Sensitive Plant
4	PLANTS	*Ageratum conyzoides*	Billygoat-Weed
5	PLANTS	*Chromolaena odorata*	Siam Weed
6	PLANTS	*Lantana camara*	Shrub Verbena
7	PLANTS	*Spathodea campanulata*	African Tuliptree
8	PLANTS	*Oxalis corniculata*	Creeping Woodsorrel
9	INVETEBRATES	*Pomacea canaliculata*	Channeled Applesnail
10	ACTINOPTERYGII	*Oreochromis mossambicus*	Mozambique tilapia
11	ACTINOPTERYGII	*Hypostomus plecostomus*	Suckermouth Catfish
12	ACTINOPTERYGII	*Clarias gariepinus*	African Sharptooth Catfish
13	ACTINOPTERYGII	*Gambusia affinis*	Mosquitofish
14	REPTILA	*Trachemys scripta elegans*	Red-Eared Slider

[28] Dated 8th December 2020 by the Prime Minister about Strengthening the Management and Control of Alien and Invasive species.

[29] Dated 14th December 2020 by the People's Committe of Gia Lai Province.

[30] Dated Decemeber 2018 by the Ministry of Natural Resrouces and Environment about Promulgating Invasive Alien Species Determination Criteria And Lists.

8.2.2 Flora and Fauna Surveys

This section summaries the sampling effort and key findings of field surveys undertaken to support the Project's biodiversity impact assessment. For further technical information about the methodologies and result analyses, refer to the technical reports attached in Appendix E, Appendix F, and Appendix G.

8.2.2.1 Survey Designs

Surveys were carried out for flying animals (i.e. avifauna (birds) and chiroptera (bats)), as well as habitats, flora, non-volant (i.e. non-flying) animals and herpetofauna (amphibians and reptiles). The survey scopes and methodologies are summarized in Table 8.7. A total of three survey visits were carried out over the following periods:

- 1st survey: 30 May to 02 June 2021
- 2nd survey: 15 to 18 July 2021
- 3rd survey: 9 to 12 November 2021

The surveys were carried out during the rainy season in the central highlands of Vietnam, which usually occurs between May to October each year. In the 1st survey (June) and 3rd survey (November), no rains occurred during the survey period. During the 2nd survey in July, intermitten light rains occurred between 7:00 and 9:00. Animals were not active during rain events; however, since only a small porportion of survey period was affected by rain, it is unlikely that the survey results would be significantly impacted by weather.

There were some limitations to the survey design. Firstly, the Project has started construction before conducting baseline surveys. At the time of conducting the first survey (from 30 May to 2 June 2021) , and the second survey (from 15 to 18 July 2021), the construction of internal roads, turbines foundation, underground cable and communication system were undergoing. At the time of conducting the 3rd survey (from 9 to 12 November 2021), construction had already finished. During the sampling period, there were no construction activities occuring along any of the sampling transects and in the vicinity of the selected vantage points that may influence the data collected.

Table 8.7 Summary of Survey Methodologies

Target	Survey Technique	Description of methodology	Survey effort spent
SURVEY TRIP 1: 30th May to 02nd June 2021			
Fauna (birds, non-volant mammals and herpetofauna)	1. Transects	Species richness in the Project area was assessed using Mackinnon-8 list method. The Project area was surveyed in daytime (6:00 – 11:00, except for the last day survey which was from 6:00 to 17:30 to cover the transmission line) and night time (17:00 to 22:00). During daytime, surveyors (one bird expert and one mammal expert) walked on transect (see Figure 8.2), using 8x42 binoculars or the naked eye to spot animals. For night time surveys, surveyors (one mammal expert and one herpetofauna expert) were equipped with high-power headlamps and handheld torches to detect any animals or eyeshine along the transect strip (5 m left and 5 m right of the transect). Time, GPS positions, photographs (where possible), number of individuals, distance and compass bearing to the sighted animals were recorded.	Each day, one daytime transect and one night time transect were conducted. From 30 May to 2 June, a total of four different daytime time transects (70.2 km distance in 25 hours total) and five night time transects (42.1 km distance in 20 hours total) were travelled.
	2. Interviews	Rapid interview surveys following the semi-structured interview approach (Torkar et al. 2011) were carried out in local communities living in the Project area (Figure 8.3) to collect supplemental data on the presence of conservation significant species. A large proportion of the interviewees were from the Gia Rai ethnic minority, who practice milpa farming (growing a mixture of crops on the edge of a forest or recently-cleared vegetation) and collecting non-timber forestry products. Therefore, they would have a higher chance of encountering wildlife if they were still around. A photo catalogue of endangered mammal species were shown to the interviewees. If the responders said they had encountered a species from the list, a series of questions regarding the biological details of such species would be asked to ensure the responder was providing reliable information. When the interviewers were confident about the reliability of the information, they would ask the responders to provide more information on times, locations, situations of each encountering case and any evidences (such as pictures, skulls, skins and bones)	From 30 May to 2 June, 42 interviews in local communities of 4 villages (Nang Glong, Sat Tau, O Sor and O Gia) belonging to Ia Pech commune were conducted.
Avifauna	1. Vantage Point Survey	Four vantage points were designed (see Figure 8.4). At each point, an observer scanned the whole area within a 2 km radius from the vantage point. Vantage points were chosen to cover the largest area of the Project footprint as possible. Each vantage point has 12 survey	From 30 May to 1 June, a total of 36 survey hours were conducted at each vantage point.

Target	Survey Technique	Description of methodology	Survey effort spent
		effort hours per day (from 6:00 to 18:00). The landscape at each vantage point is mainly coffee plantations. Parameters include information on species taxonomy, number of birds; start time and end time of flight; height of the flight in 15 second intervals; type of flight (flapping, soaring, gliding) and notes on activity/behaviour were all recorded. Height of the flight was recorded in three height bands, namely: below rotor height (<35m), at rotor height (35-150m) and above rotor height (>150m).	
Chiropteran	1. Mist-nets and harp-traps	Four strategic trapping stations were set up in the Project area (see Figure 8.5). Only one sampling station was covered per night. At each station, a combination of mist-nets (5mx30m nylon net with 38 mm mesh size, products of Avinet Research Supplies) and a customized four-band harp-trap (placed about 30m from the net) was deployed. After setting up the trapping gear, the team sits quietly away from the netting area (about 10 – 20 m) and checks for entangled bats every 10 minutes. The deploying time of harp-trap and mist-net are 4.5 hours (from 17:00 to 21:30) per night. Captured bats were identified to the lowest taxanomy possible and numbers were recorded.	A total of 18 trapping hours over 4 days (30 May to 2 June) were conducted.
	2. Acoustic Stations	Eight acoustic locations were deployed in strategic points in the Project area (see Figure 8.6). Two sampling location was covered each night. A sampling location consists of a high-sensitive recording systems (Song Meter Mini Bat produced by Wildlife Acoustic). Calls were analyzed to the lowest possible bat taxa. Bat's acoustic signals were recorded from sunset (17:30) to sunrise (6:00). Bat passes, defined as the occurrence of bats vocalization (either a single bat call or several bat calls) during a 01-second interval, were calculated per hour and used to compare bat activities between stations.	A total of 24 sampling hours were conducted each day using one pair of recording system (12 hours per system). From 30 May to 2 June, a total of 96 hours were sampled.
	3. Acoustic Transects	From 18:00 to 21:30 each day, the surveyor followed a transect and carried the Echo Meter Touch Pro, a device with sample Rate 256k or 384k samples per second at 16 bits (Wildlife Acoustic, USA) (see Figure 8.7). The recorder was time-synchronized with a smartphone to allow recording of georeferenced and time-stamped bat calls. Bat passes, defined as the occurrence of bats vocalization (either a single bat call or several bat calls) during a 01-second interval, were calculated and used to compare bat activities between transect.	From 30 May to 2 June, 4 bat transects were conducted. A total of 14 sampling hours and 17.6 km transect lengths were covered.

Target	Survey Technique	Description of methodology	Survey effort spent
Flora	1. Focal sampling points	At each sampling point, a circle plot of 10 m diameter was delineated to rapidly assess plant diversity (Figure 8.11). The habitats at each circle plot were mainly plantations (coffee, cashew, rubber), some sample plots covered some remnant of secondary growth forest (plot F3, F4 and F7). To assess the species richness, three indicators were used: ■ The number of observed taxa recorded during the survey; ■ Interpolation of the number of species in the function of the number of survey points by using rarefaction curve; ■ Extrapolation by estimator Chao for incidence data to give an estimation of the minimum species richness (including undetected species) for the study area. Chao, therefore, gives an insight of how many species are still out there in the study area that we did not detect/ record/ collect during the survey.	11 plots were sampled over the survey periods from 30 May to 2 June.
SURVEY TRIP 2: 15 to 18 July 2021			
Avifauna	1. Vantage Point Survey	Same methodologies as from the last survey.	From 15 to 18 July 2021, a total of 36 survey hours were conducted at each vantage point.
Chiropteran	1. Mist-nets and harp-traps	Same methodologies as from the last survey. Changes in locations of stations were made to cover the turbines that were not surveyed in the 1st survey (see Figure 8.8).	A total of 18 trapping hours over 4 days (15 to 18 July) were conducted
	2. Acoustic Stations	Same methodologies as from the last survey. Changes in locations of stations were made to cover the turbines that were not surveyed in the 1st survey (see Figure 8.9).	A total of 24 sampling hours were conducted each day using one pair of recording system (12 hours per system). From 15 to 18 July, a total of 96 hours were sampled.
	3. Acoustic Transects	Same methodologies as from the last survey. Changes in locations of transects were made to cover the turbines that were not surveyed in the 1st survey (see Figure 8.10)	From 15 to 18 July, four bat transects were covered. A total of 12 sampling hours and 17.6 km transect lengths were conducted.
SURVEY TRIP 3: 9 to 12 November 2021			

Target	Survey Technique	Description of methodology	Survey effort spent
Avifauna	1. Vantage Point Survey	Same methodologies as from the last surveys.	From 9 to 12 November 2021, a total of 36 survey hours were conducted at each vantage point.

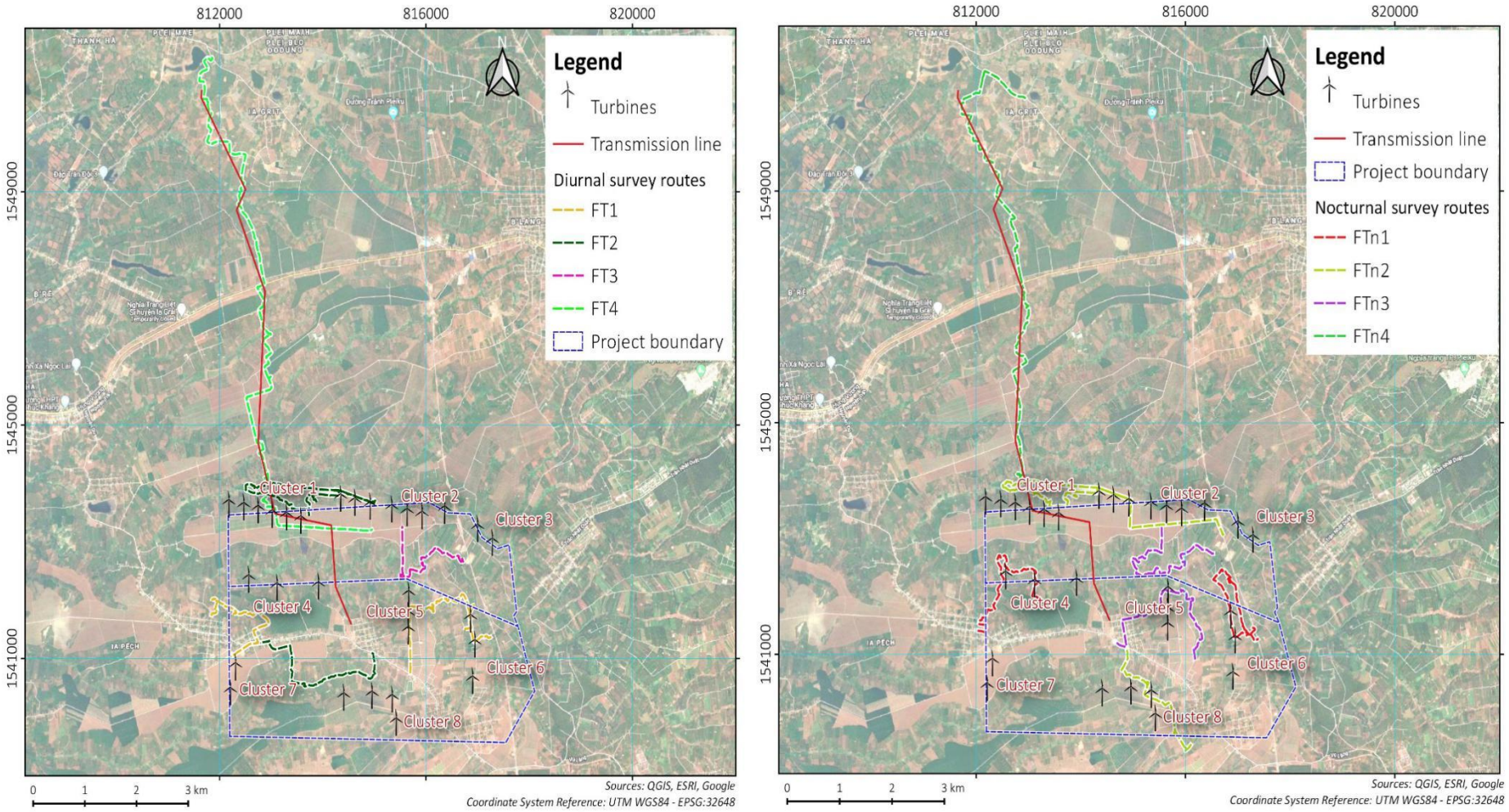


Figure 8.2 Transect Routes for Fauna during Day-time (left) and Night-time (right)

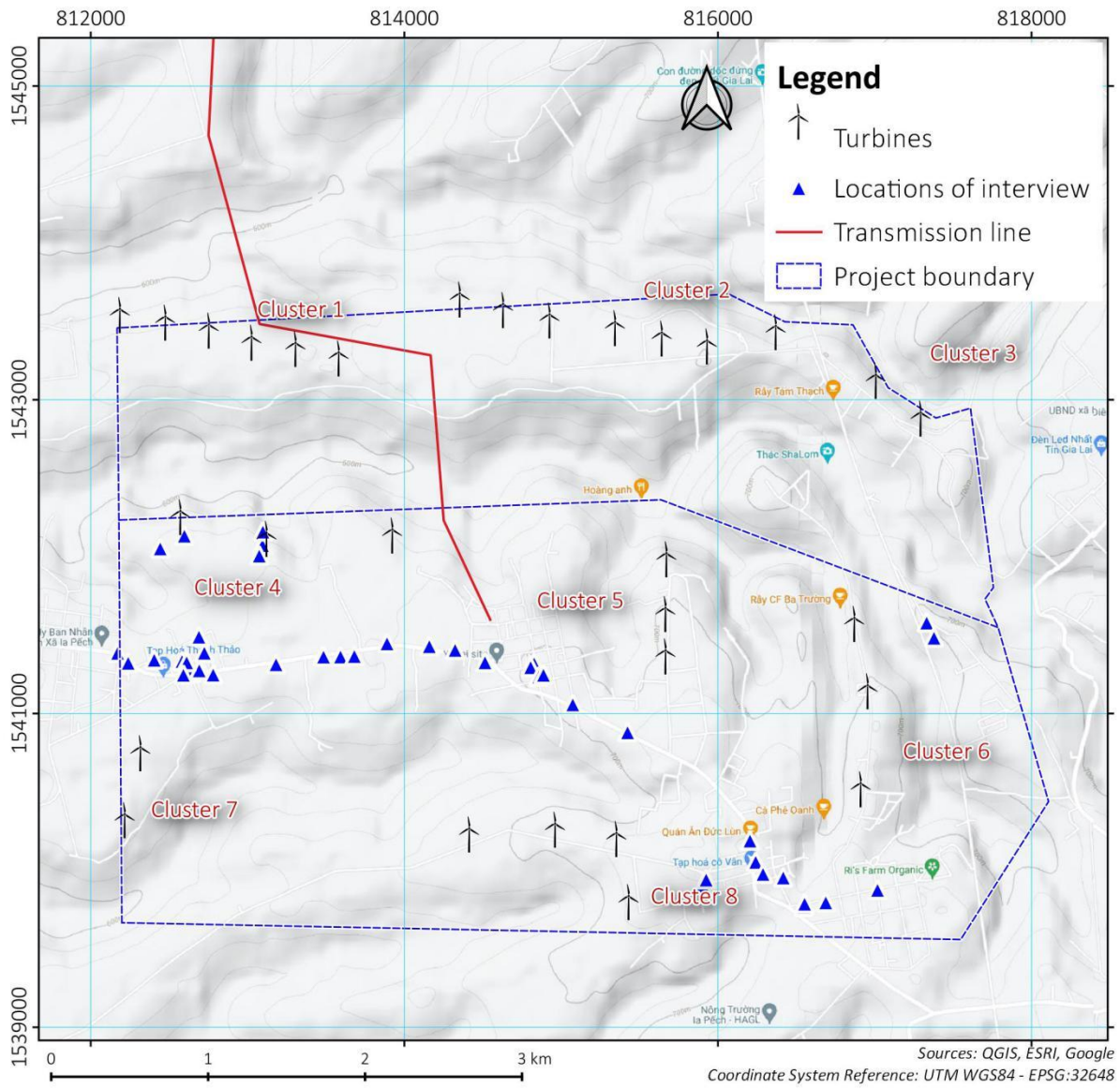


Figure 8.3 Locations of Interviews

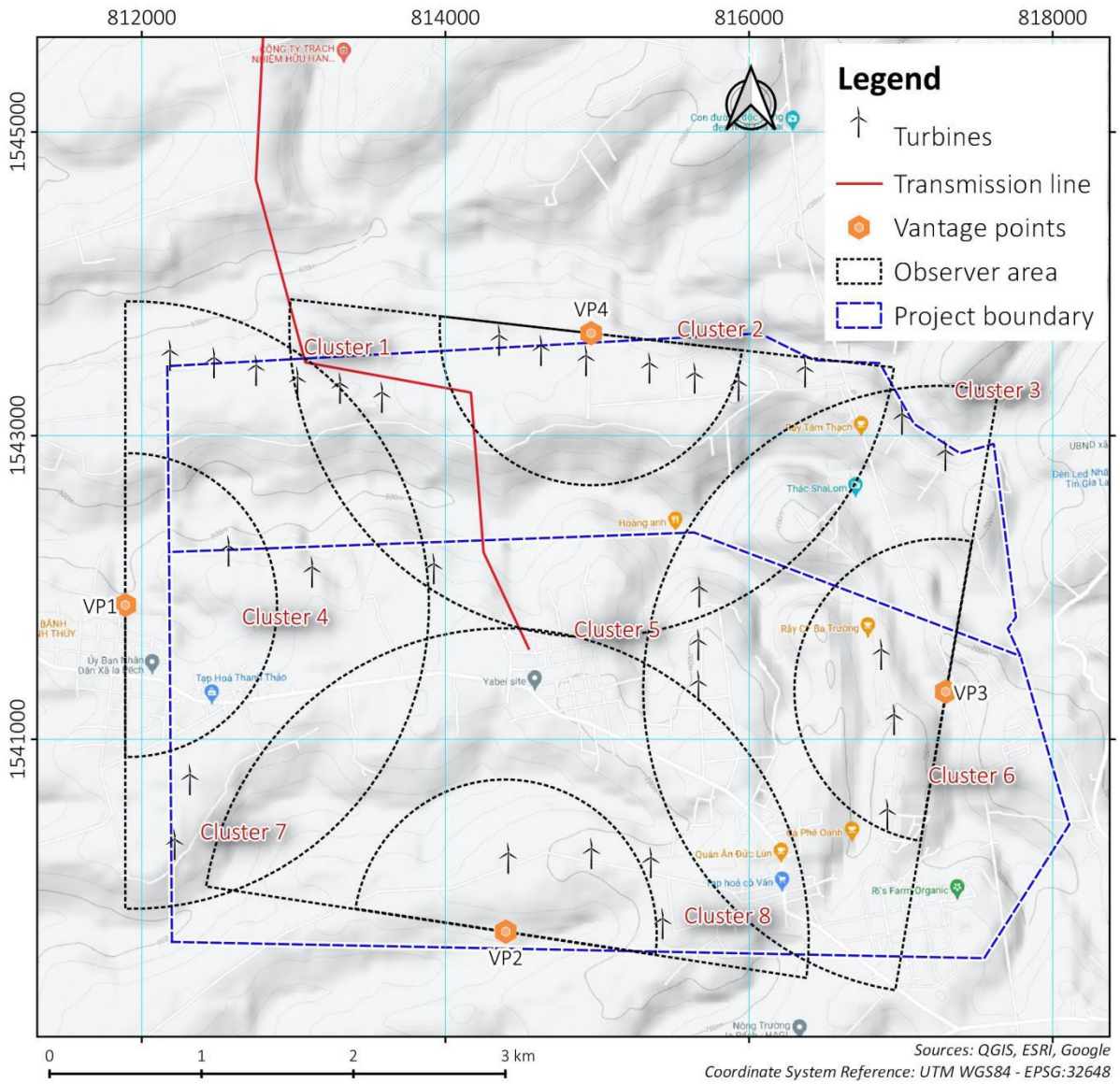


Figure 8.4 Location of Vantage Points for Birds

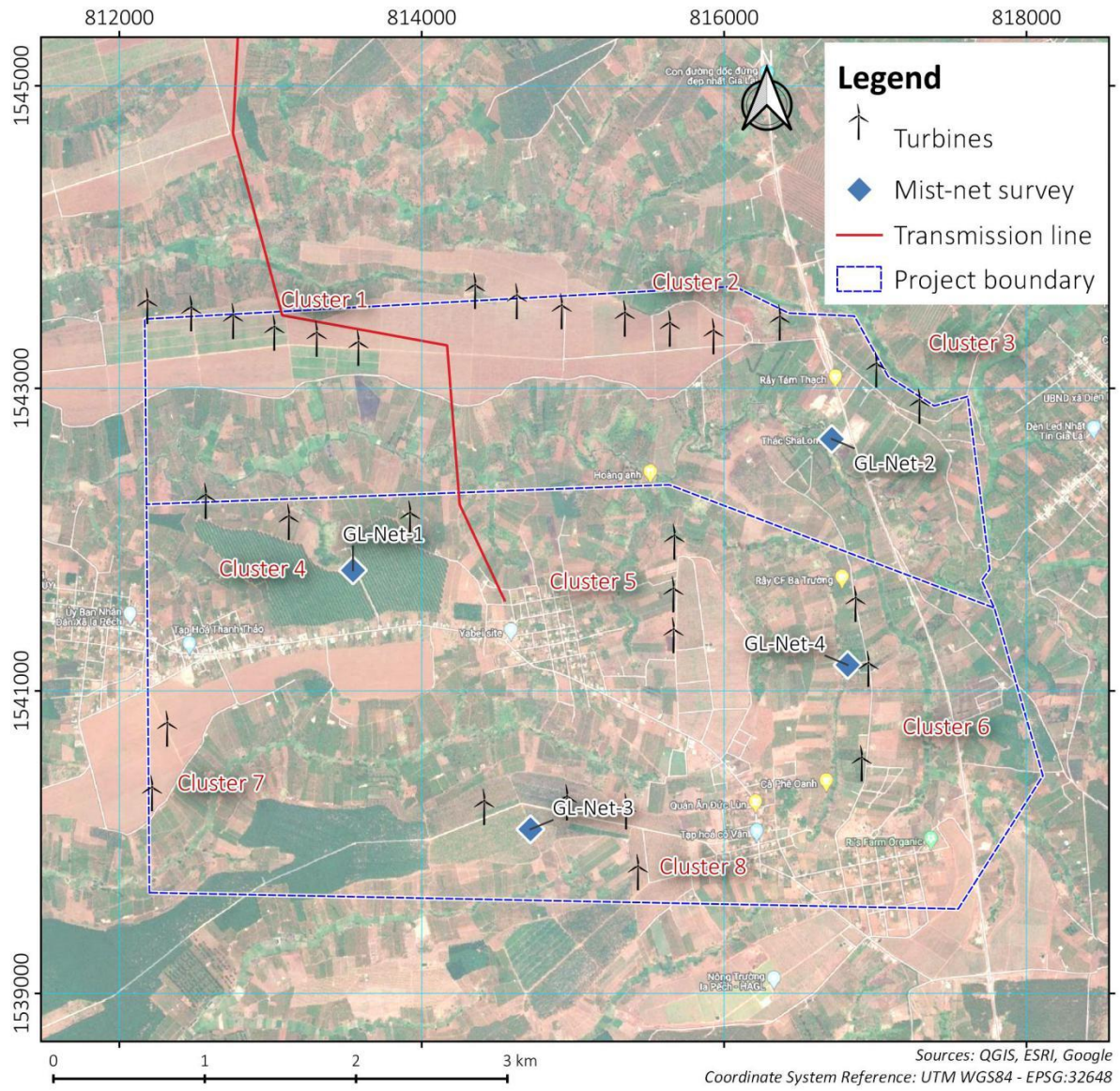


Figure 8.5 Location of Mist-nets Stations for Chiropteran Surveys (1st survey)

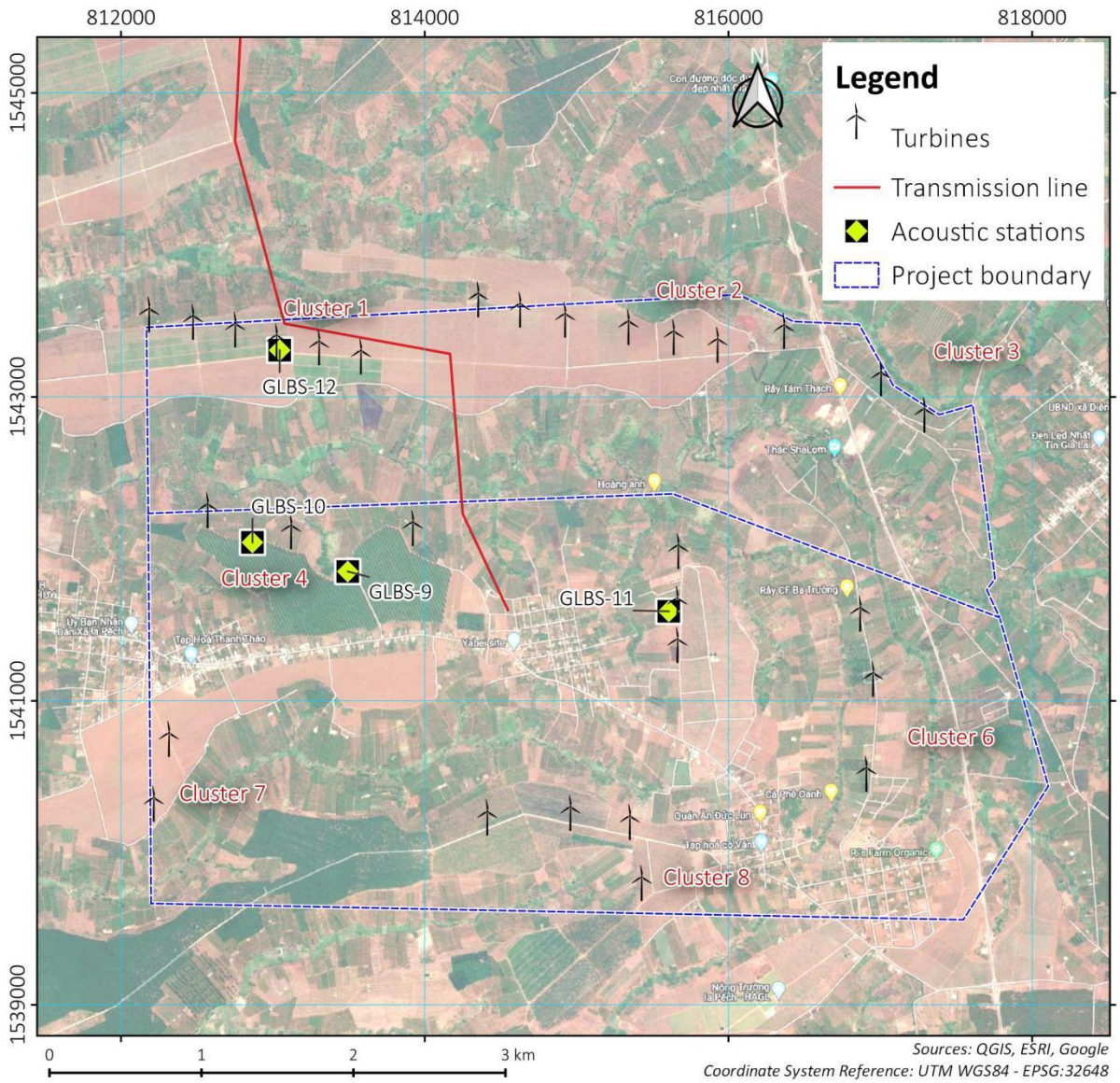


Figure 8.6 Locations of Acoustic Stations for Chiropteran Surveys (1st survey)

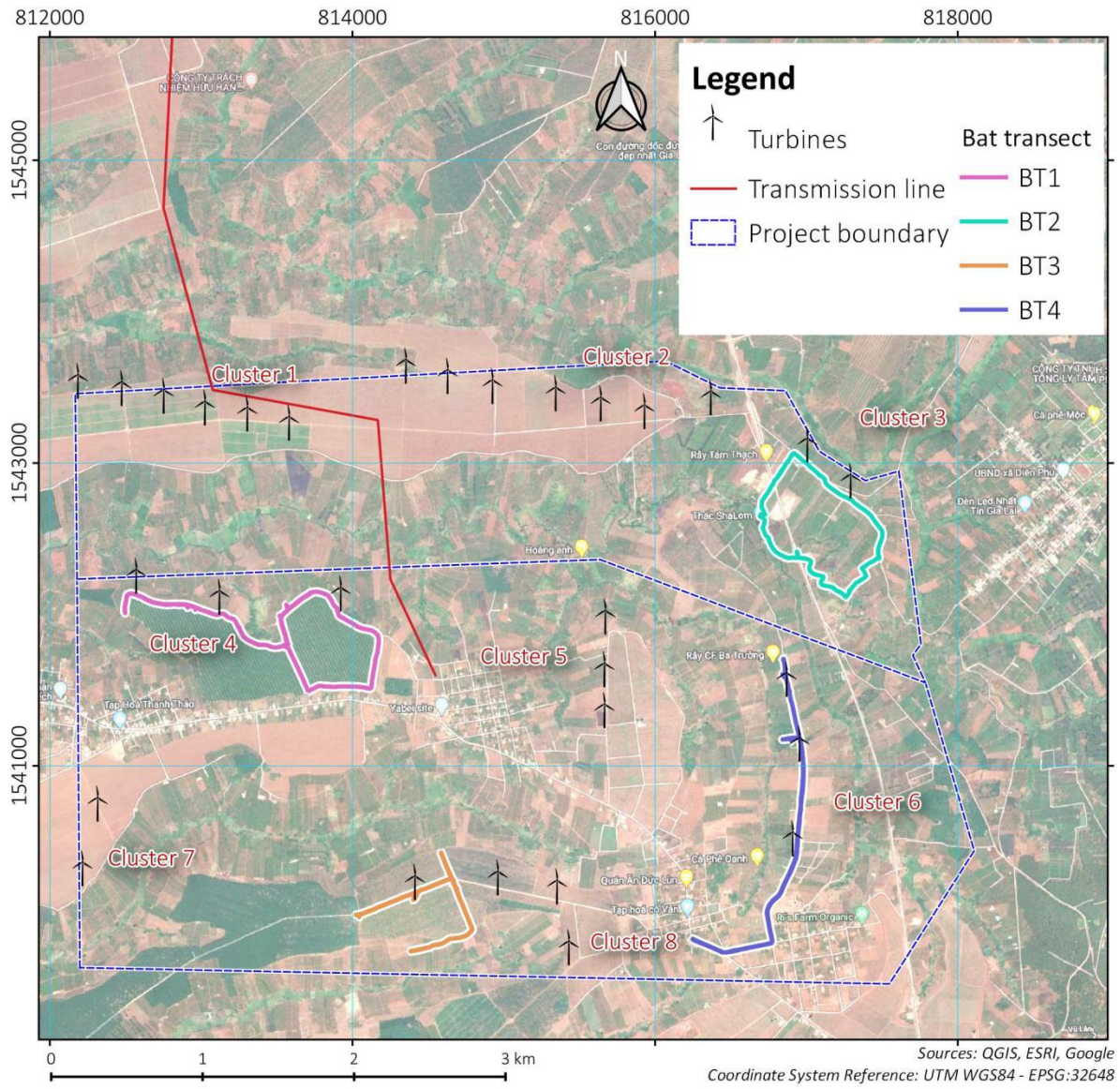


Figure 8.7 Locations of Acoustic Transects for Chiropteran Surveys (1st survey)

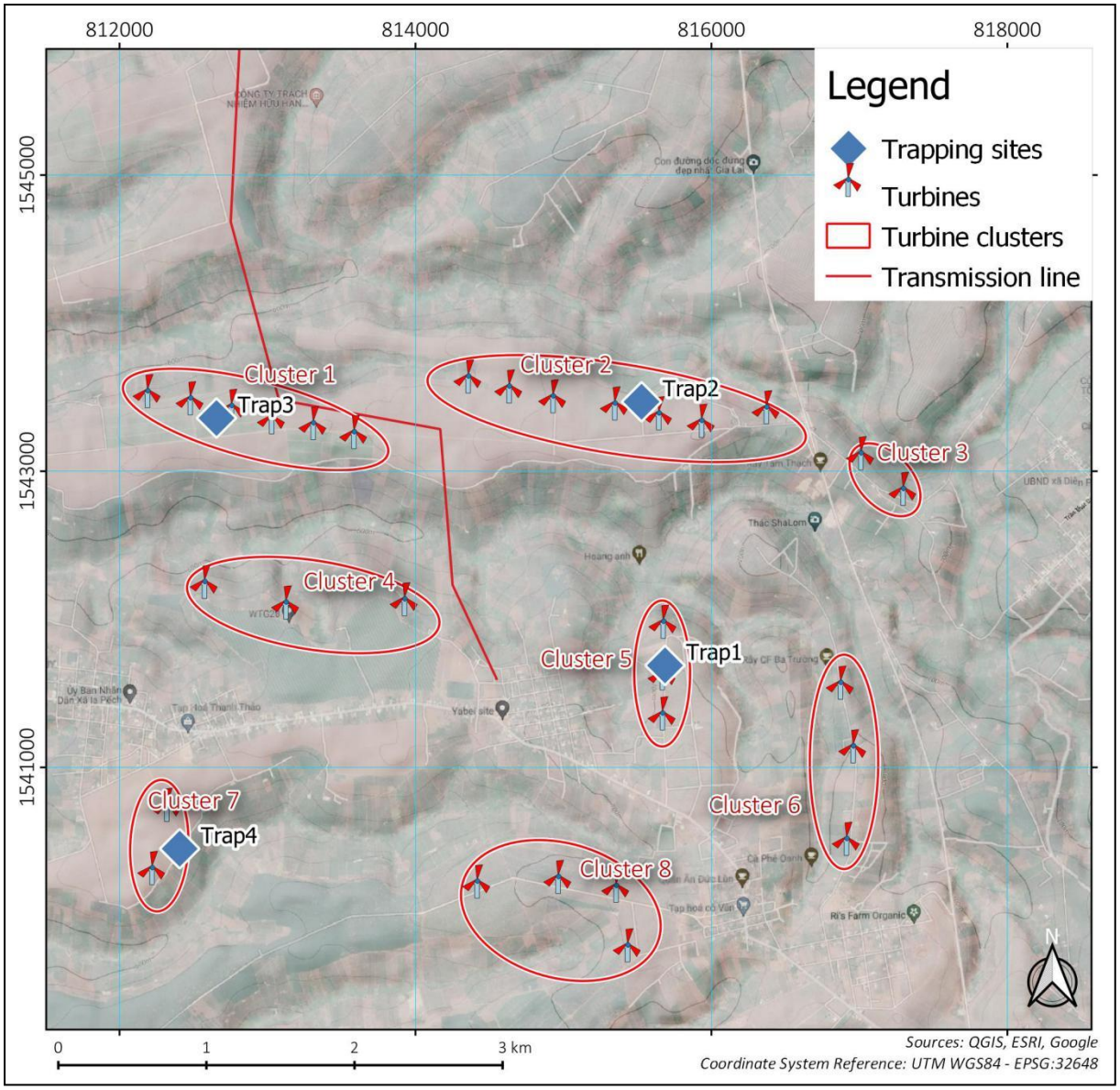


Figure 8.8 Location of Mist-nets Stations for Chiropteran Surveys (2nd survey)

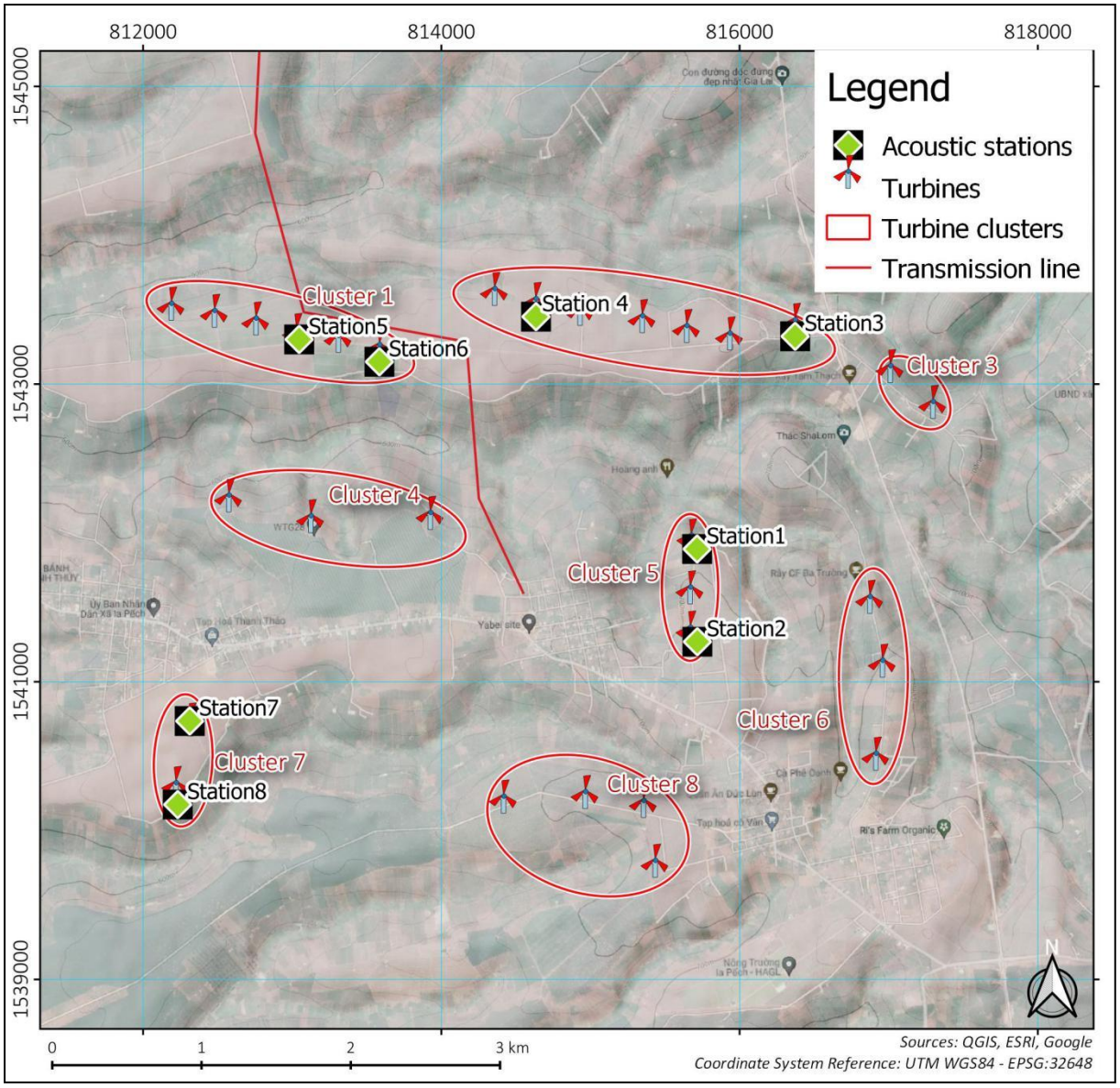


Figure 8.9 Locations of Acoustic Stations for Chiropteran Surveys (2nd survey)

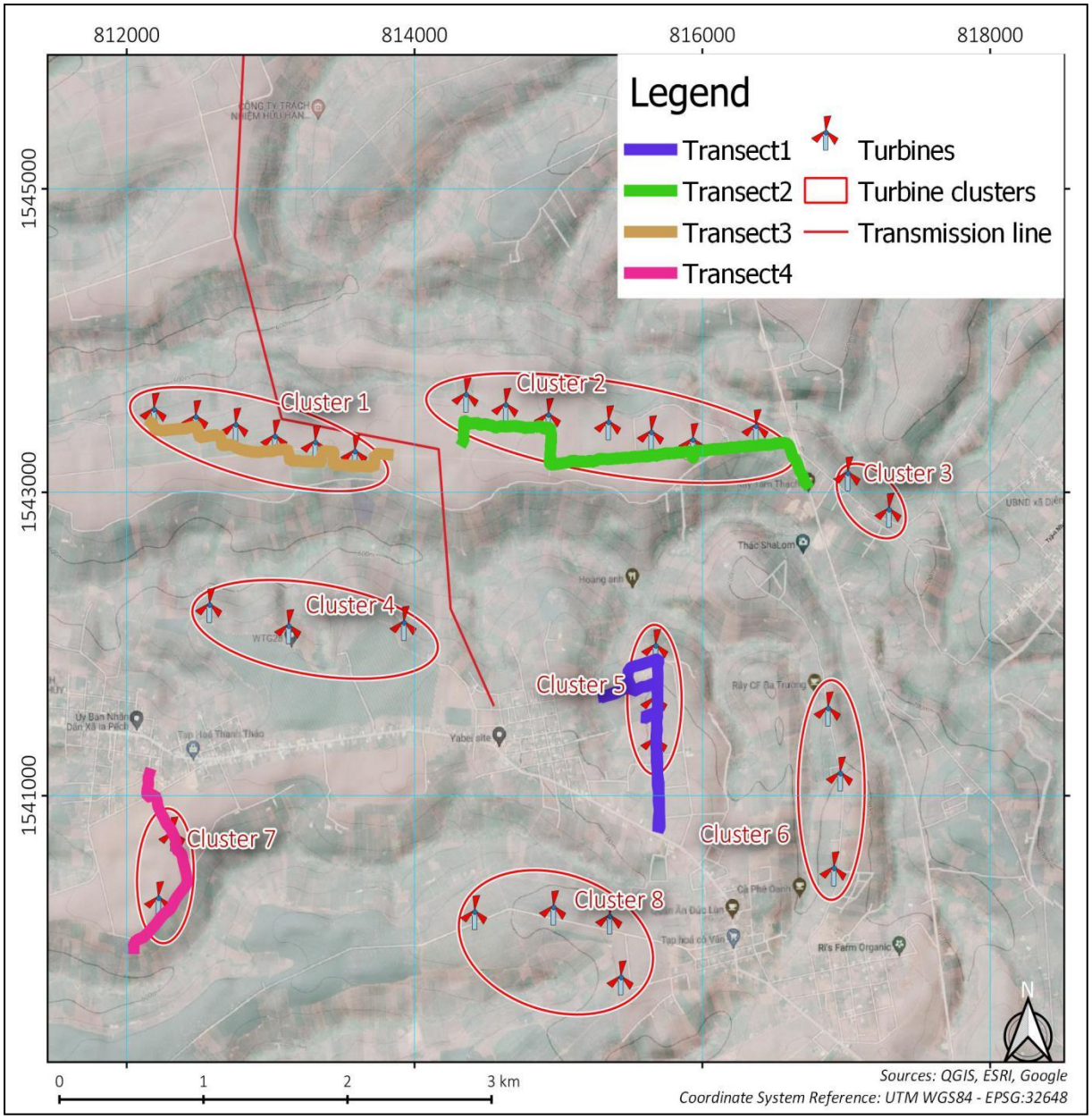


Figure 8.10 Locations of Acoustic Transects for Chiropteran Surveys (2nd survey)

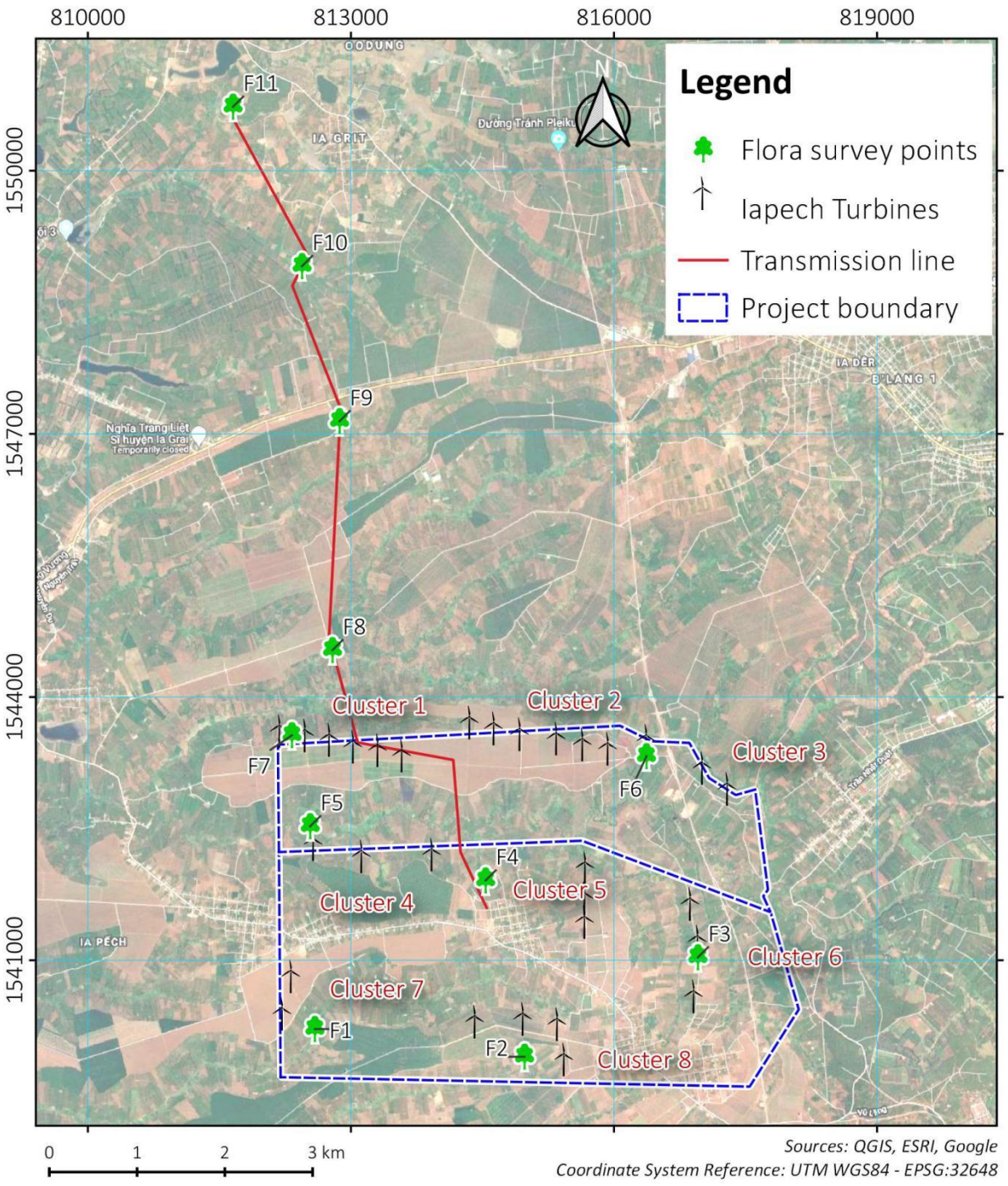


Figure 8.11 Flora Sampling Points

8.2.2.2 Survey Results and Analyses

8.2.2.2.1 Habitats

Land classification using remote sensing was conducted to identify habitat types within the Project area and within a 500m buffer from the transmission line, as shown in Table 8.8, Figure 8.12 and Figure 8.13. Project components are mainly associated with barren land and sparse vegetation. The habitats within the Project boundary in the vicinity of the transmission line are all modified. The water bodies are mainly reservoirs and small ponds that are surrounded by plantations and built-up infrastructure and mainly used for irrigation. Dense vegetation, which is often associated with secondary-growth forest, is patchy, limited to small areas and surrounded by plantations/ agricultural areas. Therefore, these features are also considered as modified habitats.

Table 8.8 Statistics of Habitats within Project Boundary and 500m Transmission Line Buffer

Land class		Definition	Size (ha)	Percentage
Modified	Surface Water	Water bodies including ponds and reservoirs.	3.65	0.12%
	Barren land	Areas that lack of vegetation cover	18.3	0.59%
	Built-up land	Refers to residential areas or infrastructures that have an artificial cover as a result of human activities	518.36	16.61%
	Sparse vegetation	Areas that have average NDVI[31] index of 0.25, usually assocaited with plantations/ agricultural area	1,366.77	43.79%
	Medium vegetation	Areas that have average NDVI index of 0.39, usually assocaited with plantations/ agricultural area	1,030.58	33.02%
	Dense vegetation	Areas that have average NDVI index of 0.82, usually associated with secondary-growth patch	183.63	5.88%
Total			**3,121.297**	

[31] Vegetation coverage is presented in the form of NDVI values ranging from -1 to 1. As rules of thumb, negative values correspond to areas with water surfaces, manmade structures, rocks, clouds, snow; while bare soil usually falls within 0.1- 0.2 range and plants will always have positive values between 0.2 and 1. Healthy, dense vegetation canopy should be above 0.5, and sparse vegetation will most likely fall within 0.2 to 0.5.

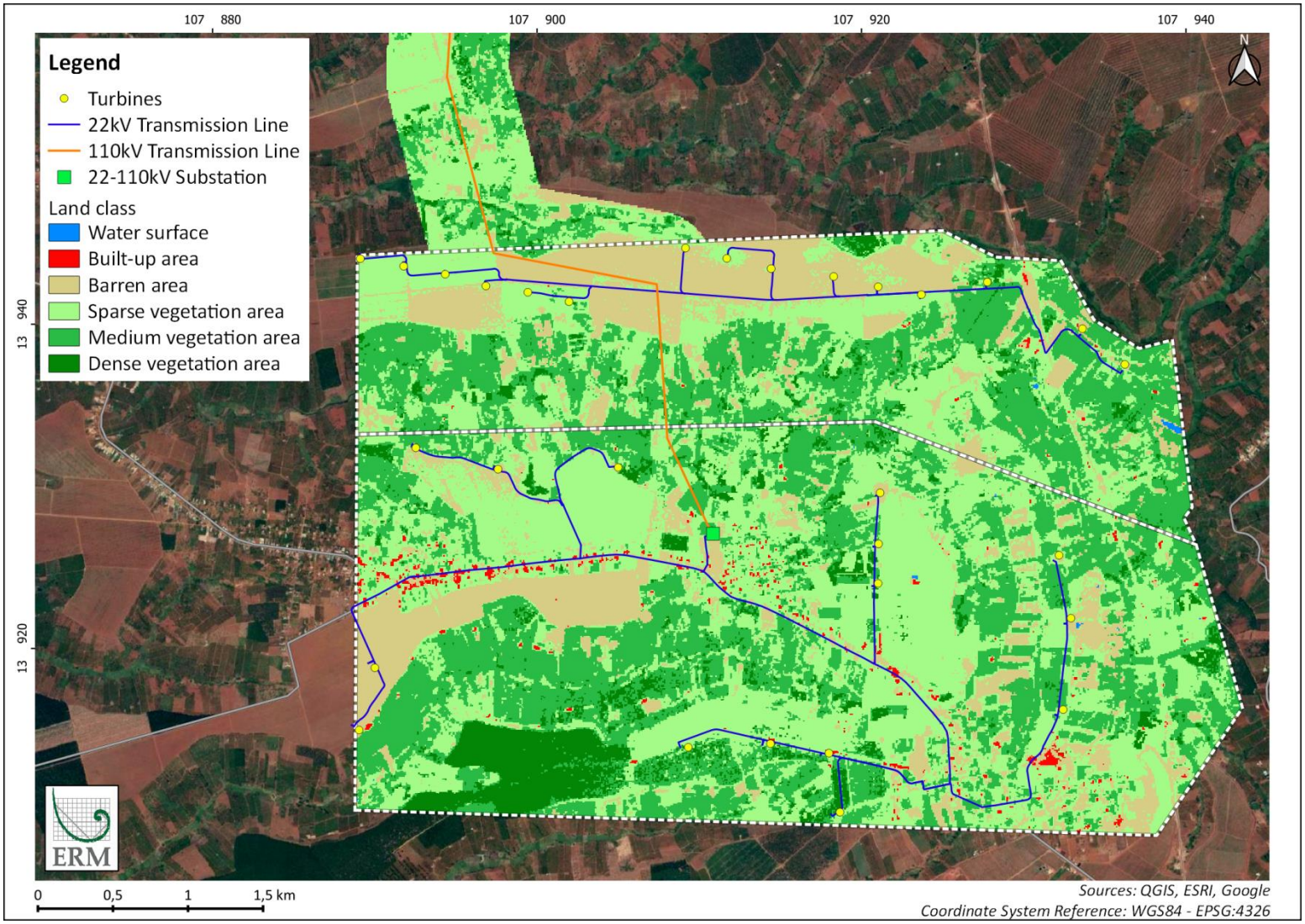


Figure 8.12 Land Classification within Project Boundary and 500m T-line Buffer

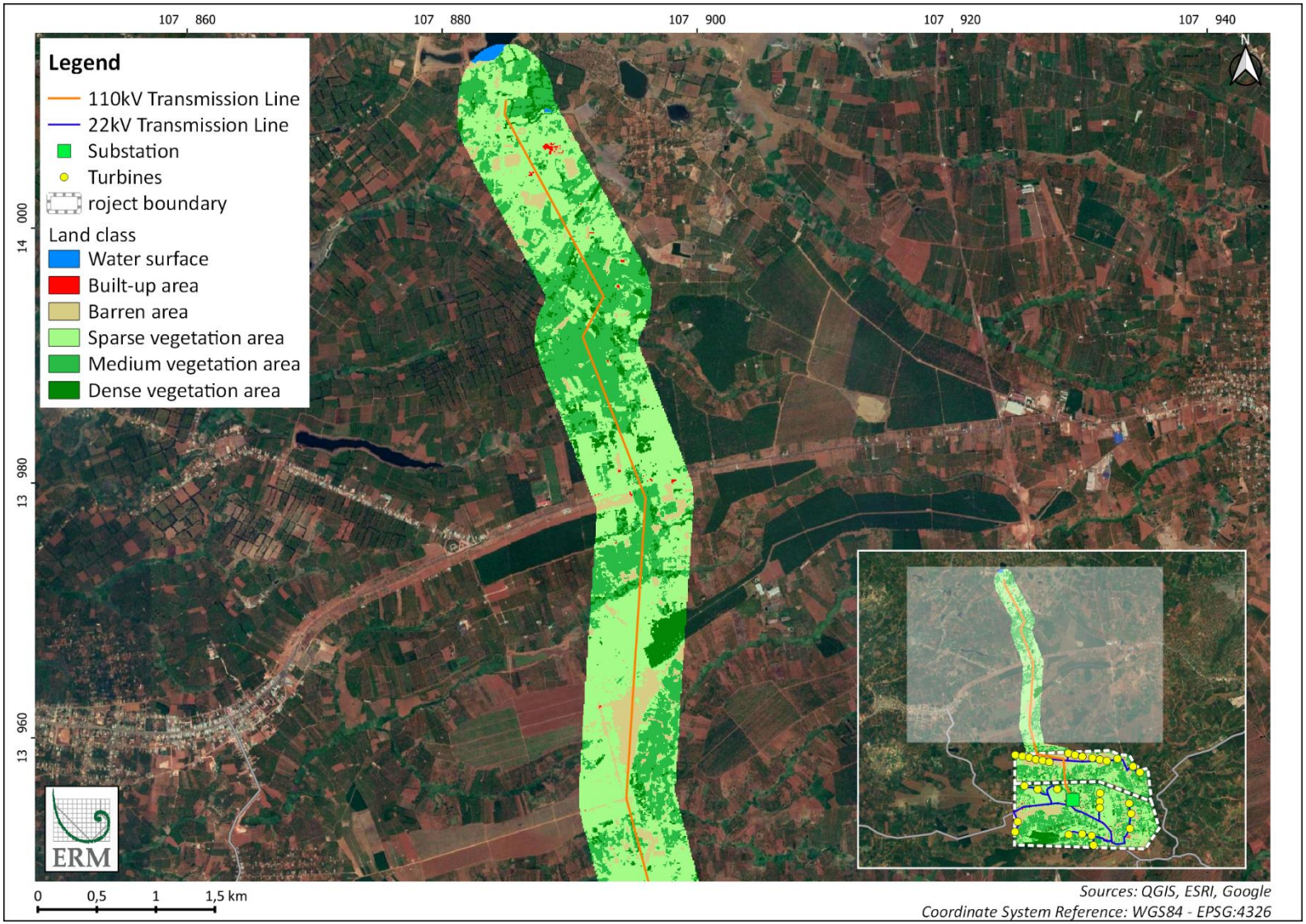


Figure 8.13 Land Classification within 500m T-line Buffer

8.2.2.2.2 Birds

After three surveys in June, July and November 2021, a total of 97 bird species have been recorded from vantage points and transects. Of which, most are common species (IUCN NE or LC; VRDB NE), except for the Red-breasted Parakeet *Psittacula alexandri* (IUCN NT; VRDN NE). No endemic or restricted-ranged species were recorded. Migratory species totalled 32 species. No endangered migratory bird species were recorded from the surveys, especially during the November trip which is in the migratory period (October – Feburary) of birds in Dak Lak province.

The Edible-nest Swiftlet *Aerodramus fuciphagus* (IUCN LC; VRDB NE) was the most abundant species within the Project area, with 1,766 contacts recorded from three surveys. This is high in comparison to other species as about 86% of the recorded species had abundances less than 50 contacts from three surveys (see details in Appendix H). The second-most abundant species is the Large-billed Crow *Corvus macrorhynchos* (IUCN LC; VRDB NE) with 625 records, followed by the Red-breasted Parakeet with 419 records. The bird composition, number of species and abundances were not significantly different between three surveys, and Edible-nest Swiftlet was the most common species in each survey.

Species that are more prone to collisions with the turbine blades include raptors and other soaring birds, species that fly in flocks and those recorded flying in the rotor swept zone (RSZ, which is band 2 flight height) during vantage point surveys. Species that are more prone to transmission line electrocution include raptors and species that have large wing spans. Species recorded from the vantage point and transect surveys that fall into the categories listed above are listed in Table 8.9 (highlighted in yellow).

Further details of vantage point surveys can be seen in Appendix E, Appendix F, and Appendix G, while details of transect surveys can be seen in Appendix E.

Table 8.9 List of Birds that are Vulnerable to Collision and Electrocution recorded from Vantage Point and Transect Surveys

No.	Scientific Name	Common Name	IUCN	VRDB	Flying in band 2	Raptor	Large wing span (>50 cm)	Flying in flocks (>10 individuals)	Total abundance	Time flying in band 2 (s)
1	*Accipiter virgatus*	Besra	LC	NE	Yes	Yes	Yes	No	2	105
2	*Accipiter trivirgatus*	Crested Goshawk	LC	NE	Yes	Yes	Yes	No	4	135
3	*Accipiter nisus*	Eurasian Sparrowhawk	LC	NE	Yes	Yes	Yes	No	2	120
4	*Elanus caeruleus*	Black-winged Kite	LC	NE	Yes	Yes	Yes	No	6	30
5	*Falco tinnunculus*	Common Kestrel	LC	NE	Yes	Yes	Yes	No	1	150
6	*Acridotheres leucocephalus*	Vinous-breasted Myna	LC	NE	Yes	No	No	No	40	45
7	*Acridotheres tristis*	Common Myna	LC	NE	Yes	No	No	No	6	45
8	*Aerodramus fuciphagus*	Edible-nest Swiftlet	LC	NE	Yes	No	No	Yes	1,130	5,565
9	*Artamus fuscus*	Ashy Woodswallow	LC	NE	Yes	No	No	No	83	405
10	*Corvus macrorhynchos*	Large-billed Crow	LC	NE	Yes	No	Yes	No	436	930
11	*Cypsiurus balasiensis*	Asian Palm-swift	LC	NE	Yes	No	No	No	11	255
12	*Delichon dasypus*	Asian House Martin	LC	NE	Yes	No	No	No	8	105
13	*Elanus caeruleus*	Black-winged Kite	LC	NE	Yes	Yes	No	No	5	30
14	*Gracupica nigricollis*	Black-collared Starling	LC	NE	Yes	No	No	No	45	255
15	*Hirundo rustica*	Barn Swallow	LC	NE	Yes	No	No	No	33	180
16	*Lanius collurioides*	Burmese Shrike	LC	NE	Yes	No	No	No	200	15

No.	Scientific Name	Common Name	IUCN	VRDB	Flying in band 2	Raptor	Large wing span (>50 cm)	Flying in flocks (>10 individuals)	Total abundance	Time flying in band 2 (s)
17	*Merops orientalis*	Asian Green Bee-eater	LC	NE	Yes	No	No	No	260	135
18	*Psittacula alexandri*	Red-breasted Parakeet	NT	NE	Yes	No	No	Yes	419	30
19	*Vanellus indicus*	Red-wattled Lapwing	LC	NE	Yes	No	No	No	2	75
20	*Lonchura punctulata*	Scaly-breasted Munia	LC	NE	No	No	No	Yes	100	N/A
21	*Merops leschenaulti*	Chestnut-headed Bee-eater	LC	NE	No	No	No	Yes	8	N/A
22	*Passer domesticus*	House Sparrow	LC	NE	No	No	No	Yes	1	N/A
23	*Sturnia malabarica*	Chestnut-tailed Starling	LC	NE	No	No	No	Yes	3	N/A
24	*Passer flaveolus*	Plain-backed Sparrow	LC	NE	No	No	No	Yes	48	N/A
25	*Gracupica nigricollis*	Black-collared Starling	LC	NE	Yes	No	No	Yes	62	225
26	*Ardeola bacchus*	Chinese Pond-heron	LC	NE	Yes	No	No	Yes	30	225
27	*Bubulcus ibis*	Cattle Egret	LC	NE	Yes	No	No	Yes	27	150
28	*Passer domesticus*	House Sparrow	LC	NE	No	No	No	Yes	1	N/A

8.2.2.2.3 Bats

Based on the chiropteran surveys conducted for the Project, a total of seven distinct bat species were found. None of which were threatened or restricted-ranged species. General bat activity recorded from the two surveys was low. Two of the bat species, namely the Nepalese Whiskered Bat *Myotis muricola* (IUCN LC; VRDB NE) and Javan Pipistrelle *Pipistrellus javanicus* (IUCN LC; VRDB NE), are insectivorous species that forage in open space above vegetation canopy, and which can fly into the RSZ.

Table 8.10 List of Bat Species from Two Surveys

S/N	Species	English name	IUCN	VRDB	Recording method	Survey	Remarks
1	*Pipistrellus javanicus*	Javan Pipistrelle	LC	NE	Acoustic station, acoustic transect	1st and 2nd	These are open-space bats that can fly quite high from the ground level. They can potentially enter the rotor height.
2	*Myotis muricola*	Nepalese Whiskered Bat	LC	NE	Acoustic station, acoustic transect	1st and 2nd	
3	*Rhinolophus sinicus*	Chinese Horseshoe Bat	LC	NE	Acoustic station, acoustic transect	1st and 2nd	These are forest-edge bats that are most likely to forage under a canopy or along trails. This species is unlikely to fly high to enter the rotor sweeping zone.
4	*Rhinolophus* cf. *pusillus*	Least Horseshoe Bat	LC	NE	Trapping, acoustic station, acoustic transect	2nd	
5	*Rhinolophus* cf. *shameli*	Shamel's Horseshoe Bat	LC	NE	Trapping, acoustic station, acoustic transect	2nd	
6	*Megaderma spasma*	Lesser False Vampire Bat	LC	NE	Acoustic station, acoustic transect	1st	
7	*Hypsugo cadornae*	Cadorna's Pipistrelle	LC	NE	Trapping, acoustic station, acoustic transect	1st and 2nd	Limited information about the species in Furey (2009) and Kruskop (2013) suggested this species can be a forest-edge forager.

8.2.2.2.4 Other Terrestrial Fauna

8.2.2.2.4.1 Non-volant Mammals

A total of three rodent species were recorded during the field survey (Table 8.11). All of which are common species.

Table 8.11 List of Recorded Non-volant Mammal Species

No.	Taxa	English name	IUCN 2021	VNRB 2007	Number of records
1	*Mus caroli*	Ryukyu Mouse	LC	NE	5
2	*Callosciurus erythraeus*	Pallas's Squirrel	LC	NE	2
3	*Tamiops rodolphi*	Cambodian Striped Squirrel	LC	NE	2

8.2.2.2.4.2 Herpetofauna

The surveys have recorded 23 species of herpetofauna, including 9 amphibian and 14 reptile species. All of the recorded species are IUCN LC and VRDB NE, except for the following:

- The Chinese water dragon *Physignathus cocincinus* listed as VU by both IUCN Red List and Vietnam Red Data Book. Three individuals of this species were recorded;
- The Tokay gecko *Gekko gecko* (IUCN LC; VRDB VU). Twelve individuals of this species were found.

None of the recorded species is endemic/restricted-ranged species.

8.2.2.2.4.3 Interview Results

Most of the interviewees (71.4%) have lived in the Project area for more than 20 years, while the rest were settlers in the area between 5 to less than 20 years. Most responders (70%) were middle-aged people (older than 40). Local people mainly collect non-timber products included honey, wild vegetable, bamboo shoots, mushrooms, wild orchids, and traditional medicine for food. Some sell the collected non-timber products to small local stores and markets for incomes. The results of interviews are presented in Table 8.12.

Table 8.12 Interview Results

Taxon	Results
Primates	■ Two individuals of Northern pig-tailed Macaque *Macaca leonina* (IUCN VU; VRDB VU) were kept as pets at one's house (see Figure 8.14). The owner said he captured them at his coffee plantations a year ago. ■ One person said he used to keep a Stump-tailed Macaque *Macaca arctoides* (IUCN VU; VRDB VU), but the animal died 2 years ago. The detailed descriptions and photographs provided by this responder matched the Stump-tailed Macaque. His most-recent encounter with primates was 3 years ago. ■ There were 13 respondents who claimed to see a Loris in the Project area. However, they could not confirm the sighting to be either the Pygmy Slow Loris *Nycticebus pygmaeus* (IUCN EN; VRDB EN) or Bengal Slow Loris *Nycticebus bengalensis* (IUCN EN; VRDB VU). Six out of 13 respondents could not recall the time and location they sighted the Loris, four responders said the encounters were 10 years ago and three respondents recalled the last encounters were about 3 years at their coffee plantations. ■ No interviewees have seen Grey-shanked Douc Langur *Pygathrix cinerea* (IUCN CR, VRDB CR), Red-shanked Douc Langur *Pygathrix nemaeus* (IUCN CR, VRDB EN) or Black-shanked Douc Langur *Pygathrix nigripes* (IUCN CR, VRDB EN).
Otter	■ Three responders said they saw Asian small-clawed Otter *Aonyx cinereus* (IUCN VU; VRDB VU) and Smooth-coated Otter *Lutrogale perspicillata* (IUCN VU; VRDB EN) eating fish/crabs

Taxon	Results
	and even otters' faeces on rocks on the banks of Duc stream. No associated evidence (e.g. photographs) of otter encountering could be collected. ■ Surveyors were unable to locate the Duc stream and were therefore unable to confirm the presence of otter. None were found during transect surveys.
Mustelid	■ Occurrence of Greater Hog Badger *Arctonyx collaris* (IUCN VU; VRDB NE) were recorded from 5 interviewees. Those respondents could recognize this species due to its special snout resembling a pig snout, and the food it eats such as insects, earthworms and fruits. One respondent revealed the most recent sighting of this species was in April 2021.
Deer	■ Three respondents said they had encountered Large-antlered Muntjac (IUCN CR; VRDB VU) more than 10 years ago. No further information from the encounters could be collected.
Pangolin	■ 11 responders claimed that they saw the Sunda Pangolin (IUCN CR; VRDB EN) in the study area more than 10 years ago. One responders revealed that one individual was caught/confiscated by the local army a year ago, while another one was hunted by local people from a forest. The interviewees could not give the exact location of the forest or where and when they saw the Sunda Pangolin.
Large mammals	■ All responders claimed they had never seen gaurs, elephants, leopards, bears or tigers in their life time.

Figure 8.14 A Northern Pig-tailed Macaque Kept at a Local House

8.2.2.2.5 Flora

The flora survey recorded 103 plant taxa at 11 sampling points. For an area that has been heavily modified by human activities, this was a quite diverse floral community. Chao estimator suggested that more flora species can be found if survey efforts is increased (e.g. from 11 sampling points to 13 sampling points or more). The potential plant species richness in the study area can reach up to 139. Most of the species are common species (IUCN and/or VRDB LC and/or NE), except for the *Dipterocarpus obtusifolius* (IUCN NT; VRDB NE). None of the recorded species are endemic or restricted-ranged species. The list of identified plant species is presented in Appendix H.

The presence of 13 invasive species were also recorded, although not very abundant (only a few individuals of each species were sighted). The list of recorded invasive species species is presented in Table 8.13.

Table 8.13 List of Invasive Plants Recorded in the Field Survey

No.	Scientific name	Common name
1	*Ageratum conyzoides*	Billygoat-Weed
2	*Chromolaena odorata*	Siam Weed
3	*Dioscorea bulbifera*	Air Potato
4	*Imperata cylindrica*	Cocongrass
5	*Lantana camara*	Shrub Verbenas (Lantanas)
6	*Leucaena leucocephala*	River Tamarind
7	*Litsea glutinosa*	Soft bollygum
8	*Megathyrsus maximus*	Guinea Grass
9	*Mimosa diplotricha*	Giant False Sensitive Plant
10	*Mimosa pigra*	Black Mimosa
11	*Mimosa pudica*	Sensitive Plant
12	*Panicum repens*	Torpedograss
13	*Tithonia diversifolia*	Tree marigold

8.2.3 Critical Habitat Assessment

8.2.3.1 EAAA Land Classification

Land classifications are presented in Table 8.14 and as well as Figure 8.15. EAAA habitats were found to all be modified. The water bodies in the EAAA are mainly reservoirs and small ponds that are surrounded by plantations and built-up infrastructure and mainly used for water supply. Dense vegetation, which are often associated with secondary-growth forest, are patchy, small in areas and surrounded by plantations/ agricultural areas. Therefore, these features are also considered as modified habitats.

Table 8.14 Land Classification within EAAA

Land class		Definition	Size (ha)	Percentage
Modified	Surface Water	Water bodies including ponds and reservoirs.	272.65	0.56%
	Barren land	Areas that are lack of vegetation cover	5,426.95	11.21%
	Built-up land	Refers to residential areas or infrastructures that have an artificial cover as a result of human activities	1,869.17	3.86%

Land class		Definition	Size (ha)	Percentage
	Sparse vegetation	Areas that have average NDVI[32] index of 0.25, usually assocaited with plantations/ agricultural area	18,080.62	37.35%
	Medium vegetation	Areas that have average NDVI index of 0.39, usually assocaited with plantations/ agricultural area	19,490.3	40.26%
	Dense vegetation	Areas that have average NDVI index of 0.82, usually associated with secondary-growth patch	3,269.98	6.75%
Total			**48,409.67**	

[32] Vegetation coverage is presented in the form of NDVI values ranging from -1 to 1. As rules of thumb, negative values correspond to areas with water surfaces, manmade structures, rocks, clouds, snow; while bare soil usually falls within 0.1- 0.2 range and plants will always have positive values between 0.2 and 1. Healthy, dense vegetation canopy should be above 0.5, and sparse vegetation will most likely fall within 0.2 to 0.5.

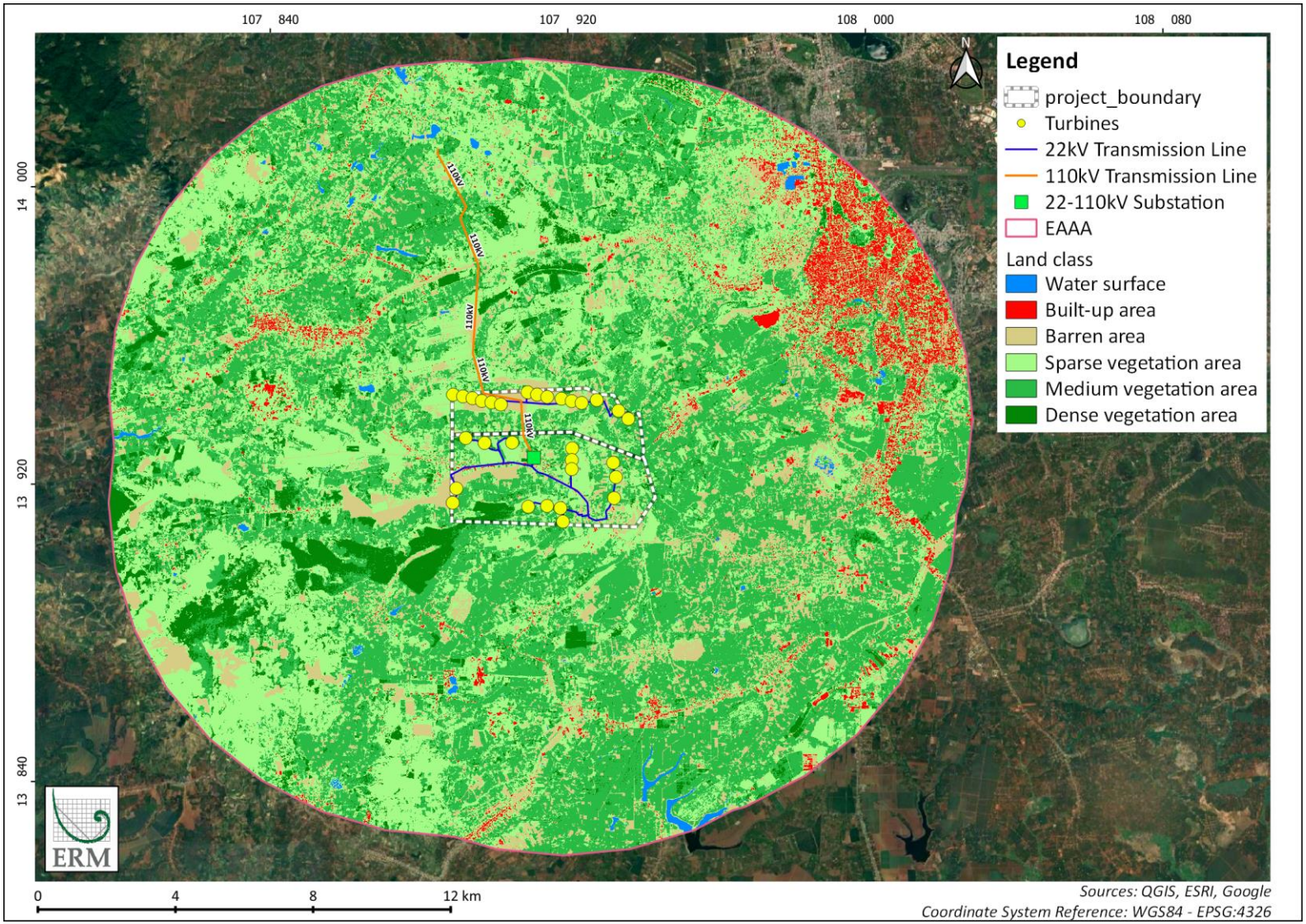


Figure 8.15 Land Classification within the Project EAAA

8.2.3.2 Candidate Species Identified from Desktop Review

8.2.3.2.1 Candidate Species Identified from IBAT

A list of species occurring within 50 km radius from the Project was generated using IBAT. A preliminary screening of this list was conducted to get an understanding of which species are candidates for the assessment of critical habitat criteria 1, 2 and 3 (see Table 8.1). In other words, the screening eliminates any species that are not threatened (CR, EN or VU), restricted-range or migratory/congregatory species. Only candidate species are carried to the critical habitat assessment. The results from the screening of candidate species identified from IBAT is presented in Table 8.15.

Table 8.15 Summary of Numbers of Candidate Species from IBAT

Criteria	Total number of candidates	Remark
Criterion 1: Critically Endangered (CR)/ Endangered (EN)/ Vulnerable (VU) species	85	40 are mammalian species, 20 are herpetofauna species, 22 are avian species and 3 flora species.
Criterion 2: Habitat of significant importance to endemic and/or restricted-range species	9	All is herpetofauna species.
Criterion 3: Habitat supporting globally significant concentrations of migratory species and/or congregatory species	216	All belongs to the Aves (birds) class, 11 of which are endangered migratory species.

8.2.3.2.2 Candidate Species Identified from Significant Areas of Conservation

A list of species that were recorded in Protected Areas (Chu Mom Ray, Chu Prong and Kon Ka Kinh) and Key Biodiversity Areas (Kon Ka Kinh and Chu Prong) within the 50km radius of the Project is presented in Appendix C. Most of the candidate species in this list have already been predicted and screened from IBAT, except for the Collared Laughingthrush *Trochalopteron yersini* (IUCN EN; VRDB EN), Chestnut-eared Laughingthrush *Garrulax konkakinhensis* (IUCN VU; VRDB NE) and Fairy Pitta *Pitta nympha* (IUCN VU; VRDB VU). These species will be added as candidates for criterion 1 habitat assessment.

8.2.3.2.3 Candidate Species Identified from eBird

A list of birds that have been recorded in Gia Lai Province was generated from eBird[33] and also screened for candidate species. Only one candidate species recorded in eBird was not previously identified in IBAT and significant areas of conservation, namely the Javan Leafbird *Chloropsis cochinchinensis* (IUCN EN; VRDB NE). However, the Javan Leafbird mainly occurs in the Java islands in Indonesia according to IUCN, so it is unlikely to occur in Gia Lai Province.

8.2.3.2.4 Potentially Occurring Candidate Species Identified from Desktop Review

After compiling and comparing data from reference sources (IBAT, online sources and literature review), a list of threatened, restricted-ranged and migratory species that occur or potentially occur in the EAAA was developed (see Table 8.16). Based on IUCN and VRDB, species ecology (e.g. habitat preferences, tolerance to modification) and presence status in Vietnam (e.g. extinct or not) were taken into account to determine the potential for occurrence in the EAAA.

[33] https://ebird.org/region/VN-30?yr=all

Table 8.16 List of Species Potentially Occurring in the EAAA Identified from Desktop Review

No.	Scientific Name	Common Name	IUCN	VRDB	Threatened	Endemic	Migratory	IBAT	eBird/ GBIF	Literature review	Justification
Aves											
1	*Emberiza aureola*	Yellow-breasted Bunting	CR	NE	Yes	No	Yes	X	X	X	This species was recorded at Chu Mom Ray National Park (Le Manh Hung pers. comm.); however when it was recorded is unknown. This species has also been recorded in Gia Lai Province (based on eBird), although the most recent record was in 1969 at Plei Ku city (about 8 km away from the Project area). According to IUCN, the species is migratory, wintering from central and eastern Nepal, Bangladesh, north-east India east to South and Souteast Asia. Therefore, the time it may be present in Vietnam is from November to February (winter season in Nepal, Bangladesh and north-east India). The species prefers rice paddies to forage during wintering; however, it can be found in cultivated areas and grasslands as well (according to IUCN). The habitats at the Project area include mainly plantations habitat which is a suitable foraging ground for this species. Therefore, it may occur in the Project area.
2	*Carpococcyx renauldi*	Coral-billed Ground-cuckoo	VU	NE	Yes	No	No	X			According to IUCN, these species (Coral-billed ground-cuckoo and Pale-capped Pigeon) can occupy modified habitats such as secondary-growth forest and plantations. The species have the potential to occur in the Project area.
3	*Columba punicea*	Pale-capped Pigeon	VU	EN	Yes	No	No	X			
4	*Leptoptilos javanicus*	Lesser Adjutant	VU	VU	Yes	No	Yes	X	X	X	This species was recorded at Chu Prong Nature Reserve (Tran et al. 2001). According to VRDB,

No.	Scientific Name	Common Name	IUCN	VRDB	Threatened	Endemic	Migratory	IBAT	eBird/ GBIF	Literature review	Justification
											the species' presence in Vietnam is associated with wetlands in forest. However, according to IUCN, this species can also inhabit modified wetlands. The Project area contains some reservoirs and lakes, which could support the species.
5	Sterna aurantia	River Tern	VU	NE	Yes	No	Yes	X			According to IUCN, this species occurs in Vietnam during non-breeding season (early June to late January). It inhabits rivers and freshwater lakes, also occurring rarely on estuaries. The water bodies (lakes and reservoirs) in the Project area could provide suitable habitats for this species.
6	*Clanga clanga*	Greater Spotted Eagle	VU	NE	Yes	No	Yes	X			According to IUCN, the species is migratory with birds leaving their breeding grounds in October and November to winter in southern Asia and return in February and March. According to IUCN, the species mainly occur in forested areas and wetlands, but can also occur in grassland or agricultural areas. The Project area contains some small to medium reservoirs and lakes, which can support the foraging of this species during migration.
7	*Trochalopteron yersini*	Collared Laughingthrush	EN	EN	Yes	Yes	No			X	Recorded in Kon Ka Kinh National Park (Dang, Le & Hoang 2013). According to IUCN, it is resident in dense undergrowth of primary and logged montane evergreen forest, secondary growth and scrub bordering forest. The Project area contains secondary growth forest. Therefore, the species may occur in the Project

No.	Scientific Name	Common Name	IUCN	VRDB	Threatened	Endemic	Migratory	IBAT	eBird/ GBIF	Literature review	Justification
											area, although there are limited evidence to support this.
8	*Garrulax konkakinhensis*	Chestnut-eared Laughingthrush	VU	NE	Yes	Yes	No			X	It has been recorded in Kon Ka Kinh National Park (Dang, Le & Hoang 2013) and only a few localities have been recorded in Vietnam. According to IUCN, the forest around where it was found in Kon Ka Kinh was being logged and had many clearings. The species has also subsequently been found at four sites in a single forest block within the Mang Canh Plateau in Kon Prong State Forest Enterprise, Kom Tum Province. Its presence in logged forest indicates some tolerance for disturbed habitat, according to IUCN. Therefore, it may occur in the Project area, although there is limited evidence to support this.
9	*Pitta nympha*	Fairy Pitta	VU	VU	Yes	No	Yes			X	This species has been recorded in Chu Mom Ray (Le Manh Hung pers. comm.) and Kon Ka Kinh National Park (Dang, Le & Hoang 2013). According to IUCN, this species is resident in Taiwan, Korea and South China. It can be recorded in Vietnam on passage (usually October-November and April-May) to and from its winter ground mainly on Borneo islands (Nguyen Hoai Bao pers. comm). The species can use grassland and aritifical lands to forage. Therefore, tt may occur in the Project area.

No.	Scientific Name	Common Name	IUCN	VRDB	Threatened	Endemic	Migratory	IBAT	eBird/ GBIF	Literature review	Justification
Mammals											
10	*Nycticebus pygmaeus*	Pygmy Slow Loris	EN	EN	Yes	No	No	X		X	This species was recorded in Chu Mom Ray (Le, Dang & Nguyen 2011), Chu Prong (Tran et al. 2001) and Kon Ka Kinh (Dang, Le & Hoang 2013). According to IUCN, this species has been sighted in a wide variety of habitats. It shows preference for thick, complex forested areas with mixed deciduous and bamboo forests. However, it has also been recorded to occur in heavily-modified areas like plantations (according to IUCN). Therefore, it could occur in the secondary growth forests in the Project area.
11	*Nycticebus bengalensis*	Bengal Slow Loris	EN	VU	Yes	No	No	X			According to IUCN, this species mainly occurs in forests; but in Vietnam, this species can be found in heavily degraded areas (e.g. agricultural land, plantations) due to the loss of habitats. This species could occur in the secondary growth forests in the Project area.
12	*Lutrogale perspicillata*	Smooth-coated Otter	VU	EN	Yes	No	No	X			According to IUCN, otters prefer slow or stagnant water bodies with vegetation that provides ample cover on the banks to forage and nest. These kinds of habitats are present in the Project area.
13	*Aonyx cinereus*	Asian Small-clawed Otter	VU	VU	Yes	No	No	X			
14	*Macaca arctoides*	Stump-tailed Macaque	VU	VU	Yes	No	No	X		X	These species (Stump-tailed Macaque, Nicobar crab-eating Macaque and Long-tailed Macaque were recorded in Chu Mom Ray (Le, Dang & Nguyen 2011) and Kon Ka Kinh (Dang, Le & Hoang 2013). According to IUCN, these species
15	*Macaca fascicularis*	Nicobar Crab-eating Macaque	VU	LR	Yes	No	No	X		X	

No.	Scientific Name	Common Name	IUCN	VRDB	Threatened	Endemic	Migratory	IBAT	eBird/ GBIF	Literature review	Justification
16	*Macaca fascicularis ssp. fascicularis*	Long-tailed Macaque	VU	NE	Yes	No	No	X		X	prefer dense evergreen forests, but can persist in disturb secondary forests and those adjoining human-modified habitats. In Vietnam, they have been recorded throughout the country. Therefore, these species can occur in the Project area.
17	*Macaca leonina*	Northern Pig-tailed Macaque	VU	VU	Yes	No	No	X		X	
18	*Arctonyx collaris*	Greater Hog Badger	VU	NE	Yes	No	No	X			According to IUCN, this species occurs across a wide variety of habitats, including modified non-forest habitats. However, in South-east Asia most records come from forests, which could be attributed to the high hunting pressure in non-forested areas if they were to present. The Project area contains suitable habitats for this species; the presence of which is possible if the hunting pressure is not factored in.
19	*Galeopterus variegatus*	Sunda Flying Lemur	LC OR LR/LC	EN	Yes	No	No	X			According to IUCN, this species is a forest-dependent species, but can be found in secondary habitats close to human populations. It is found quite readily in plantations, perhaps even breeding there in Thailand and Vietnam. The species can occur in the Project area where contains suitable habitats such as secondary growth forests and plantations.
Herpetofauna											
20	*Cyrtodactylus gialaiensis*	Gialai Bent-toed Gecko	CR	NE	Yes	Yes	No	X			This species is known only from a coffee farm in Gia Lai Province. The ecology of this species is poorly known. Based on the location where the specimens were found, the species is assumed

No.	Scientific Name	Common Name	IUCN	VRDB	Threatened	Endemic	Migratory	IBAT	eBird/ GBIF	Literature review	Justification
											to tolerate modification. It can occur in the Project area.
21	*Cuora amboinensis*	Southeast Asian Box Turtle	EN	VU	Yes	No	No	X		X	It has been recorded in Kon Ka Kinh National Park (Dang, Le & Hoang 2013). Southeast Asian Box Turtle is largely restricted to standing water bodies, but opportunistically inhabits most types of water bodies except large rivers and reservoirs. It prefers lowland swampy areas with dense vegetation, but also occurs in intermittent streams in hill forest areas, mangrove creeks, rice paddies and irrigation canals. This species may occur in the water bodies in the Project area.
22	*Naja siamensis*	Black And White Spitting Cobra	VU	NE	Yes	No	No	X			The two cobras and Common water monitor have been recorded in Kon Ka Kinh National Park (Dang, Le & Hoang 2013). According to IUCN, these species can inhabit a variety of habitat and tolerate modification (e.g. agricultural areas and wetlands). In Vietnam, it has been recorded throughout the country. Therefore, these species may occur in the Project area.
23	*Ophiophagus hannah*	King Cobra	VU	CR	Yes	No	No	X		X	
24	*Varanus salvator*	Common Water Monitor	LC OR LR/LC	EN	Yes	No	No	X		X	

8.2.3.3 Candidate Species from Field Surveys

The field surveys recorded no candidate species. Interviews with local people suggested that eight endangered species could occur in the Project area, which includes the Northern pig-tailed Macaque, Stump-tailed Macaque, Pygmy Slow Loris, Bengal Slow Loris, Asian small-clawed Otter, Smooth-coated Otter, Greater Hog Badger, Large-antlered Muntjac and Sunda Pangolin.

However, only the presence of the Northern pig-tailed Macaque in the Project area can be confirmed through live evidence. Evidences of other species, especially Large-antlered Muntjac and Sunda Pangolin, are doubtfult as according to the interviewees, the encounters with these species were a long time ago (10 years) and the Project area does not contain suitable habitats for them. Although one responder revealed two cases of Sunda Pangolin hunting and/or confiscation in the past, it is unclear that whether the those pangolins were captured in the Project areas or its vicinity, or the cases were associated with illegal trades in which pangolins had been caught elsewhere. Otters, loris, macaques and the Greater Hog Badger could potentially be present in the Project area; however, any populations persisting in the Project area are expected to be low due to high risks of human exploitation and the supporting habitats are not optimal.

8.2.3.4 Critical Habitat Assessment Results

Based on results from desktop review and interviews from the two previous sections, 24 species have been identified as likely to occur in the Project area; although their occurrences were not completely confirmed through field surveys (see Table 8.16).

These 24 species were carried through to critical habitat assessment (see Table 8.17). The full list of critical habitat screening for all other candidate species that are predicted in desktop review (e.g. IBAT) and field surveys are presented in Appendix I. Other species were excluded from critical habitat assessment in this section due to (i) the unlikeliness to occur in the Project area because the habitats are not suitable for them, (ii) they are extinct in Vietnam or (iii) they are common migratory species with large global populations that it is unlikely for at least 1% of the populations to occur in the Project EAAA.

The assessments have concluded that no species triggered Criteria 1, 2 and 3.

Regarding criterion 4, no ecosystems in Vietnam have been assessed by the IUCN Ecosystem Red List. At the local scale, the EAAA contains only modified habitats, which are not considered as highly threatened and/or unique. The habitats within the Project area do not trigger criterion 4.

Regarding criterion 5, the Project EAAA does not contain any landscape that is associated with evolutionary processes (for example isolated areas, areas of high endemism, spatial heterogeneity, environmental gradients, edaphic interfaces, biological corridors or sites of demonstrated importance to climate change adaptation). The habitats within the Project area do not trigger criterion 5.

Table 8.17 Critical Habitat Assessment Results (for focused species)

Species	IUCN	VRDB	Recorded in	Species information	Critical habitat Justification
Criterion 1					
Yellow-breasted Bunting	CR	NE	Desktop review	This species once bred across the northern Palaearctic from Finland, Belarus and Ukraine in the west, through Kazakhstan, China and Mongolia, to far eastern Russia, Korea and northern Japan. However, it is now thought to have potentially completely disappeared from Finland, Belarus, Ukraine and large parts of Russia. The species is migratory, wintering from central and eastern Nepal, Bangladesh, north-east India east to south-east China (Guangdong) and Taiwan (Province of China), south to the north Malay Peninsula and south-east Asia. It winters in large flocks in cultivated areas, rice fields and grasslands, preferring scrubby dry-water rice fields for foraging and reedbeds for roosting. The breeding season is normally from the second half of June to the beginning of July. The decline is likely to be driven by excessive trapping at migration and, in particular, wintering sites.	According to IUCN, this species is present in Vietnam from November to February. The species could be found in cultivated areas but shows a preference for rice paddies. Rice paddies are limited in the EAAA. In addition, the most recent record of this bird in Gia Lai Province was in in 1969 at Plei Ku city (about 8 km away from the Project area), according to eBird. On a precautionary basis, this species is included for critical habitat assessment, but it is considered unlikely to regularly occur in the EAAA in numbers that would trigger criterion 1 (0.5% of its global population and 5 reproductive units).
Coral-billed Ground-cuckoo	VU	NE	Desktop review	The species restricted to Cambodia, Laos, Vietnam and Thailand. Throughout most of its range (Cambodia, Laos, Vietnam), the population is likely small and extremely patchily distributed as a consequence of population declines caused by increased levels of hunting. Only in Thailand, the species continues to be regularly recorded in the south of the country. The global population size has not been quantified, but the species is reported to be uncommon. The species occupies the lower and middle strata of lowland forest, scrub and second growth with dense vegetation cover, ranging from sea level to 900 m and exceptionally 1,500 m. The species is mainly terrestrial, but places its nest in trees. The species is heavily threatened by the rapid expansion of industrial drift-fence cable snaring, which is taking place since the early 2000s. Snaring is particularly affecting parts of the species's range in Vietnam, Laos and, to a slightly lesser extent, Cambodia.	According to Birds of South East Asia, this species is resident in central Vietnam (which means it is present year-round). The three field surveys did not identify the presence of this species; therefore it is unlikely that this species regularly occur in the EAAA in numbers that would trigger criterion 1 (0.5% of its global population and 5 reproductive units).
Pale-capped Pigeon	VU	EN	Desktop review	Pale-capped Pigeon is locally distributed across its broad range, which encompasses parts of northern India, Bangladesh, Myanmar, Thailand, Laos, Cambodia and Vietnam. In Vietnam it can be found in central (Thua Thien Hue, Quang Tri provinces) and south-central (Lam Dong province) Vietnam. Small numbers have been recently reported from Mang Den/Kon Plong, Kontum Province in 2010 and from magrove forest at Ho Tram, approx 100 km south-east of Ho Chi Minh City, in 2011. However, large flocks (over 90 individuals) were reported in the past from near Da Lat Plateau, whilst regarded as uncommon but resident on some islands in Bai Tu Lam Bay, and seen across mangroves in the Red River Delta despite no previous breeding observations nearby. The global population is estimated at 2500-9999 mature individuals. Its EOO is estimated at 1,530,000 km^2. It frequents a wide variety of habitats from the lowlands up to 1,600 m, chiefly primary or secondary evergreen forest, but also open, deciduous dipterocarp forest, bamboo, and agricultural fields or overgrown cultivation, particularly in close proximity to forest.	According to Birds of South East Asia, this species is resident in central Vietnam. The three field surveys did not identify the presence of this species; therefore it is unlikely that this species regularly occur in the EAAA in numbers that would trigger criterion 1 (0.5% of its global population and 5 reproductive units).
Lesser Adjutant	VU	VU	Desktop review	Lesser Adjutant has an extensive range across South and South-East Asia. Inland, birds inhabit natural and human-modified wetlands, both open and forested. Coastal populations frequent mangroves and intertidal flats. It nests colonially in large trees, and historically on cliffs, often at traditional sites in or adjacent to wetlands. It utilises small wetlands within Asian dry forest, and can breed some distance from these; shrinking of pools during the dry season and limited availability can lead to overlap with human uses and resulting disturbance. The global population probably numbers 5,500-10,000 mature individuals with substantial populations remain only in Cambodia (estimated in the range of 1,500-3,500 pairs). It is a resident species in Vietnam. It can be found in South Central Coast and South Vietnam, commonly found in Dong Nai in wetlands (Cat Tien National Park), wetlands in Dong Thap Muoi (Tram Chim, Tam Nong, Dong Thap), coastal plain Mekong River and U Minh Melaleuca forest, as well as in Yok Don National Park (Dak Lak). The numbers in Vietnam are small and breeding site is thought to remain restricted (in protected areas). The species' EOO is unknown.	According to Birds of South East Asia, this species is resident in central and southern Vietnam. The three field surveys did not identify the presence of this species; therefore it is unlikely that this species regularly occur in the EAAA in numbers that would trigger criterion 1 (0.5% of its global population and 5 reproductive units)
River Tern	VU	NE	Desktop review	This species occurs along river systems across a wide range in southern and south-east Asia, being found in Pakistan, India, Bangladesh, Myanmar, Cambodia, and southern China (Yunnan), as well as	According to IUCN, this species occurs in Vietnam during its non-breeding season (early June to late January). The surveys in June and July did not identify the presence of this species; therefore it

Species	IUCN	VRDB	Recorded in	Species information	Critical habitat Justification
				Laos, and Vietnam during the non-breeding season. It is generally resident over most of its range. Whilst the population in India, Bangladesh (albeit has become rare here), Pakistan, Myanmar and Cambodia are largely resident with some seasonal movement, breeders from southwest China migrating to northern Laos and Vietnam. In contrast to declines noted in South-East Asia, the species is now more regular in southern India than was once thought, having probably benefited from the development of reservoirs. It inhabits rivers and freshwater lakes, also occurring rarely on estuaries, and breeds on sandy and rocky islands, especially along river banks. The species is known to be breed in high concentrations in large reservoirs and rivers, as well as natural and artificial wetlands. Breeding occurs mainly in February-May, although the season may extent from November to May. The multitude of dam construction projects completed, underway or planned in South-East Asia threaten the species through changes to flow regime and flooding of nest-sites. Dams along the Sesan river in Vietnam have precipitated the decline and led to near-extirpation of the species downstream in Cambodia.	is unlikely that this species regularly occur in the EAAA in numbers that would trigger criterion 1 (0.5% of its global population and 5 reproductive units)
Greater Spotted Eagle	VU	NE	Desktop review	This species is found throughout western Asia, central Asia, parts of eastern and southern Asia, a few isolated parts of Europe and Africa. The global population is estimated at 3300-8800 mature individuals. Its EOO is estimated at 18,100,000 km^2. It occurs in lowland forests near wetlands, nesting in different types of (generally tall) trees, depending on local conditions. It is a migratory species, with birds leaving their breeding grounds in October and November to winter in southern Europe, southern Asia and north-east Africa (del Hoyo et al. 1994). They tend to return in February and March.	According to IUCN, this species is present in Vietnam from November to February. The EAAA provide suitable habitats for this species. However, the lack of evidence of occurrence of this species on ebird and literature review suggested that the species is unlikely to regularly occur in the EAAA in numbers that would trigger criterion 1 (0.5% of its global population and 5 reproductive units). The 3rd field survey conducted during the migration season of this species in Vietnam did not found the presence of it in the Project area.
Collared Laughingthrush	EN	EN	Desktop review	Collared Laughingthrush is endemic to the Da Lat plateau, Vietnam. It is known from a handful of localities, the most important of which appear to be Mount Lang Bian, Mount Bi Doup and Chu Yang Sin National Park, with a recent discovery for the first time in Da Nhim Watershed Protection Forest (Mahood and Eames 2012). It is localised and generally uncommon. The population is estimated to number 2,500-9,999 mature individuals based on an assessment of known records, descriptions of abundance and range size. A government resettlement program has greatly increased human pressure on the Da Lat plateau, increasing problems of forest degradation and fragmentation through logging, shifting agriculture, fuelwood-collection and charcoal production. On Mount Lang Bian, all land below 1,500 m is now logged or under cultivation.	According to Birds of South East Asia, this species is resident in central Vietnam. The species was not recorded in the two surveys. Therefore it is unlikely that this species regularly occur in the EAAA in numbers that would trigger criterion 1 (0.5% of its global population and 5 reproductive units)
Chestnut-eared Laughingthrush	VU	NE	Desktop review	It was first discovered at Kon Ka Kinh Mount in Kon Ka Kinh Nature Reserve, one of the highest peaks in the Central Highlands of Vietnam, in the undergrowth of primary upper montane evergreen forest. The forests within Kon Ka Kinh Nature Reserve comprise a mosaic of primary and seral forest formations, and, on the evidence of shifting cultivation, indicate a long history of human utilisation. The forest around the type locality was being logged for large and in many places the canopy was broken and there were many clearings. Its presence in logged forest indicates some tolerance of disturbed habitat. The species has also subsequently been found at four sites in a single forest block within the Mang Canh Plateau in Kon Prong State Forest Enterprise, Kom Tum Province. The population size is preliminarily estimated to fall into the band 1,000-2,499 mature individuals. EOO is 19,400km2	According to Birds of South East Asia, this species is resident in central Vietnam. The species was not recorded in the two surveys. Therefore it is unlikely that this species regularly occur in the EAAA in numbers that would trigger criterion 1 (0.5% of its global population and 5 reproductive units)
Fairy Pitta	VU	VU	Desktop review	*Pitta nympha* breeds in north-east Asia in Japan, South Korea, mainland China and Taiwan (China), and winters mainly on the island of Borneo, in east Malaysia, Brunei and Kalimantan, Indonesia. It has also been recorded on passage in northern Taiwan, North Korea, Vietnam, Hong Kong (China) and, most recently, Thailand. BirdLife International (2001) estimated the total population to be 1,500-7,000 mature individuals. It breeds in subtropical forest, where its localised distribution suggests that it has specialised habitat requirements, although breeding has been recorded from plantations and the species appears to be adaptable to modified forest habitats. Peak breeding season in Taiwan is in May and June. The key threat is extensive lowland deforestation in its breeding range, particularly for development and gravel extraction.	According to Nguyen Hoai Bao (pers. comm.), the species may be present in Vietnam in October-November and April-May. The first field survey in late May, early June did not record the presence of this species. It is unlikely that this species regularly occur in the EAAA in numbers that would trigger criterion 1 (0.5% of its global population and 5 reproductive units). The 3rd field survey conducted during the migration season of this species in Vietnam did not found the presence of it in the Project area.

Species	IUCN	VRDB	Recorded in	Species information	Critical habitat Justification
Pygmy Slow Loris	EN	EN	Desktop review, Interviews	In Viet Nam, researchers have concluded that wild populations are in major decline throughout the country. In 2002 in Phong Nha-Ke Bang National Park only seven sightings of this species; in Ben En National Park, only eight animals were encountered. 2013-14 surveys in North Vietnam recorded 0.19 individuals/km and 0.4 individuals/km respectively. Surveys carried out in Central Viet Nam in 2015 found low densities of N. pygmaeus, with no animals observed in 20 km at Bach Ma National Park, and 0.19 ind./km at Son Tra Nature Reserve. The species has also been observed in Cat Tien National Park and Vinh Cuu Biosphere Reserve, which are both part of the Dong Nai Biosphere Reserve. No estimations about its EOO or global population size. This species has been sighted in a wide variety of habitats, including primary evergreen and semi-evergreen forest, forest on limestone, secondary and highly degraded habitats, and bamboo thickets. It prefers thick, complex forested areas with bamboo to dry dipterocarp forest, and observations confirm their preference of mixed deciduous to semi-evergreen forests. Pygmy slow loris is nocturnal and forages alone or in groups of up to four individuals. The slow loris feed on exudates, fruits, arthropods, flower parts and sometimes reptiles.	Interview with local people suggested the presence of this species in the EAAA, although evidences were not recorded through field surveys. Any sub-populations that may be present in the Project EAAA face high hunting pressure and is considered to unlikely to persist to the amount that trigger criterion 1 (0.5% of its global population and 5 reproductive units).
Bengal Slow Loris	EN	VU	Dekstop review	The Bengal Slow Loris occurs in Bangladesh, Cambodia, China, India, Lao, Myanmar, Thailand and Vietnam. This is an arboreal, nocturnal species that inhabits tropical evergreen rainforest, semi-evergreen forest, and mixed deciduous forest. In Viet Nam it is found only in secondary forests, on the edge of primary forests and also occurs in agricultural fields and plantations. It can live in heavily disturbed agricultural areas if suitable foods are available. The diet of the Bengal Slow Loris consists of nectar, plant bark, fruits and small invertebrates; the majority of their wild diet comprises plant exudates and this is a key staple year round. The Vietnamese populations are severely reduced and have disappeared from many forests. It used to be found quite widespread within the country before 1975, namely Yen Bai (Ta Lang), Tuyen Quang (Ban Bung, Tat Ke), Bac Kan (Dinh Ca, Ban Thi, Ba Be, Cho Ra), Lang Son (Hoa Thong), Bac Ninh (Thang Long), Hoa Binh (Hoa Binh). Da Bac), Quang Tri (Lao Bao), Thua Thien - Hue (Bach Ma), Gia Lai (Koncharang), Kontum (Sa Thay, Mom Ray). Since 1975, the Vietnamese populations decreased sharply. The number of subpopulations is about 30. The causes of variation include loss of habitats, and hunting for pet and trading. Unlike in Vietnam, Cambodia and Laos, this species is more widespread in protected areas of other countries, espcially in Bangladesh. This species has not been surveyed specifically in Bhutan and Thailand, where wild populations may still persist. The species' EOO and populations are unknown.	Interview with local people suggested the presence of this species in the EAAA, although evidences were not recorded through field surveys. Any sub-populations that may be present in the Project EAAA face high hunting pressure and is considered to unlikely to persist to the amount that trigger criterion 1 (0.5% of its global population and 5 reproductive units).
Smooth-coated Otter	VU	EN	Desktop review, Interviews	The Smooth-coated Otter is distributed throughout south Asia and southeast Asia. Because of the secretive and nocturnal behaviour of Smooth-coated Otter, reliable estimates of its population are not available. In southeast Asia it is found in large groups, where the basic family group consists of an adult female and her offspring, the father of the offspring, and older siblings (usually about 3 -5 individuals per group). Generally, it uses large rivers and lakes, peat swamp forests, mangroves and estuaries, and it even uses the rice fields for foraging. In southeast Asia rice fields appear to be one of the most suitable habitats in supporting its viable populations. The Smooth-coated Otters prefer rocky stretches since these stretches provide sites for den and resting. River stretches with bank side vegetation and marshes are used in proportion to their availability especially in summer as they provide ample cover while travelling or foraging. Open clayey and sandy banks are largely avoided as they lack escape covers. In rice fields and pond areas they prefer sites having moderate diversity of vegetation. Rivers with moderate to slow or stagnant water and water bodies having a width of 10-40 m are preferred. In Vietnam, this species has only been recorded in Quang Ninh (Halong Bay), Dak Lak, and Lam Dong provinces; however, it is considered to be potentially occur within the whole country. The Vietnam Red Data Book estimates that the national populations are under 2,500 individuals. Major threats to Asian otter populations are loss of wetland habitats due to construction of large-scale hydroelectric projects, reclamation of wetlands for settlements and agriculture, reduction in prey biomass, poaching and contamination of waterways by pesticides.	Interview with local people suggested the presence of this species in the EAAA, although occurrence in the Project area weas not recorded through field surveys. According to the VRDB, the species is regarded as EN due to the populations estimated to have under 2500 mature individuals within the country. Any sub-populations that may be present in the EAAA face high hunting pressure. It is therefore considered unlikely to persist in numbers that would trigger criterion 1 (0.5% of its national population and 5 reproductive units).
Sunda Flying Lemur	LC OR LR/LC	EN	Desktop review	The species occurs in Indochina (including Viet Nam, Lao PDR and Cambodia), south through Thailand, eastern Myanmar, Malaysia and Indonesia. This species is a forest-dependent species, but	According to the VRDB, the species is regarded as EN due to its population estimated to have under 2500 mature individuals within the country. The species was not found during field surveys.

Species	IUCN	VRDB	Recorded in	Species information	Critical habitat Justification
				can be found in secondary habitats close to human populations. It is found quite readily in plantations, perhaps even breeding there in Thailand and Viet Nam. According to the Vietnam Red Data Book, this species lives restrictedly on trees and glide from trees to trees. The species is distributed in Lai Chau, Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Thua Thien - Hue, Kon Tum, Gia Lai, Dak Lak, Dong Nai, Binh Phuoc, Tay Ninh. Deforestation is a threat to this species, as it is dependent on lowland forest. In the northern part of the range, including Thailand and Viet Nam, habitat loss is the main threat to this species, not hunting.	Therefore, any sub-populations that may be present in the EAAA face high hunting pressure and unlikely to persist in numbers that would trigger criterion 1 (0.5% of its national population and 5 reproductive units).
Stump-tailed Macaque	VU	VU	Desktop review, Interviews	This specie is found in Vietnam, Cambodia, Myanmar, Vietnam (Phuoc Binh National park). There are no available population estimates for this taxon in Vietnam. The population is probably large as the species is frequently encountered throughout its distribution in these countries, although populations are mostly fragmented and isolated. This species has a wide habitat range from tropical evergreen forest to semi-deciduous, deciduous forest and limestone forest. It prefers dense evergreen forests, but can persist in disturb secondary forests and those adjoining human-modified habitats. It occurs widely in the hill and mountain areas of Vietnam. There are no available population estimates for this taxon in Lao PDR, Viet Nam, Cambodia and Thailand (R. Boonratana pers. comm.). The population is probably large as the species is frequently encountered throughout its distribution in these countries, although populations are mostly fragmented and isolated. The species is also protected in national wildlife acts of Lao PDR, Viet Nam, Thailand, Cambodia, Malaysia, and Myanmar.	Interview with local people suggested the presence of these species in the EAAA, although no record were made during field surveys. Any sub-populations that may be present in the EAAA face high hunting pressure. The EAAA is considered unlikely to hold areas that support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds.
Nicobar Crab-eating Macaque	VU	LC	Desktop review, Interviews	In Vietnam, *Macaca fasicularis* is found in the northern region and in Con Son Island, off the coast of southern Viet Nam. The species is extremely tolerant of a range of habitats, including mangrove and swamp forests, and can be found in agricultural areas near forest (secondary growth, secondary forest, and primary forest). Although this species is widely distributed and is known to be tolerant to habitat changes, excessive hunting and persecution of this species is cause for concern. Population size and EOO have not yet been estimated.	
Long-tailed Macaque	VU	NE	Desktop review, Interviews	This species has a wide distribution in Asia, and occurs in southern Lao PDR, South Viet Nam, Cambodia, east and south Thailand (and offshore islands), south to the Malay peninsula, Borneo, Sumatra, Java, Bali, and most but not all offshore islands. The species is extremely tolerant of a range of habitats, including mangrove and swamp forests, and can be found in agricultural areas near forest. This species is semi-terrestrial, diurnal, and omnivorous. It is hunted for food and captured live for research and sport hunting.	
Asian Small-clawed Otter	VU	VU	Desktop review, Interviews	The Asian Small-clawed Otter has a large distribution range, extending from India in South Asia eastwards through Southeast Asia. In most of its range the Asian Small-clawed Otter is sympatric with Smooth-coated and Eurasian otters. A reliable population estimate of the Asian Small-clawed Otter is lacking. The Asian Small-clawed Otter occurs in freshwater and peat swamp forests, rice fields, lakes, streams, reservoirs, canals, mangrove and along the coast. In west Java, its presence is positively correlated with slow flowing and stagnant broad rivers and smaller streams, depicting a distinct decline in preference from slow to deep-water bodies. In rice fields, they chose slow-flowing irrigation channels narrower than 2 m and with a varied, moderate or low vegetation structure. Like Smooth-coated Otter the Asian Small-clawed Otter dislike bare and open areas that do not offer any shelter. It prefers pond areas and rice fields than the rivers, whereas it uses mangroves and lakes in proportion to their availability. In riverine systems it prefers moderate and low vegetation structure, though their presence was also observed from banks with poor vegetation cover. Neither in ponds nor in rice field areas did they show preference for any of the vegetation structure categories, though poor nor bare structural conditions were the least favoured both in riverine and pond areas and along the rice fields. The Small-clawed Otter feeds mainly on crabs, snails and other molluscs, insects and small fish such as gouramis and catfish. They supplement their diet with rodents, snakes and amphibians too. In Vietnam, this species occur throughout the country. The Vietnam Red Data Book	

Species	IUCN	VRDB	Recorded in	Species information	Critical habitat Justification
				estimates its population to be under 10,000 individuals. The declines in populations in Vietnam are due to habitat loss and hunting.	
Greater Hog Badger	VU	NE	Desktop review, Interviews	Greater Hog Badger occurs from Bangladesh and North-east India east through Myanmar, Thailand and Lao PDR to Vietnam and south to Cambodia and peninsula Thailand. In Vietnam, this species occur in the central highlands (Dac Nong, Dak Lak, Kon Tum provinces) and in Bu Gia Map national park. Roberton (2007) traced confirmed field records for the genus, all assumed to be Greater Hog Badger, from most of Viet Nam, occurrence was patchy and no records were found for the Mekong Delta. The current distribution in Viet Nam is likely to be highly fragmented. A recent review of small carnivore camera-trap records failed to produce any records additional to those in Roberton (2007), despite several surveys within suitable habitat, and within some of the country's largest protected areas (Willcox et al. 2014: Table SOM3). As of mid 2014, only two camera-trap records were known for the entire country, from Pu Mat Nature Reserve and Pu Luong NR. This species occurs across a wide variety of habitats. In South-east Asia most records come from forests. The extent of actual and potential occupation of non-forest habitats is unknown: concerted survey in them is rare and off-take of mammals of this size is heavy in much of this species' range. Thus, it is possible that they would occur widely in non-forest parts of South-east Asia but are currently excluded by hunting levels.	
Northern Pig-tailed Macaque	VU	VU	Desktop review, Interviews	The Northern Pig-tailed Macaque occurs in the southeast Asia. This species occur in central and southern Viet Nam (historical records in in Nghe An province, but there is uncertainty whether the species was ever found in the northern province). The species is widely distributed and common in large forest blocks remaining in southern and central Lao PDR, but it is much scarcer in northern Lao PDR and Viet Nam. Found in lowland primary, secondary forest, pine, dry dipterocarp, coastal swamp, montane forest. Frequently observed in riparian forests in western Thailand and Laos, occasionally near human settlements, cultivated fields where it once relatively common (back in 1990), even in highly degraded regions. Home range is 83-347 ha. Multi-male, multi-female groups of 12-40 individuals are usually seen. There are few records of groups numbering 50-150 individuals in KhaoYai National Park in Thailand, DakLak Province in Viet Nam and DhouPhouVieng National Biodiversity Conservation Area in Laos. It may be the case that two or more groups were feeding together. Niche occupation studies by Feroz (2012) in Bangladesh indicated the mean group size of 19.8 (13-26) individuals, with a density of 2.5-6.9 individuals/km2 as studied in 21 sites. Habitat disturbances affecting the future survival of this species include: selective logging; timber and firewood collection for making charcoal; building roads, dams, power lines; and deliberately setting fires.	The interview recorded two individuals of this species captured by a local people from a coffee plantation. This species lives in a group of 20 individuals in average. However, any group that may be present in the EAAA face high hunting pressure and the EAAA is considered unlikely to hold areas that support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds.
Gialai Bent-toed Gecko	CR	NE	Desktop review	This species is known only from a coffee farm near Chu Se Town in Gia Lai Province, in the Central Highlands of Viet Nam. No data on population. All specimens in the type series were taken from the trunks of coffee trees in a sun-grown coffee farm, between 19:30 and 22:00 hrs.	These species were not found during field surveys. These species are considered unlikely to regularly occur in the EAAA in amounts that would trigger criterion 1 (0.5% of its global population and 5 reproductive units)
Southeast Asian Box Turtle	EN	VU	Desktop review	Southeast Asian Box Turtle occurs throughout Southeast Asia from northeastern India and the hills of eastern Bangladesh through mainland Southeast Asia, but not entering the hill and mountain areas north and east of the Mekong. It occurs throughout the Southeast Asian archipelago, from the Nicobar Islands through Indonesia to the Moluccas and throughout the Philippines. Southeast Asian Box Turtle is largely restricted to standing water bodies, but opportunistically inhabits most types of water bodies except large rivers and reservoirs. It prefers lowland swampy areas with dense vegetation, but also occurs in intermittent streams in hill forest areas, mangrove creeks, rice paddies and irrigation canals, from tidal areas up to about 400 m altitude. It was found in Gia Lai, Dak Lak, Binh Thuan, Ba Ria - Vung Tau, Tay Ninh, Long An, Kien Giang, Ca Mau. The species' EOO and global population are unknown.	
Black And White Spitting Cobra	VU	NE	Desktop review	This species is recorded from the Chao Phraya River and the Mekong basin (from Yunnan in southern China to Viet Nam). This species inhabits lowland and upland forest and cultivated areas, including rice paddies. It is found in deciduous, disturbed and open forest, and is absent from closed-canopy evergreen forest. There is no detailed population information available for this species, but	The species was not found during field surveys. Any sub-populations that may be present in the EAAA face high hunting pressure. The EAAA is considered unlikely to hold areas that support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds.

Species	IUCN	VRDB	Recorded in	Species information	Critical habitat Justification
				snake hunters in the region of U Minh Thuong National Park, Viet Nam, report that the species has become much rarer (Like other cobras, this species is heavily harvested in Vietnam).	
King Cobra	VU	CR	Desktop review	The King Cobra is widely distributed in South and Southeast Asia. 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 with remnants of woodland. The surviving population of this snake in Viet Nam may be very small. No EOO and population size are available. This species is threatened by destruction of habitat due to logging and agricultural expansion, as Southeast Asia is experiencing one of the highest rates of deforestation in the tropics and this species appears to be most abundant in forested habitats.	These species were not found during field surveys. Any sub-populations that may be present in the EAAA face high hunting pressure. The species is considered unlikely to regularly occur in the EAAA in numbers that would trigger criterion 1 (0.5% of its global population and 5 reproductive units)
Common Water Monitor	LC OR LR/LC	EN	Desktop review	This species is extremely widespread throughout southern and Southeast Asia. Recent work has shown that the species is absent from northeastern Myanmar, northern and northeastern Thailand, all but coastal Cambodia, and all of Laos except for the ranges on the Vietnam border and northwestern Vietnam. This species group is thought to be abundant in many places (Gaulke and Horn 2004), including some cities like Bangkok, but no specific population data exists. This species is semi-aquatic and opportunistic and inhabits a variety of natural habitats, such as primary forests and mangrove swamps, agricultural areas (e.g., rice, oil palm) and even cities with canal systems (e.g. in Sri Lanka). Although the species may inhabit all the habitats listed above in at least parts of its range, they cannot all be considered equally as important. The habitats considered most important to this species are mangrove vegetation, swamp and wetlands at altitudes of below 1,000 m. The main threat to this species in Vietnam comes from hunting, as the skin of this species is used in the leather trade, its meat is eaten, and its fat is used in traditional medicine, according to Vietnam Red Data Book.	
Criterion 2					
Collared Laughingthrush	EN	EN	Desktop review	Collared Laughingthrush is endemic to the Da Lat plateau, Vietnam. It is known from a handful of localities the most important of which appear to be Mount Lang Bian, Mount Bi Doup and Chu Yang Sin National Park, with it recently discovered for the first time in Da Nhim Watershed Protection Forest (Mahood and Eames 2012). It is localised and generally uncommon. The population is estimated to number 2,500-9,999 mature individuals based on an assessment of known records, descriptions of abundance and range size. A government resettlement programme has greatly increased human pressure on the Da Lat plateau, increasing problems of forest degradation and fragmentation through logging, shifting agriculture, fuelwood-collection and charcoal production. On Mount Lang Bian, all land below 1,500 m is now logged or under cultivation.	These species are considered unlikely to trigger critical habitat criterion 1 in the Project EAAA (0.5% of its global population and 5 reproductive units); therefore, they are subsequently unlikely to trigger criterion 2 (≥10% of the global population size AND ≥10 reproductive units)
Chestnut-eared Laughingthrush	VU	NE	Desktop review	It was first discovered at Kon Ka Kinh Mount in Kon Ka Kinh Nature Reserve, one of the highest peaks in the Central Highlands of Vietnam, in the undergrowth of primary upper montane evergreen forest. The forests within Kon Ka Kinh Nature Reserve comprise a mosaic of primary and seral forest formations, and, on the evidence of shifting cultivation, indicate a long history of human utilisation. The forest around the type locality was being logged for large and in many places the canopy was broken and there were many clearings. Its presence in logged forest indicates some tolerance of disturbed habitat. The species has also subsequently been found at four sites in a single forest block within the Mang Canh Plateau in Kon Prong State Forest Enterprise, Kom Tum Province. The population size is preliminarily estimated to fall into the band 1,000-2,499 mature individuals. The population size is preliminarily estimated to fall into the band 1,000-2,499 mature individuals. EOO is 19,400km2	
Gialai Bent-toed Gecko	CR	NE	Desktop review	This species is known only from a coffee farm near Chu Se Town in Gia Lai Province, in the Central Highlands of Viet Nam. No data on population. All specimens in the type series were taken from the trunks of coffee trees in a sun-grown coffee farm, between 19:30 and 22:00 hrs	
Criterion 3					

Species	IUCN	VRDB	Recorded in	Species information	Critical habitat Justification
Yellow-breasted Bunting	CR	NE	Desktop review	This species once bred across the northern Palaearctic from Finland, Belarus and Ukraine in the west, through Kazakhstan, China and Mongolia, to far eastern Russia, Korea and northern Japan. However,it is now thought to have potentially completely disappeared from Finland, Belarus, Ukraine and large parts of Russia. The species is migratory, wintering from central and eastern Nepal, Bangladesh, north-east India east to south-east China (Guangdong) and Taiwan (Province of China), south to the north Malay Peninsula and south-east Asia. It winters in large flocks in cultivated areas, rice fields and grasslands, preferring scrubby dry-water rice fields for foraging and reedbeds for roosting. The breeding season is normally from the second half of June to the beginning of July. The decline is likely to be driven by excessive trapping at migration and, in particular, wintering sites.	These species have been considered unlikely to trigger critical habitat criterion 1 in the Project EAAA (0.5% of its global population and 5 reproductive units); therefore, they are subsequently unlikely to trigger criterion 3 (areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population at any point of the species' lifecycle or ≥10 percent of the global population during periods of environmental stress).
Lesser Adjutant	VU	VU	Desktop review	Lesser Adjutant has an extensive range across South and South-East Asia. Inland, birds inhabit natural and human-modified wetlands, both open and forested. Coastal populations frequent mangroves and intertidal flats. It nests colonially in large trees, and historically on cliffs, often at traditional sites in or adjacent to wetlands. It utilises small wetlands within Asian dry forest, and can breed some distance from these; shrinking of pools during the dry season and limited availability can lead to overlap with human uses and resulting disturbance. The global population probably numbers 5,500-10,000 mature individuals with substantial populations remain only in Cambodia (estimated in the range of 1,500-3,500 pairs). It is a resident species in Vietnam. It can be found in South Central Coast and South Vietnam, commonly found in Dong Nai in wetlands (Cat Tien National Park), wetlands in Dong Thap Muoi (Tram Chim, Tam Nong, Dong Thap), coastal plain Mekong River and U Minh Melaleuca forest, as well as in Yok Don National Park (Dak Lak). The numbers in Vietnam are small and breeding site is thought to remain restricted (in protected areas). The species' EOO is unknown.	
River Tern	VU	NE	Desktop review	This species occurs along river systems across a wide range in southern and south-east Asia, being found in Pakistan, India, Bangladesh, Myanmar, Cambodia, and southern China (Yunnan), as well as Laos, and Vietnam during the non-breeding season. It is generally resident over most of its range. Whilst the population in India, Bangladesh (albeit has become rare here), Pakistan, Myanmar and Cambodia are largely resident with some seasonal movement, breeders from southwest China migrating to northern Laos and Vietnam. In contrast to declines noted in South-East Asia, the species is now more regular in southern India than was once thought, having probably benefited from the development of reservoirs. It inhabits rivers and freshwater lakes, also occurring rarely on estuaries, and breeds on sandy and rocky islands, especially along river banks. The species is known to be breed in high concentrations in large reservoirs and rivers, as well as natural and artificial wetlands. Breeding occurs mainly in February-May, although the season may extent from November to May. The multitude of dam construction projects completed, underway or planned in South-East Asia threaten the species through changes to flow regime and flooding of nest-sites. Dams along the Sesan river in Vietnam have precipitated the decline and led to near-extirpation of the species downstream in Cambodia.	
Greater Spotted Eagle	VU	NE	Desktop review	This species is found throughout western Asia, central Asia, parts of eastern and southern Asia, a few isolated parts of Europe and Africa. The global population is considered estimated at 3300-8800 mature individuals. Its Estimated Extent of Occurrence (EOO) is estimated at 18,100,000 km2. It occurs in lowland forests near wetlands, nesting in different types of (generally tall) trees, depending on local conditions. It is a migratory species, with birds leaving their breeding grounds in October and November to winter in southern Europe, southern Asia and north-east Africa (del Hoyo et al. 1994). They tend to return in February and March.	
Fairy Pitta	VU	VU	Desktop review	Fairy Pitta breeds in north-east Asia in Japan, South Korea, mainland China and Taiwan (China), and winters mainly on the island of Borneo, in east Malaysia, Brunei and Kalimantan, Indonesia. It has also been recorded on passage in northern Taiwan, North Korea, Vietnam, Hong Kong (China) and, most recently, Thailand. BirdLife International (2001) estimated the total population to be 1,500-7,000 mature individuals. It breeds in subtropical forest, where its localised distribution suggests that it has	

Species	IUCN	VRDB	Recorded in	Species information	Critical habitat Justification
				specialised habitat requirements, although breeding has been recorded from plantations and the species appears to be adaptable to modified forest habitats. Peak breeding season in Taiwan is in May and June. The key threat is extensive lowland deforestation in its breeding range, particularly for development and gravel extraction.	

8.2.4 Ecosystem Services

8.2.4.1 Defining Ecosystem Services

Ecosystem Services (ES) are defined as the benefits that people, including businesses, derive from ecosystems (International Finance Corporation (IFC) Guidance Note 6 (GN6), 2019)[34]. This definition is aligned with the Millennium Ecosystem Service Assessment (MES, 2006)[35], a UN initiated global assessment on such services. Ecosystem services are substantial and varied, underpinning basic human health and survival needs as well as supporting economic activities, the fulfilment of people's potential, and enjoyment of life.

Ecosystem services are organized into four major categories as set out below (Table 8.18).

Table 8.18 Four Categories of ES

Provisioning Services	**These are the goods or products obtained from ecosystems, such as food, timber, fiber, and freshwater.**
Regulating Services	These are the contributions to human well-being arising from an ecosystem's control of natural processes, such as climate regulation, disease control, erosion prevention, water flow regulation, and protection from natural hazards.
Cultural Services	These are the nonmaterial contributions of ecosystems to human well-being, such as recreation, spiritual values, and aesthetic enjoyment.
Supporting Services	These are the natural processes, such as nutrient cycling and primary production that maintain the other services.

In line with the IFC Performance Standard 6: *Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012)* (PS6), this chapter identifies and prioritizes ecosystem services in the Project area and Area of Influence (AoI) as defined by IFC GN6 Paragraph GN117, establishing how these services are of relevance to affected local communities and are likely to be impacted by the Project. The following sections provide an assessment of potential impacts arising from construction and operational activities of the Project on identified ecosystem services within the Project area and AoI.

According to World Resource Institute (WRI) Guidelines: *Weaving Ecosystem Service into Impact Assessment*, priority ecosystem services are those services on which project impacts affect the well-being (e.g., livelihoods, health, safety, culture) of the ecosystem service beneficiaries, and those services that could prevent the project from achieving planned operational performance. Only priority ecosystem services will be carried forward in the ESIA process for detailed baseline data collection, impact analysis, and mitigation and management where warranted.

[34] IFC, June 2019, retrieved on: January 2021, retrieved at : https://www.ifc.org/wps/wcm/connect/5e0f3c0c-0aa4-4290-a0f8-4490b61de245/GN6_English_June-27-2019.pdf?MOD=AJPERES&CVID=mRQjZva

[35] The Millennium Assessment, November 2006, retrieved on: January 2021, retrieved at : https://www.researchgate.net/publication/232660941_The_Millennium_Assessment/link/561541d808aed47facefbd62/download

8.2.4.2 Applicable Standards and Guidelines

IFC performance standards require projects to assess and preserve the benefits from ES. IFC also requires that the environmental and social risk and impact identification process considers the project and communities' dependence on ES. A fundamental component is to apply the mitigation hierarchy to determine measures to limit impacts on ES.

IFC PS6 requires projects to identify Priority ES. These are defined in PS6 as:

- Those services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts to affected communities; and/or
- Those services on which a project is directly dependent for its operations (for example, water).

ERM has also utilized the WRI Guidelines: *Weaving Ecosystem Service into Impact Assessment* to guide the approach used to assess ES in relation to the project. The ES review was undertaken following a five-stage approach (WRI 2014):

- Screening assessment to identify ES that may occur within the study area;
- Data collection and prioritization for 'screened in' ES;
- Scoping to refine the list of ES based on those identified in the study area and potentially impacted by the Project; and
- Prioritization to identify ES importance to beneficiaries.

8.2.4.3 Identification of Relevant Ecosystem Services

8.2.4.3.1 Area of Influence

The Area of Influence (AoI) is defined in the WRI Guidelines as follows:

"*…area relevant to the assessment of project impacts and dependencies on priority ecosystem services. It includes (1) the ecosystems that supply the priority ecosystem services and (2) the locations where the project and affected stakeholders access priority ecosystem services.*"

For the purposes of this ES screening, the AoI consists of community areas and sites used by the community for their livelihoods. The AoI is based on the EAAA identified for the Project (refer to Section 8.1.3 and 8.2.3.1.

8.2.4.3.2 Screening and Scoping

An ES screening assessment was undertaken to determine the likely ES values that could be potentially important to affected communities. The types of ES that have been defined in the WRI Guidelines is used as a basis to verify the presence of ES in the AoI; potential ES in the AoI that correspond with the definition are then screened in for prioritization. ES that are not found in the AoI and/or have very minimum use will be screened out. The results of the screening assessment are contained in Table 8.19. This assessment was done using available sources of primary data including information collected during the scoping visit, social and environmental baseline surveys. The survey also gathered information from local interviews with communities.

Table 8.19 Ecosystem Services Screening Assessment

Ecosystem Service Type	Description of Service Type	Currently Known Ecosystem Services	Screened in?	Baseline section reference
Provisioning Services				
Food: wild-caught fish and shellfish & aquaculture	Fish caught for subsistence or commercial sale; Fish, shellfish, and/or plants that are bred and reared in ponds, enclosures, and other forms of fresh- or salt-water confinement for harvesting	Aquaculture is not a common practice in the Project area. Water bodies in the Project area are mainly lakes and reservoirs used for irrigation of plantations. Local people may go fishing at these water bodies for food occasionally; but the lakes/reservoirs are unlikely to provide a sustainable amount of fishes for commercial harvesting. The regulatory FS mentioned that the Project will use water from available reservoirs during construction; however, it is unlikely that it will significantly affect this ecosystem service of providing fish as food for the local people.	No	Section 8.2.2.2.1
Food: wild meat	Animals hunted for primarily food (recreational hunting covered under cultural services)	Encounters and capture of endangered species have been recorded during interviews with local people. Captured wildlife were reported to be kept as pets (two individuals of the vulnerable Northern pig-tailed Macaque were found at a house). However, there is no evidence of active or recreational hunting recorded from interviews. Local people do not heavily depend on wild food sources.	No	Section 8.2.2.2.4.1
Food: cultivated crops	Annual and permanent crops grown for subsistence use and commercial sale	Coffee mixed plantations (e.g. coffee and cashew) are widespread within the EAAA, which represent the main source of income for local people. According to the information provided by the client, the Project components will acquire a total of 41,919 ha of cultivation/ plantation lands from local people.	Yes	Section 8.2.2.2.1 and Section 9.3.5.1

Ecosystem Service Type	Description of Service Type	Currently Known Ecosystem Services	Screened in?	Baseline section reference
Food: herbs and plants	Herbs and plants collected for food by local people	Evidence gathered suggests that local people may harvest herbs and plants (e.g. bamboo shoots, wild vegetables and mushrooms) for food and as a minor source of income.	Yes	Section 8.2.2.2.4.1
Food: Livestock farming	Sedentary and nomadic livestock farming	Evidence gathered suggests that livestock farming is not a common practice in the Project area. Project activities are unlikely to affect this type of ecosystem services.	No	Section 9.6.7.6
Biomass fuel	Wood, dung and plant matter collected for charcoal, fuel	Firewood may be used as a cooking biomass fuel. However, local residents do not heavily rely on firewood for domestic activities like cooking.	No	N/A
Biological materials: Timber and wood products	Wood collected for local use or for sale as timber, wood pulp and paper	The result of social baseline survey suggests that local people plant acacia and rubber trees for wood. The project acquired about 2.96 ha rubber, plantation which affected this type of ecosystem services.	Yes	Section 9.3.5.1.1.2
Biological materials: Non-Timber Forest Products (NTFP)	Non-timber products collected from the forest. For example, cane, palm, straw, cotton, resin, hemp, twine and rope, natural rubber	Evidence gathered suggests that local people collected non-timber products (e.g. honey) for food and as a minor income source. However, Project activities do not involve forest clearance. This type of ecosystem services are unlikely to be significantly impacted by Project activities	No	Section 8.2.2.2.4.1
Biological raw materials: Animal skins	Processed skins of cattle, deer, pigs, snakes, sting rays, or other animals	No skinning practices were identified in the Project area.	No	N/A
Biological raw materials: Sand	Sand formed from coral and shells	No sand formed from coral or shells was identified in the Project area.	No	N/A
Biological raw materials: Ornamental resources	Products derived from ecosystems that serve aesthetic purposes	Evidence gathered suggests that local people sometimes collect wild orchids for decoration and/or as a minor income source through selling at markets. However, no	No	Section 8.2.2.2.4.1

Ecosystem Service Type	Description of Service Type	Currently Known Ecosystem Services	Screened in?	Baseline section reference
		ecosystem products that are traditionally used for aesthetic purposes were identified from interviews.		
Freshwater	Freshwater for bathing, drinking, irrigation, laundry, household and industrial use	Water bodies in the Project area are mainly lakes and reservoirs used for irrigation of plantations. The regulatory FS mentioned that the Project will use water from available reservoirs during construction. This will likely to impact this type of ecosystem services.	Yes	Section 8.2.2.2.1
Biochemical, natural medicines, pharmaceuticals	Natural medicines, biocides, food additives, pharmaceuticals and other biological material for commercial or domestic use.	Local people plant natural medicines in their gardens. However the Project only acquired 21 m^2 of garden land which is unlikely will affect ecosystem services.	No	Section 9.6.5.3
Genetic resources	Genes and genetic information used for animal breeding, plant improvement, and biotechnology	Evidence suggests that there are no current use of genes and genetic information used for animal breeding, plant improvement, and biotechnology in the community.	No	N/A
Regulating services				
Regulation of air quality	The influence ecosystems have on air quality by extracting chemicals from the atmosphere (i.e., serving as a “sink”) or emitting chemicals to the atmosphere (i.e., serving as a “source”)	The Project area mainly consists of sparse and medium vegetation mostly associated with plantations. This type of habitats plays a minor role as chemicals sinks. Clearance of these habitats due to the Project is unlikely to significantly affect the regulation of air quality services in the EAAA.	No	Section 8.2.2.2.1
Regulation of climate	Carbon sequestration (impacts on global climate change) regulation of temperature, shade air quality by vegetated areas	The Project area mainly consists of sparse and medium vegetation that are mostly associated with plantations. This type of habitats plays a minor role as carbon sinks. Clearance of these habitats due to the Project is unlikely	No	Section 8.2.2.2.1

Ecosystem Service Type	Description of Service Type	Currently Known Ecosystem Services	Screened in?	Baseline section reference
		to significantly affect the regulation of climate services in the EAAA.		
Regulation of water timing and flows	Influence ecosystems have on the timing and magnitude of water runoff, flooding, and aquifer recharge	The Project area mainly consists of sparse and medium vegetation that are mostly associated with plantations. This type of habitats plays a minor role in regulation of water flows (e.g. preventing flood). Clearance of these habitats due to the Project is unlikely to significantly this type of ecosystem services.	No	Section 8.2.2.2.1
Water purification and waste treatment	Role played by vegetation and bacteria in the filtration and decomposition of organic wastes and pollutants and the assimilation and detoxification of compounds.	Vegetation (e.g. plantations) can help in the decomposition of organic wastes (that make fertilizers) and assimilation of compounds (e.g. crops). Project activities involve clearance of plantations but they are unlikely to significantly affect this type of ecosystem services.	No	N/A
Regulation of natural hazards	Role of natural habitats (e.g. wetlands, beaches, reefs) in protecting crops, buildings, recreation areas from waves, wind and flooding from coastal storms and to maintain natural fire frequency and intensity	Natural habitats that provide shelters from natural hazards are not present in the EAAA.	No	Section 8.2.2.2.1
Regulation of pests	Predators from forests, grassland areas, etc. may control pests attacking crops or livestock	Pests can be controlled by a lot of taxon including birds, bats, small mammals and reptiles. Increased fatalities of avifauna and chiropteran due to the operation of the wind farm have the potential to affect the regulation of pest services.	Yes	Section 11.4.6 and Section 11.4.7
Regulation of disease	Influence ecosystems have on the incidence and abundance of human pathogens	There are no ecosystems that will influence the abundance of human pathogens in the EAAA.	No	N/A

Ecosystem Service Type	Description of Service Type	Currently Known Ecosystem Services	Screened in?	Baseline section reference
Erosion control	Role of vegetation in regulating erosion on slopes and riparian areas	The EAAA's landscape is mountainous, which is a common landscape in the central highlands in Vietnam. Plantations help to prevent erosion on slopes, the clerance of which will affect this type of ecosystem services.	Yes	Section 7.2.8
Pollination	Birds, insects and some small mammals pollinate certain flora species, including some agricultural crops	Birds and bats contribute to pollination services. Increased fatalities of avifauna and chiropteran due to the operation of the wind farm have the potential to affect pollination services.	Yes	Section 11.4.6 and Section 11.4.7
Cultural Services				
Spiritual, religious or cultural value	Natural spaces or species with spiritual, cultural or religious importance	No natural spaces or species that have spiritual, cultural or religious importance were identified from interviews.	No	N/A
	Cultural value placed on traditional practices such as hunting, fishing, crafts and use of natural resources.	There are no important traditional practices identified from interviews.	No	N/A
	Cultural value placed on the aesthetic value provided by landscapes, natural landmarks	Interviews showed that the ethnic minorities had aesthetic values placed on landscapes. The development of the turbines may cause visual disturbance to the ethnic minorities.	No	N/A
Recreation and ecotourism	Use of natural spaces and resources for tourism and recreation (e.g. swimming, boating, hunting, bird-watching, fishing)	There are no recreation activities of local people identified from interviews.	No	N/A

Ecosystem Service Type	Description of Service Type	Currently Known Ecosystem Services	Screened in?	Baseline section reference
Educational and inspirational values	Information derived from ecosystems used for intellectual development, culture, art, design, and innovation.	There are no ecosystem serving for intellectual development, culture, art, design, and innovation identified.	No	N/A
Supporting Services				
Conservation	Species and areas valued globally as high conservation value	There are some endangered species likely to be present in the Project area recorded from desktop review and field survey e.g. Northern pig-tailed Macaque.	Yes	Section 8.2.2.2.4.1
Primary production	Formation of biological material by plants through photosynthesis and nutrient assimilation	Biological materials as products of photosynthesis (e.g. coffee) are the main source of income for local people.	Yes	Section 9.3.5.1
Nutrient cycling	Flow of nutrients (e.g., nitrogen, sulfur, phosphorus, carbon) through ecosystems.	Flow of nutrients exist in many natural processes (e.g. nutrients uptake and excretion by plants) in the EAAA.	Yes	N/A
Water cycling	Flow of water through ecosystems in its solid, liquid, or gaseous forms.	Small streams and rivers exist within the EAAA.	Yes	Section 7.2.8
Soil formation	Natural soil forming processes throughout vegetated areas.	EAAA's ecosystems are not considered relevant for natural soil forming processes.	No	N/A
Habitat	Natural spaces that maintain species populations and protect the capacity of ecological communities to recover from disturbances.	There are no natural habitats identified within the EAAA.	No	Section 8.2.2.2.1

Notes: [a] *Numbers in this column refer to sections within the Socio-Economic Baseline Report which forms part of this ESHIA*
[b] *WRI Guidelines: Weaving Ecosystem Service into Impact Assessment*

8.2.4.4 Ecosystem Services Scoping

The scoping exercise was undertaken to refine the list of ES that have:

- **Potential beneficiaries:** Known and potential beneficiaries for a service at the local, national, and / or global level;
- **Sources of impact:** Potential sources of impact were considered based on the social data obtained for the site; and
- **Project dependence:** IFC PS-6 requires that the ES assessment take into consideration any services that the Project may rely upon during construction, operation and/or decommissioning. Therefore, all services for which there is a potential project dependency were scoped into the prioritization stage.

The goal of the scoping exercise was to identify a list of ES to be assessed during the surveys.

8.2.4.4.1 Approach

The WRI Guidelines and IFC PS6 requires that priority ES are identified and impacts to those services are assessed (IFC, 2012). The prioritization process is aimed at identifying those services for which Project impacts would be most likely to result in adverse impacts on project affected communities and other beneficiaries. Using the information collected through the baseline data collection and stakeholder engagement processes, ES were prioritized according to a priority matrix ranking two criteria:

- Importance of the ES to the beneficiary, which considers the intensity of use, degree of dependence and the importance expressed by the project affected communities; and
- Irreplaceability of the ES, which refers to the availability of alternatives, the accessibility, cost and appetite for those alternatives as discussed with the beneficiary.

8.2.4.4.2 Results

After compiling baseline information on the importance and irreplaceability of each ES, these ratings were combined to assign a priority rating to ES ranging from Low to Major, as shown in the ES prioritization matrix in Table 8.20.

ES identified as High priority or Major priority were considered Priority ES. The weighting given to each of these components varied slightly depending upon the service provided to community and industries in the area, but stakeholder values were given precedence over other criteria where the rating was not uncertain.

In addition to the above, according to the IFC definition on priority ES, all ES for which project dependencies are identified are considered Priority ES. The importance and irreplaceability of services relied upon by the Project was assessed through the same prioritization process outlined above, with the Project filling the role of the beneficiary.

In addition to the prioritization exercise, the baseline data collection process provided the opportunity to collect information on the status, trends, and sustainability of resource use as they pertain to the habitats and species that support ES. This information was gathered through secondary sources, field-based surveys and where appropriate through engagement with local stakeholders. This information is important for the assessment of impacts on ES and therefore on local people as the end receptors of these changes.

Table 8.21 outlines the results of prioritization assessment for each type of ES.

Table 8.20 Ecosystem Services Prioritization Matrix

Importance to Beneficiaries		Replaceability		
		High (2)	**Moderate (3)**	**Low (5)**
Low (1)	The service is used and valued by parts of the community, but it is not important in maintaining quality of life or livelihoods of Project Affected Communities.	**Low Priority (2)**	**Low Priority (3)**	**Moderate Priority (5)**
Medium (2)	The service is readily used by some members of the Project Affected Communities for income or subsistence, but they are not dependent upon the service for their livelihoods, and not everyone utilizes the service.	**Low Priority (4)**	**Moderate Priority (6)**	**High Priority (10)**
High (3)	The service is highly important in maintaining the livelihoods of the Project Affected Communities, and is used by most of the community regularly.	**Moderate Priority (6)**	**High Priority (9)**	**Major Priority (15)**
Essential (4)	The service is essential to maintain the health of the Project Affected Communities, and the service is used by all members of the community.	**High Priority (8)**	**Major Priority (12)**	**Major Priority (20)**

Replaceability definition	
High	Many spatial alternatives exist that are readily available to the Project Affected Communities, and there are no major impediments to their usage.
Moderate	Spatial alternatives exist but are either less accessible than the affected service, or there are other barriers to their use such as distance, cost and skills required to access the service.
Low	There are few to no spatial alternatives available to the Project Affected Communities.

Table 8.21 Result of Prioritization

Ecosystem service	Trends and sustainability	Beneficiaries	Importance to beneficiaries	Replaceability	Potential Alternatives	Priority
Provisioning Service						
Food: cultivated crops	Decrease in the area for agriculture and plantation due to land acquisition	Affected household that have their coffee lands acquired	High	Moderate	Barriers to acquire land alternatives include costs and distance	High Priority (9)
Food: herbs and plants	Decrease in the amount of herbs and plants due to land acquisition	Affected household that collect wild herbs and plants	Low	High	Wild herbs can be bought from markets and collected in other areas that are not cleared	Low Priority (2)
Biological materials: Timber and wood products	Decrease in the amount of land for acacia and rubber plantations for wood collection	Affected household that have their acacia/rubber lands acquired	High	Moderate	Barriers to acquire land alternatives include costs and distance	High Priority (9)
Freshwater	Decrease the amount of freshwater for irrigations and local uses and potential for degrading water quality due to Project activities	Affected household that use freshwater for irrigation and domestic uses	High	High	Water quality can be maintained through existing monitoring programs. There are many water bodies in the EAAA available for use. In addition, local people can use treated/tap water, not directly from lakes/reservoirs.	Moderate Priority (6)
Regulating services						
Regulation of pests	Decrease in the abundances of birds and bats that eat pests.	Local community within EAAA.	Medium	High	Many other species can control pests and another alternative for predator is use of pesticides.	Low Priority (4)
Erosion control	Decrease in vegetation that helps to prevent erosion on slopes.	Local community within EAAA.	Medium	Moderate	There are alternatives to preventing erosion; but costs associated with implementation may render alternatives not practicable to implement.	Moderate Priority (6)

Ecosystem service	Trends and sustainability	Beneficiaries	Importance to beneficiaries	Replaceability	Potential Alternatives	Priority
Pollination	Decrease in the abundances of birds and bats that help to pollinate.	Local community within EAAA.	Medium	High	Many other species (e.g. insects) can help in pollination.	Low Priority (4)
Supporting Services						
Non-use value of biodiversity (e.g. existence, bequest value).	Potential adverse effects to species and areas valued globally as of high conservation value.	Communities within the Project AoI	Low	High	The plantation habitats are widespread within the EAAA that can provide habitats for the endangered species identified from desktop review and interviews.	Low Priority (2)

8.2.4.5 Priority Ecosystem Services

Ecosystem services identified as high or major priority were considered Priority Ecosystem Services. After understanding the combination between the importance to beneficiaries and the irreplaceability, the highest rank identified in the prioritization process is High (9) (Food: cultivated crops) and the second-highest is Moderate (6) (Freshwater and Erosion control). The mitigation measures to reduce impacts to these services (see Table 8.22) will then be assessed further in impact assessment.

Table 8.22 Identified Priority Ecosystem Services

Priority Ecosystem Service	Description
Food: cultivated crops	Decrease in the area for agricultulre and plantation due to land acquisition.
Biological materials: Timber and wood products	Decrease in the amount of land for acacia and rubber plantations for wood collection
Erosion Control	Decrease in vegetation that helps to prevent erosion on slopes.
Freshwater	Decrease the amount of freshwater for irrigations and local uses and potential for degrading water quality due to Project activities

9. SOCIAL BASELINE

9.1 Introduction

9.1.1 Objectives

This report describes details of the socio-economic survey of communities potentially affected by the Ia Pech and Ia Pech 2 Wind Farm Project (the Project) in Ia Grai district, Gia Lai province where the Project components are located. It is one of the specialist studies for the Environmental and Social Impact Assessment (ESIA) report for the Project. The economic and social analyses demonstrate the Project's intention to manage and mitigate its impacts on the local community's living conditions and livelihoods. The objectives of the socio-economic survey are to:

- Gather data about socio-economic conditions of the communities affected by the Project to help identify potential impacts; and
- Identify and understand the perceptions and concerns of stakeholders including local authorities and local communities, who might be affected by the Project's construction and operation activities.

The reported findings are based on a review of socio-economic conditions collected during a remote the survey performed between 27 and 31 August 2021. Efforts have been made to highlight the differences between genders and ethnicities on a number of socio-economic parameters. The study employed the research and engagement methodology which achieves data validity with methodological triangulation and which adheres to international standards.

9.2 Methodology

9.2.1 Research Area

The research area includes Ia Pech, Ia Hrung, and Ia Der communes and Ia Kha commune-level town of Ia Grai district, Gia Lai province where the Project's components are located.

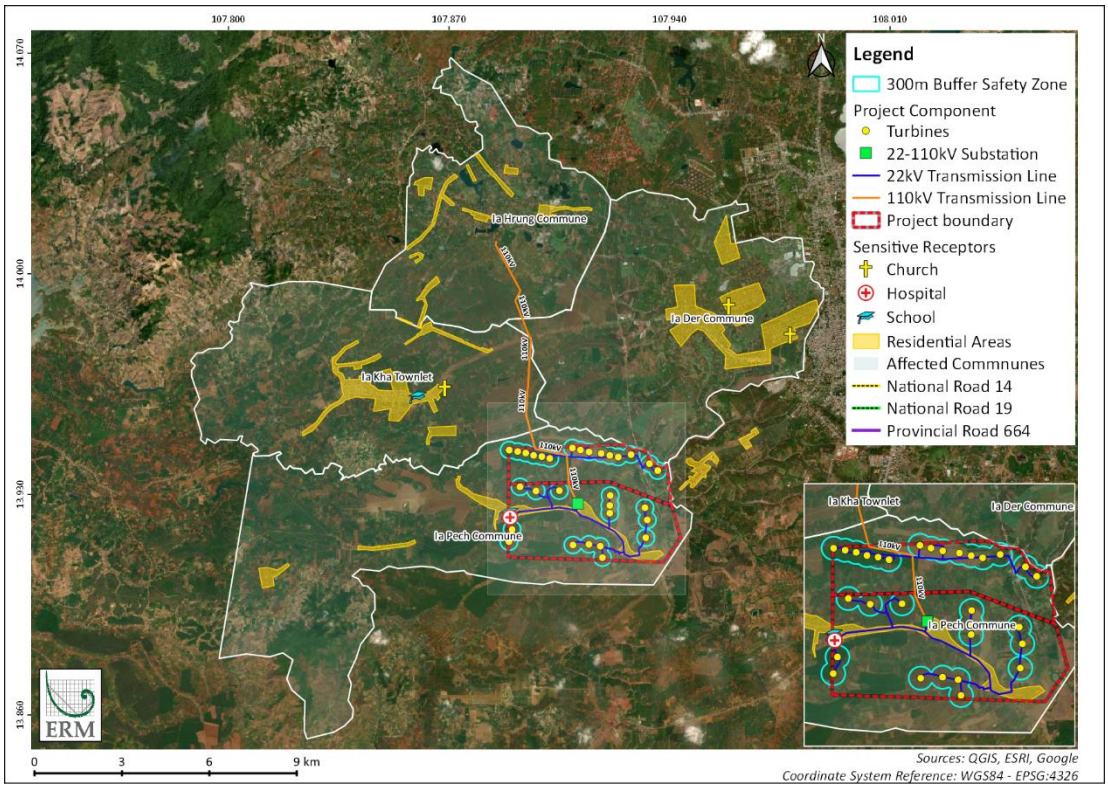


Figure 9.1 Sensitive Social Receptors

9.2.2 Data Collection

The socio-economic data collection was designed so that information was gathered at the provincial, district, commune, and household levels in enough detail to detect changes in the perceptions of affected communities towards the Project. In order to capture the multidimensional realities and fuller picture of the subject under investigation, the socio-economic survey adopted a multiple method approach. The task includes secondary and primary socio-economic baseline data collection. Data for the provincial level is from secondary data sources and desk-based research while data for the district, commune, and household levels is based on both secondary and primary data sources.

9.2.2.1 Secondary Data Collection

The study collected secondary data sources such as socio-economic statistical data and published reports from reliable sources at the national, provincial, and district levels. In addition, socio-economic reports were collected from local authorities at the provincial, district, and commune levels. Secondary sources were used to build a socio-economic baseline at provincial, district, and commune levels including the following aspects:

- Demographic profiles: population, ethnicity, and religion;
- Administration and institutions;
- Natural conditions;
- Infrastructure and public services: road network, electricity, water, irrigation system, waste management, education, and health services;
- Land use and tenure;
- Economy, livelihood, and employment;
- Education;
- Healthcare facilities and programs;
- Vulnerability; and
- Archaeological, cultural heritage, and religious sites.

Sources were also identified to provide a basis for comparison between the reported local context, and the primary baseline data collected.

9.2.2.2 Primary Data Collection

9.2.2.2.1 Methods and Sampling

The study undertook the primary data collection with a multilayer approach to socio-economic analysis using mixed methods which combine qualitative and quantitative methods, including:

- Semi-structured interviews with local authorities;
- Key informant interviews (KIIs);
- Focus group discussions (FGDs); and
- Household interviews.

All interviews with local authorities, KIIs, FGDs, and household interviews were conducted by telephone or virtual communication platform due to travel restrictions imposed by the government at the time of the assement, due to the complicated context of the coronavirus disease 2019 (COVID-19) pandemic

in Vietnam. At the commune and household levels, the study could only collect primary data collection from Ia Pech commune while survey engagements in the remaining Ia Kha commune-level town, Ia Hrung and Ia Der communes could not be facilitated as local authorities were reluctant to take the interviews by phone as well as lack of support from the leaders of the communes' people committee for survey arrangement at that time were hardly carried out as these communes have been in the critical circumstances under the COVID-19 prevention and control. This was the reason why there was a reduction in the number of households that actually participated in the household interviews in comparison with the initial plan (from 140 to 63 households).

Nevertheless, considering the fact that the majority of the Project components (30 turbines, 110kv/22kv substation, 22kv transmission lines, administration building and internal access roads, etc.) are located within Ia Pech Commune, this commune is the most significantly impacted by the Project activities.

Purposive sampling method (as a branch of non-probablility sampling method) was used for the selection of households for the household interviews.[36] In order to serve the purpose of the social impact assessment specifically for the Project, we targeted to sample relevant groups that were highly likely affected by the Project activities and proportionality was not the primary concern.

In order to organise the interviews and household survey, invitation letters were prepared and sent in coordination with the developer personnel, to the local authorities prior to performing the meetings. The household survey was organised in collaboration with the commune level authorities, and in particular the village heads. The surveyed households were selected based on diverse and inclusive requirements related to age cohorts, educational background, livelihoods, genders, vulnerable and social groups. Table 9.1 shows the surveyed sample that ERMcould obtain within La Pech commune and the research methods in the study.

Table 9.1 Research Sample by Geographical Location and Research Method

Level of Administration				Number of Engagements			
Province	District	Commune	Village	Interviews with local authorities	KIIs	FGDs	Household Interviews
Gia Lai	Ia Grai	Ia Pech		1	1		
			Nang Long-Osor		2	3	41
			Sat Tau		1	1	14
			O Gia		1		8
Total				**1**	**5**	**4**	**63**

Source: Socio-economic survey conducted by ERM, August 2021

9.2.2.2.2 Consultations with Local Authorities

Using semi-structured interviews, ERM collected updated information on the socio-economic conditions of the area as well as the key concerns and perceptions of local authorities about the Project. Suggestions were also presented to the Project for environmental and social performance management and impact mitigation. This consultation assisted the team in confirming development trends and any changes in socio-economic conditions, infrastructure, and public services. The consultation process also aimed to inform stakeholders about Project's progress, while assessing awareness at different levels and identifying some of the key issues, concerns, and expectations of the community.

[36] Sampling methodology for social indicators, page 11.

It was planned that consultations would be conducted with Ia Pech Commune People's Committee (CPC), Ia Der CPC, Ia Hrung CPC, and Ia Kha commune-level town People's Committee. However, only the consultation with Ia Pech CPC was successfully implemented while other consultations with the remaining communes could not be implemented due to local authorities' time constraints during the COVID-19 prevention and control period. The consultation with Ia Pech CPC covered the following topics:

- Updating about Project's progress and current status of the ESIA;
- Obtaining up-to-date socio-economic data regarding demography, health, education, livelihoods and employment, infrastructure and public services, and cultural sites in the commune;
- Gaining feedback or perceptions about the Project development; and
- Obtaining acceptance and support from the People's Committee to conduct the household survey in the area.

9.2.2.2.3 Key Informant Interviews

Five key informant interviews (KIIs) were conducted in the potentially affected communities of Ia Pech commune including Nang Long-Osor, Sat Tau, and O Gia villages. Representatives of the village management boards (i.e. village head, former village head, influential ethnic minority individual, and village Party Cell secretary) and representative of the commune-level Women's Union were identified as key informants for KIIs. A total of five participants who engaged in the KIIs are of Gia Rai ethnicity, including three males and two females (see Table 9.2).

Table 9.2 Key Informants by Geographical Location

Commune	Village	Number of Key Informants
Ia Pech		1
	Nang Long-Osor	2
	Sat Tau	1
	O Gia	1

Source: Socio-economic survey conducted by ERM, August 2021

The KII was semi-structured with major questions prepared in advance in the form of checklists. The questions for key informants concentrated on general information about the community, social networks, community context, employment, perceptions about the Project, and suggestions for community development schemes. The interviews lasted approximately one hour, were conducted via telephone and recorded. The named list of informants are provided in Appendix J.

9.2.2.2.4 Focus Group Discussion

A focus group discussion (FGD) approach enables ERM to observe interactions between members within a group, and to listen to their views, opinions, experiences, and attitudes about their socio-economic conditions. This method is useful to get a consensus as people collectively address concerned topics which they may not have previously considered as individuals. By conducting the FGDs, ERM has obtained an understanding of the current socio-economic condition of the impacted villages, their livelihoods, customs and culture, their dependence on natural resources, their access to utility services, and their opinions or concerns about the Project.

Four FGDs with agriculture group, vulnerable group, ethnic minority group, and women group were conducted in Ia Pech commune. Each FGD involved a heterogeneous group of five to seven people with distinctive backgrounds in terms of age, gender, economic and social status in order to obtain an

inclusive perspective and objective reporting. A total of 24 people were engaged in FGDs including 12 males and 12 females (see Table 9.3). By ethnicity, of the 24 FGD participants, four are of Kinh ethnic group and 20 are of Gia Rai ethnicity.

Table 9.3 FGD Participants by Geographical Location and Gender

Commune	Village	Group	Date of FGDs	Total Participants	Gender		Ethnicity	
					Male	Female	Kinh	Gia Rai
Ia Pech	Nang Long-Osor	Ethnic minority group	29 August 2021	5	5			5
		Women group	29 August 2021	6		6		6
		Vulnerable group	30 August 2021	7	1	6		7
	Sat Tau	Agriculture group	31 August 2021	6	6		4	2
Total				**24**	**12**	**12**	**4**	**20**

Source: Socio-economic survey conducted by ERM, August 2021

The FGD began with an introduction about objectives and methods. The focus group was structured around the following main sections:

- ERM enquired about the participants' socio-economic condition, and their perception about the Project; and
- Participants, with a focus on women and vulnerable groups, were asked to list stakeholders who might support them during time of need. These might include friends, family, local authorities or non-governmental organisations (NGOs). Based on a list of stakeholders, participants were invited to rank them in terms of importance for their needs.

The FGDs were held through telephone and virtual communication platform and lasted for approximately one hour. Note-taking was carried out during the discussion. The list of FGD respondents are provided in Appendix J.

9.2.2.2.5 Household Interviews

9.2.2.2.5.1 Sampling

Household survey was only conducted in Ia Pech commune (see further Table 9.4). A sample of 63 households residing in the proximity of around 2km of the Project site was purposively selected for household interviews (see Appendix J). The 63 surveyed households have a population of 290 people, including:

- By gender, 151 males and 139 females;
- By ethnicity, 197 Gia Rai people, 92 Kinh people, and one Bahnar person. This Bahnar person moved to a Gia Rai household via interethnic marriage and therefore will be analysed under their Gia Rai family.

The surveyed population includes households ranging in size from two to eight people with the average being nearly five people per household. Table 9.4 details the surveyed population by geographical location, while a named list of interviewed households is provided in Appendix J.

Table 9.4 Surveyed Population by Gender and Ethnicity

Commune	Village	No. of Surveyed Households	Surveyed Population by Gender		Surveyed Population by Ethnicity		Total Population
			Male	Female	Kinh	Gia Rai	
Ia Pech	Nang Long-Osor	41	102	88	27	163	190
	Sat Tau	15	32	33	52	13	65
	O Gia	7	17	18	13	22	35
Total		**63**	**151**	**139**	**92**	**198**	**290**

Source: Socio-economic survey conducted by ERM, August 2021

9.2.2.2.5.2 Survey Questionnaire

The survey employed the household questionnaire method, whereby a set of data was collected at the household level using structured questionnaires. The questionnaire for the household interview (see Appendix K) was designed to capture the following data and information:

- Family status and demographics (i.e. population, residency, household size, age, ethnicity, religion, and marital status);
- Vulnerability profile (i.e. gender, ethnicity, age, physical or mental disability, and economic disadvantage may be more adversely affected by the Project development);
- Educational background (i.e. education level of members in the surveyed households);
- Occupation, livelihoods, and working status (employed or self-employed, no work or unpaid work);
- Housing, household assets, and land holdings (i.e. land use pattern);
- Health conditions of the household being interviewed;
- Economic conditions (i.e. income and expenditure [seasonal income is also accounted for], and debts affordability);
- Current conditions of local public services and infrastructure including roads, electricity and water supply, waste management services, market, education, healthcare, internet and telecommunications services, and drainage system as well as the household's access to these services;
- Land acquisition and impacts of land acquisition (only for land affected households); and
- Local perception about the Project.

The point of contact for interviews at the household level was any appropriate adult member of the household. The household survey was conducted via telephone due to travel restrictions during the COVID-19 pandemic, subject to their availability.

9.2.3 Data Analysis

The data collected was systematically transcribed and thematically analysed. The method for identifying, analysing, and reporting themes from data transcripts was applied. Narrative development and network analysis were also used to highlight different aspects of the research issues.

Data collected from the paper-based questionnaires of the household surveys was transferred to digital form using Microsoft Excel. Before the analysis, multiple checking processes were conducted to identify potential errors. Some of the answers were cross-checked to make sure of the consistency of the data. The final databases for the surveys were then analysed using Microsoft Excel to provide different frequency and percentage tables. The baseline analysis is based on the following categories:

- Demographic information;
- Education;
- Employment;
- Income and expenditure;
- Health;
- Access to infrastructure and public services;
- Land, housing, and household assets;
- Local perceptions and concerns linked to the Project;
- Needs assessment for livelihood restoration; and
- Local needs for community development.

In addition, major cross-cutting issues including gender and vulnerability are analysed and presented as separate sections.

9.2.4 Limitations

Even though every effort was made to achieve the best database and sample-size under the Covid restrictions that ERM had to face during the performance of this social baseline, the research team recognises that the key limitation to this study is the quality and extent of available information as well as the limitiations to access other communes. Firstly, this study relies on the most recent reports and statistical information available at the time of writing (i.e. statistical data 2017, 2018, and 2019 for some socio-economic indicators), which may not accurately reflect current social and economic conditions. However, this information remains the most up-to-date official data source available at the time of writing. In addition, the levels of data availability and coverage as well as statistical quality are not standardised particularly at the commune contexts, making for a less unified analysis. Efforts were made to cross-check and triangulate information from different sources to confirm their accuracy.

Secondly, the social research team planned to conduct interviews with local authorities and households within three communes and one commune-level town of the Project site including Ia Pech, Ia Der, Ia Hrung, and Ia Kha but as previously explained, the ERM team only achieved to interview Ia Pech commune. The remaining Ia Kha commune-level town, Ia Hrung and Ia Der communes could not be timely engaged in the survey even though efforts were made to introduce the survey purposes and working protocols in the COVID-19 context. The remote social baseline survey could not be facilitated as local authorities were reluctant to take the interviews by phone as well as lack of support from the leaders of the communes' people committee for survey arrangement at that time were hardly carried out. As a result, the social baseline is mainly based on primary data collection from Ia Pech commune where the main components of the Project are located (30 turbines, 110kv/22kv substation, 22kv transmission lines, administration building and internal access roads, etc.), which aims to provide an insight of socio-economic conditions at commune and household levels. Socio-economic conditions of the remaining affected communes were analysed only based on data that was provided by the district and commune authorities at the time of this assessment.

Third, all engagements with local authorities, key informants, and households in Ia Pech commune were conducted via telephone or virtual communication platform. Telephone-based interviews had some drawbacks such as low response rates, high interview break-offs, expressed uneasiness about discussing sensitive topics, more refusal to answer questions, difficulties in developing long-term relationships and approaching hard-to-reach populations (i.e. vulnerable households without telephone devices or households in remote areas). Given acknowledgements of challenges induced by telephone interviews, the survey team attempted to ensure the adequacy and reliability of information. Prior to initiating telephone calls, approximately all of the participating households were notified in advance of

the telephone contact with information about the survey purposes and communication protocols between respondents and surveyors. Respondents were encouraged to schedule an interview to minimise potential barriers for their participation. In this process, surveyors were trained in establishing rapport, minimising interviewer bias, using probing questions, managing transitions, and determining when they had sufficient information to move to next questions.

Fourthly, more interviewees are male household heads but in some parts of the questionnaire were about gender issues, where both the household head and their spouse were engaged for their opinions. Gender analysis was presented in this report as an integral part even though more men as household owners were involved in the interviews. Furthermore, a women group was invited to the FGD so that their own views and needs could be elaborated.

Fifthly, some surveyed Gia Rai people could not communicate fluently in Vietnamese with the interviewers. This partly made difficulties for the interviewers to capture all feelings and inner thoughts of the interviewees and this took a longer time for interviewers to complete the interviews than expected. In addition, some detailed household information was not obtained, but the survey team double-checked information with the village head and re-contacted respondents for data confirmation when needed.

Finally, FGD participants were selected and invited by the village representatives based on pre-determined criteria set by the social research team as discussed in Section 9.2.2.2.4. However, there was a likelihood that the selection of FGD participants were based on the proximity of selected participants rather than located evenly throughout the village. Data from FGDs was triangulated with that from household interviews and KIIs.

9.3 Gia Lai Province

9.3.1 Overview of Gia Lai Province

Gia Lai is a mountainous province in the North Central Highlands with total area[37] of 15,510.13 km^2 (see Table 9.5). It is the second-largest province of Vietnam with the natural area of 16,490 km^2 ranked after Nghe An province[38]. The province borders Quang Ngai, Binh Dinh, and Phu Yen provinces to the East, Cambodia to the West with 90 km of national borderline, Dak Lak province to the South, and Kon Tum province to the North[39] (see Figure 9.2). Gia Lai province is located in the Cambodia - Laos - Vietnam development triangle area, so the province plays an important role as the socio-economic centre of the Central Highlands region in particular and Vietnam in general. In addition, it also serves as the crucial transport hubs connecting Western Highlands with the Central Coastal region and Cambodia.

Table 9.5 Gia Lai Province Overview

Gia Lai Province	
Number of cities	1 (Pleiku)
Number of districts	14
Number of towns	2 (An Khe and Ayun Pa)
Area	15,510.13 km^2 (2020)
Population	1,541,829 people (2020)
Poverty proportion	5.4% (2020)

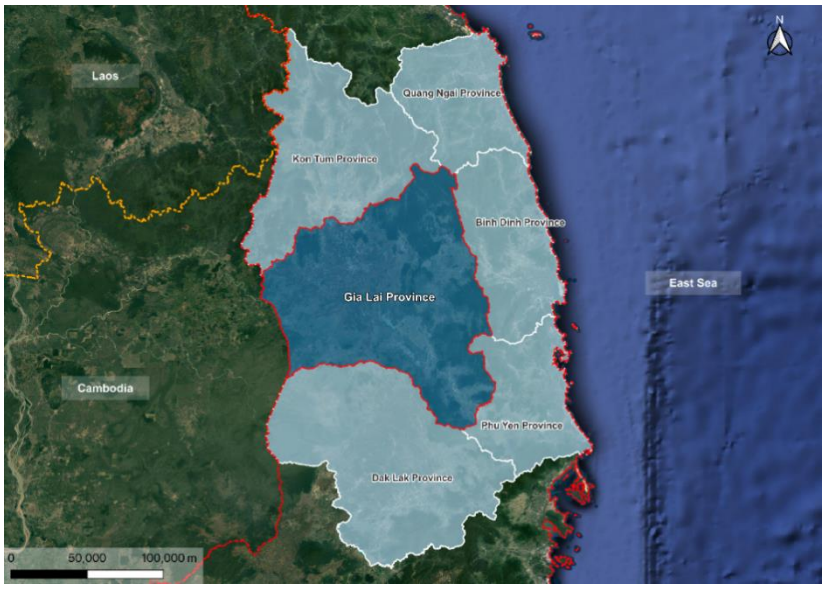
[37] Gia Lai Province Statistics Office (2021)

[38] Huynh Nhi (2021)

[39] Gia Lai PPC Portal (n.d.)

Gia Lai Province	
Main ethnic groups	Kinh, Gia Rai, Bahnar, Ede, and Tay
Main religions	Buddhism, Catholicism, Protestantism, Caodaism, and Bahaism
GRDP 2020	VND 80,000,318 million (at current prices)
Average income per capita 2020	VND 51.9 million

Source: Gia Lai Province Statistics Office (2021)



Source: QGIS

Figure 9.2 Geographical Location of Gia Lai Province

- Administrative Units

Gia Lai has 17 district-level administrative units including one city (Pleiku), two towns (An Khe and Ayun Pa), and 14 districts (KBang, Dak Doa, Chu Pah, Ia Grai, Mang Yang, Kong Chro, Duc Co, Chu Prong, Chu Se, Dak Po, Ia Pa, Krong Pa, Phu Thien, and Chu Puh). Pleiku city is the political, economic, and cultural center of the province. The province has 220 commune-level administrative units, comprising 24 wards, 14 commune-level towns, and 182 communes.

- Topography

Gia Lai territory slopes down from the North to the South and from the East to the West. Its topography comprises three main terrains including mountains, hills, and valleys complexly intermixed with the highest point known as Kon Ka Kinh peak in KBang district (1,748 m above the sea level) and the lowest point known as Ba river basin (100m above the sea level)[40].

Gia Lai topography can be divided into three main types: mountainous terrain, plateau topography, and valley topography[41].

- Mountainous terrain accounts for two fifths of the natural area of the province, and is mostly located in the North.

[40] Gia Lai PPC Portal (n.d.)

[41] Department of Natural Resources and Environment of Gia Lai province (2020)

- The plateau topography is the most common and important topography of Gia Lai province. Gia Lai has two large plateaus known as Kon Ha Nung plateau with the total area of 1,250 km^2 and the average height at 800 m above the sea level (covering KBang and An Khe district), and Pleiku plateau with the total area of 4,550 km^2 and the average height at 800 m above the sea level (covering Pleiku city and surrounding districts and towns).
- The valley topography which was soon exploited by humans for food production is mostly located in the East of the province. The two largest valleys are An Khe valley (with the area of 1,312 km^2) and Ayunpa - Krongpa valley (with the area of 1,474 km^2). The average height of these valleys ranges from 200 m to 300 m.

- Water Sources

Gia Lai has moderate water resources in comparison with other parts of the country. Rivers and specialised water surface[42] of Gia Lai have the total water surface of 27,665.21 ha (accounting for 1.8% of the province's land in 2018)[43] with the total surface water volume of approximately 23 billion m^3 distributed in the main river systems including Ba river, Se San river, and tributary system of Serepok river. In addition, the province's groundwater has great potential for exploitation with reserves and good water quality. This water bed is mainly distributed in the complex containing basalt eruption water. This source together with surface water sources provide water supply for production and domestic use of local people[44]. In addition, Bien Ho is regarded as the largest surface water reserve in Pleiku plateau which is only used for supplying domestic water in Pleiku city[45].

In addition, the uneven rainfall distribution during the year transparently reflects in the fact that in the dry season, the province undergoes water shortage for production while an excess surface water in the rainy season causes flooding and soil erosion[46].

- Climate

Gia Lai has a tropical monsoon climate with two distinctive seasons in the year, the rainy season from May to October and the dry season from November to April next year. An average annual rainfall in the western region of Truong Son Mountain is from 2,200 to 2,500 mm while this number in the eastern region of Truong Son Mountain is recorded from 1,200 to 1,750 mm. An average annual temperature ranges from 22^{o}C to 25^{o}C[47].

- Natural Land

In 2019, the whole Gia Lai province had the natural area at 15,510.99 km^2 with the main soil groups according to soil classification by Food and Agriculture Organisation (FAO) and United Nations Educational, Scientific and Cultural Organisation (UNESCO) as follows[48]:

- Alluvial soil group: This type of soil takes up 64,218 ha, accounting for 4.1% of the province's total natural area. The alluvial soil group is distributed in flat terrains with thick soil layers, which is suitable for the development of agricultural crops, especially wet rice and food crops.

[42] Specialised water surface includes land areas in territorial waters, internal waters, rivers, lagoons, and large lakes not belonging to agricultural production.

[43] Gia Lai Province Statistics Office (2020)

[44] Gia Lai Province Portal (n.d.)

[45] Gia Lai Province Portal (n.d.)

[46] Gia Lai Province Portal (n.d.)

[47] Gia Lai Province Portal (n.d.)

[48] Department of Natural Resources and Environment of Gia Lai province (2020)

- Gray soil group: This type of soil takes up 364,638 ha, accounting for 23.5% of the the province's total natural area, which is formed on ancient alluvium, acid magma, and sandstone. This soil type has light mechanical composition and poor nutrition holding capacity, creating a favourable condition for short-term industrial crops planting or protection forest planting.
- Red and yellow soil group: This type of soil takes up 756,433 ha, accounting for 48.7% of the province's total total natural area. This soil group has many important soil types, especially red soil on basalt rock, concentrated in districts on Pleiku and Kon Ha Nung plateaus, which is suitable for growing long-term industrial crops such as tea, coffee, rubber, and fruit trees.
- Sloping black soil group: This type of soil takes up 16,774 ha, accounting for 1.1% of the province's total natural area. This soil type is formed at the altitude of 300 – 700 m with the slope from three to eight degrees and it is suitable for afforestation and restoration of surface vegetation to protect soil.
- Inert erosive soil with gravel: This type of soil takes up 164,751 ha, accounting for 10.6% of the province's total natural area; however, this land is not arable.

9.3.2 Demographic Information

9.3.2.1 Population

In 2020, the average population of Gia Lai province was 1,541.8 thousand people (accounting for 1.5% the whole country's population), an increase by 21.6 thousand people compared to 2019. Of which, the male population was 773.1 thousand people (50.1%) while the female's figure was 768.7 thousand people (49.9%). The province's population density in 2020 was 99 people per km^2, which was much lower than the average population density of the whole country (295 people per km^2). However, the population was unevenly distributed among the local areas. Specifically, most of the province's population resided in rural areas with nearly 71% (1,094.6 thousand people) while the remaining 29% (447.2 thousand people) lived in urban areas[49] (see Table 9.6).

Table 9.6 Population Distribution by Gender and Residence in Gia Lai Province 2017-2020

Year	By Gender				By Residence			
	Male (thousand people)	%	Female (thousand people)	%	Urban (thousand people)	%	Rural (thousand people)	%
2017	736.3	50.12	732.6	49.88	424.3	28.89	1,044.7	71.11
2018	749.6	50.11	746.1	49.89	432.6	28.92	1,063.1	71.08
2019	761.7	50.10	758.4	49.90	440.3	28.96	1,079.9	71.04
2020	773.1	50.14	768.7	49.86	447.2	29.01	1,094.6	71.99

Source: Gia Lai Province Statistics Office (2021)

In 2020, the province's natural growth rate reached 14.6%, which was 4.4% higher than the average number of the whole country (10.2%). In addition, the crude birth rate[50] was 19.9‰ (an increase of

[49] General Statistics Office (GSO) (2020)

[50] Crude birth rate is an indicator which is one of two components of natural population increase. The crude birth rate indicates that for every 1,000 people, how many live births are in the reference period.

0.1‰ compared to 2019) while the crude death rate[51] was 5.3‰ (a decreased of 0.2‰ compared to 2019)[52].

9.3.2.2 Labour Force

In 2020, the provincial labour force (15 years of age and above) was 898,843 people, a decrease of 9.3 thousand people compared to that in 2019. Of which, 468,460 people are male (52.1%) while the rest 430,383 are female (47.9%). By residential area, 26.6% of labour force at 15 years old and above live in urban areas (238,813 people) while the majority reside in rural areas (73.4% or 660,030 people)[53]. The proportion of employed population at 15 years old and above was 98.4% (884,298 people), accounting for 98.4% of the total labour force and 57.4% of total provincial population[54]. The unemployment rate of labour force at 15 years old and above was 1.6%, of which this figure in female population is higher than that of male population (2.1% versus 1.5% respectively) and by residence this figure in urban areas exceed that in rural areas (2.1% versus 1.6% respectively).

Due to the impacts of the COVID-19 epidemic, job creation has faced many difficulties. In 2020, the province created employment for 24,225 workers, reaching 95% of the plan, decreasing by 5.3% over the same period in 2019. Vocational training for rural workers was estimated at 3,200 people, reaching 100% of the plan[55].

9.3.2.3 Ethnicity

By April 2019, Gia Lai had 1,513,847 inhabitants of 44 ethnic groups, excluding foreigners and unidentified ethnic minority people. The ethnic minority population was 699,760 people, accounting for 46.2% of the whole province's population. Of which, Gia Rai ethnicity was dominant with 30.4%, Ba Na ethnicity accounted for 12.5% and other ethnic minority groups took up 3.3%[56] (see Table 9.7).

Table 9.7 Ethnic Minorities in Gia Lai with the Population over Ten Thousand People 2019

Ethnic Minorities	Total Population (people)	Male (people)	Female (people)
Gia Rai	459,738	225,604	234,134
Bahnar	189,367	93,605	95,762
Tay	11,412	5,923	5,489

Source: CEMA and GSO (2020)

In 2019, of 699,760 ethnic minority people in Gia Lai province, the number of female population surpassed the male's (353,922 people versus 345,838 people respectively). By residential area, the majority of ethnic minority people live in rural areas, accounting for 90.8% (635,657 people) while in urban areas, this figure just reached approximately a tenth (64,103 people)[57].

[51] Crude death rate is an indicator which is one of two components of natural population increase. The crude death rate indicates that for every 1,000 people, how many deaths are in the reference period.

[52] GSO (2020)

[53] Gia Lai Statistics Office (2021)

[54] GSO (2020)

[55] Gia Lai PPC (2020a)

[56] Gia Lai Province Committee for Ethnic Minority Affairs (2020)

[57] CEMA and GSO (2020).

9.3.2.4 Religion

Gia Lai province has five religions officially recognised by the State, including Buddhism, Catholicism, Protestantism, Caodaism, and Bahaism. The number of religious followers was 376,720 people, accounting for about 25% of the province's population in 2021. In which, Protestantism has the largest number of followers who are mainly ethnic minorities[58]. According to statistical data 2021, Gia Lai province has 279 places of worship registered for concentrated religious activities under the Law on Belief and Religion and only 41 places unregistered due to low number of followers[59].

9.3.3 Healthcare Facilities and Programs

All 182 communes of Gia Lai province have health stations[60]; of which 90% of health stations[61] met the national standards for health stations[62] in 2020. The province had 252 health establishments (including 28 hospitals, 220 health stations in communes and precincts, and four medical service units in offices) with 4,225 hospital beds reaching the ratio of 27.4 hospital beds per 10,000 people. In addition, Gia Lai had 4,283 medical staff (including 938 doctors, 473 physicians, 1,202 nurses, 543 midwives, 297 medical technicians, and 830 others) and 316 pharmaceutical staff (including 88 pharmacists, 225 pharmacists of middle degree, and three assistant pharmacists)[63].

The ratio of doctor per 1,000 people of the province was 0.8 in 2020, lower than World Health Organisation (WHO) standards (one doctor per 1,000 people). The rate of communes having doctors reached 92% in 2020 and the number of people registering health insurance schemes in Gia Lai province was 1,403,479, accounting for 91.1% the province's population[64].

Regarding reproduction health for women, every year, the provincial Department of Population and Family Planning provides free contraceptives. The rate of modern contraceptive use reached 73%. From the period of 2016-2020, the Centre for Disease Control in Gia Lai province conducted screening activities for genital infections, early detection and treatment of precancerous lesions for cervical cancer prevention. The total number of visits for gynaecological examination was 325,125 turns; of which, nearly 40% were treated[65] (see Table 9.8).

Table 9.8 Gynaecological Examination and Treatments in Gia Lai Province 2016-2020

Year	Number of Gynaecological Examination and Treatments		Percentage (%)
	Number of Gynaecological Examination	Number of Gynaecological Treatments	
2016	81,462	28,289	34.73
2017	71,554	28,402	39.69

[58] Ngoc Anh (2021)

[59] Thanh Nhat (2019)

[60] Gia Lai PPC (2021)

[61] Gia Lai PPC (2020a)

[62] Standards for health care center and hospital ranking are defined in the Circular No. 23/2005/TT-BYT dated 25 August 2005 by the Ministry of Health.

[63] Gia Lai Statistics Office (2021)

[64] Gia Lai PPC (2020a)

[65] Gia Lai PPC (2020)

Year	Number of Gynaecological Examination and Treatments		Percentage (%)
	Number of Gynaecological Examination	Number of Gynaecological Treatments	
2018	76,484	32,734	42.79
2019	69,518	28,071	40.37
2020	26,107	11,174	42.80
Total	325,125	128,670	39.58

Source: Gia Lai PPC (2020)

9.3.4 Education

According to statistical data at the beginning of the school year 2020-2021, the province has 760 schools (of which 45 are private schools) with 12,483 classes at kindergarten and general education levels (from primary to upper secondary education levels) (see Table 9.9). In addition, the whole province has 400,149 pupils in the levels from kindergarten to upper secondary school, of which, 176,066 pupils are of ethnic minority groups (accounting for 44% of the total province's pupils)[66].

Table 9.9 Education System of Gia Lai Province in the School Year 2020-2021

Level	Number of Schools	Number of Classes	Number of Teachers and Staff	Number of Pupils	
				Total	Number of Ethnic Minority Pupils
Kindergarten	265	3,008	4,332	82,557	36,671
Primary	210	5,756	7,116	167,962	85,344
Lower secondary	237	2,692	4,722	105,860	44,463
Upper secondary	48	1,027	2,110	43,770	9,588
Total	**760**	**12,483**	**18,280**	**400,149**	**176,066**

Source: Gia Lai Province Statistics Office (2021)

In addition, Gia Lai province also has other education establishments[67], including:

- Two province-level colleges with 3,148 students;
- Three branch schools of Agriculture and Forestry University, East Asia University, and Forestry University with 715 students;
- Three vocational schools of Forestry, Health, and Culture - Arts; and
- 279 continuing education centres.

In 2020, the rate of 5-year-old children accessing preschool education reached 94.5%[68]. The rate of pupils going to school at the right age at lower secondary level reached 91.5%[69]. In addition, the rate of pupils graduating from lower secondary schools and continuing to follow the higher levels of

[66] Gia Lai Statistics Office (2021)

[67] Gia Lai Statistics Office (2021)

[68] Gia Lai PPC (2021a)

[69] Gia Lai PPC (2020a)

education reached 81.1%[70]. The rate of pupils graduating upper secondary schools reached 97.5%, an increase of 6.9% compared to the same period in 2019[71].

9.3.5 Economy, Livelihoods and Employment

9.3.5.1 Economic Structure

The average annual economic growth rate in the 2016-2020 period reached 7.6%. Of which, the agriculture, forestry and fishery sector increased by 5.8%; industry and construction sector increased by 8.7%; and services sector increased by 8.2%. Gross Regional Domestic Products (GRDP) of the province by 2020 at current prices reached over VND 80,000 billion, 1.6 times higher than that in 2015. Average income per capita in 2020 reached VND 51.9 million, an increase of nearly 1.5 times compared to that in 2015[72].

The economic structure has shifted in a positive direction. Specifically, by 2020, the proportion of agriculture, forestry and fishery accounted for 37.2% (decreased by 2.9% compared to that in 2015); industry and construction accounted for 28.4% (increased by 1.7% compared to that in 2015); and services accounted for 34.4% (increased by 1.2% compared to that in 2015).

9.3.5.1.1 Agriculture, Forestry, and Fishery

In 2020, the production value of agriculture, forestry and fishery (at 2010 constant prices) of Gia Lai province was estimated at VND 30,186 billion, reaching 100.5% of the plan, increasing by 5.8% compared to the same period in 2019. Specifically, agriculture rose by 5.9%, forestry witnessed an increase of 1%, and fishery increased by 4.2% compared to the same period in 2019[73].

9.3.5.1.1.1 Agriculture

Gia Lai has nearly 549,368 ha of agricultural production land with favourable climate and topographic conditions to develop agricultural production. Of which, more than 260,851 ha of land are for food crops, more than 38,239 ha of short-term industrial crops, 220,954 ha of long-term industrial crops, and 10,162 ha of annual crops, 18,180 ha of fruit crops, and 982 ha of medicinal and perennial trees according to statistical data 2020[74].

Agricultural development oriented commercial production, has formed and developed some production areas of industrial crops with high economic value, such as coffee, rubber, and pepper throughout Gia Rai province. In 2020, the province replanted 2,096.6 ha of coffee plants; of which, local enterprises were responsible for 164 ha and the remaining 1,932.6 ha were planted by local households. Notably, of 1,932.6 ha of the coffee replanting areas, 622.6 ha were cultivated by 1,610 ethnic minority households[75]. The province has 163 large-scale farms with 8,840.93 ha and with the participation of 3,607 households and eight enterprises for planting annual and perennial crops such as rice (two farms), sugarcane (136 farms), cassava (four farms), coffee (six farmers), pepper (one farm), and fruit trees (14 farms). In addition, the province has three safe vegetable cultivation areas meeting Vietnamese Good Agricultural Practices (VietGAP) standards on an area of 53 ha with the participation

[70] Gia Lai PPC (2021a)

[71] Gia Lai PPC (2020a)

[72] Gia Lai PPC (2021b)

[73] Gia Lai PPC (2020a)

[74] Gia Lai PPC (2020a)

[75] Gia Lai PPC (2020a)

of 198 households, one enterprise, and two cooperatives and 112 ha of VietGAP-based avocado planting land area[76].

Innovative irrigation practices have been promoted in agricultural production. In 2020, 28,130.6 ha of plants were applied with innovative water-efficient irrigation technology; of which 21,310.2 ha were practised by local farmers, 6,690.5 ha by local enterprises, and 129.9 ha invested by the State[77].

As for annual crops, rice, maize, and cassava are commonly found and rice is cultivated twice a year in the province. Notably, due to the constantly high price of cassava, many farmers have converted their inefficient planted areas of sugarcane to grow cassava in 2020. In addition, farmers converted 591 ha of inefficient rice cultivation areas to economically valued crops such as maize (65.8 ha), sweet potato (113 ha), cassava (45 ha), vegetables (157.5 ha), peanuts (0.5 ha), tobacco (78 ha), watermelon (89 ha), flowers (32.2) ha, and chili (10 ha)[78].

In terms of livestock raising, as recorded in 2020, the province had 14,140 buffaloes, 417,000 cows, and 425,250 pigs. The output of live buffalo and beef increased by 13% over the same period in 2019 while the output of live pork increased by 6.4%[79]. Animal disease outbreaks were recorded in some localities in 2020, such as African swine fever outbreaks in Ia Pa and Phu Thien districts, and Ayun Pa town with 220 infected animals and nearly 5.2 tons destroyed[80]. In 2020, there were 68 high-tech livestock projects in process of applying for investment approval.

9.3.5.1.1.2 Forestry

The whole province had approximately 5,004 ha of forest planted in 2020, 145,357.7 ha of forest protected by contract, and 18,087.7 ha of forest cared. There were 110 thousand m^3 of forest timber exploited in 2020. The province recorded five forest fires in the dry season with a damage of 35,725 ha and 481 cases of violations of the Forest Law in 2020 (increased by five cases over 2019)[81]. In addition, the province also successfully organised 542 communication campaigns on forest protection and forest fire safety with 37,940 participants[82].

9.3.5.1.1.3 Fishery

In 2020, the province's aquaculture area was 15,040 ha, increasing by 4.4% compared to the same period in 2019 with total production of 6,515 tons, increasing 2.6% compared to the previous year. Some localities having the large aquaculture area in Gia Lai province are Chu Pah, Ia Grai, Kbang, Chu Prong, Krong Pa, An Khe, and Chu Se districts[83].

9.3.5.1.2 Industry

The industrial production value 2020 (at 2010 constant price) of Gia Lai province was estimated at VND 22,519 billion, an increase of 6.6% compared to the same period in 2019, which met the growth target in the COVID-19 epidemic context. In which, the mining industry was estimated to reach VND 174.1

[76] Gia Lai PPC (2020a)

[77] Gia Lai PPC (2020a)

[78] Gia Lai PPC (2020a)

[79] Gia Lai PPC (2020a)

[80] Gia Lai PPC (2020a)

[81] Gia Lai PPC (2020a)

[82] Gia Lai PPC (2020a)

[83] Gia Lai PPC (2020a)

billion, increasing by 6.6% compared to the previous year; electricity and gas production and distribution industry reached VND 7,193.2 billion, increasing by 6.4% compared to the previous year; water supply, waste and wastewater treatment and management industry reached VND 92.1 billion, increasing by 6.3% compared to the previous year[84].

The production value of some industrial products also increased compared to the same period in 2019, including electricity (up by 6.4%), refined sugar (up by 4.2%), tea (up by 1.6%), cassava starch (up by 14.8%), medium-density fibreboard (MDF) products (up by 2.2%), cement (up by 26.3%), granite (up by 0.6%), and microbiological fertilizer (up 0. 5%). Dairy products decreased by 10.2% over the same period in 2019[85].

The whole province had 49 hydropower plants (including eight large-sized plants and 41 medium and small-sized plants), two biomass power plants, two solar power plants, and 1,619 rooftop solar power systems (capacity of about 143 MW), which have been put into operation with a capacity of 2597.7 MW[86]. In 2020, the number of local households accessing to the national electricity was 383,213, accounting for 99.9% of the total households of the province.

Industrial zones of the province have been continuously invested. Tra Da industrial zone had 58 projects from 51 investors with total capital of VND 2,403 billion, including four foreign direct investment (FDI) projects. Le Thanh international border gate economic zone attracted 30 investors with 37 projects valued VND 508.3 billion. South Pleiku industrial zone has been in the infrastructure development phase with total registered capital of VND 517.5 billion. In addition, the province approved other 11 industrial clusters with total area of 378.97 ha[87].

Gia Lai has great potentials to develop renewable energy sources such as hydropower, biomass power, solar power, and especially wind power. The province has 14 wind power projects with a capacity of 1,192.4 MW added in the National Power Development Plan VII for the period of 2016 - 2030 with the vision to 2030 (see Table 9.10).

Table 9.10 Wind Power in Gia Lai Province

No.	Project Name	Capacity (MW)	Commune	District
1	Cuu An	46.2	Song An and Cuu An	An Khe town
2	Song An	46.2	Song An and Cuu An	An Khe town
3	Cho Long	155	Cho Long and Dak Po Pho	Kong Chro
4	Yang Trung	145	Yang Trung, Dak Po Pho and Cho Long	Kong Chro
5	Hung Hai Gia Lai	100	An Trung and Chu Krey	Kong Chro
6	Ia Le	100	Ia Phang and Ia Le	Chu Puh
7	Nhon Hoa 1, 2	100	Chu Don and Ia Phang	Chu Puh

[84] Gia Lai PPC (2020a)

[85] Gia Lai PPC (2020a)

[86] Gia Lai PPC (2020a)

[87] Gia Lai PPC (2020a)

No.	Project Name	Capacity (MW)	Commune	District
8	Central Highlands Business and Processing	50	Bau Can and Thang Hung	Chu Prong
9	Mountain Development	50	Bau Can	Chu Prong
10	Ia Pech	50	Ia Pech	Ia Grai
11	Ia Pech 2	50	Ia Pech	Ia Grai
12	Ia Pet-Dak Doa	200	Trang, Ia Pet and Glar	Dak Doa
13	Ia Bang 1	50	Ia Bang	Chu Prong
14	Ia Boong-Chu Prong	50	Ia Boong, Ia Drang, Ia O and Ia Me	Chu Prong

Source: The Prime Minister (2020)

It is expected that the operation of wind power projects will contribute to promoting socio-economic development, attracting tourism, and increasing local budget revenue[88].

9.3.5.1.3 Trade and Services

The province's total retail sales of goods and services was estimated at VND 75,000 billion in 2020, increasing by 7.8% compared to the same period in 2019 and meeting the growth target during the COVID-19 context[89].

The province's export turnover was estimated at USD 580 million in 2020, increasing 16% over the same period in 2019, reaching 100% of the growth target in the COVID-19 context. In which, Gia Lai province exported 200,000 tons of coffee with the value of USD 298 million, increasing by 11.7% in productivity and 2.4% in value; 6,500 tons of rubber latex with the value of USD 9.4 million, increasing by 75.6% in productivity and 70.9% in value; wood products valued USD 7.5 million, increasing by 7.1% over the same period in 2019[90].

The province's import turnover reached USD 90 million, reaching 100% of the plan, a decrease of 5.5% compared to the same period in 2019[91].

9.3.5.2 Main Types of Livelihoods

According to the staitiscial data 2020, of the employed labour force (884,298 people), 3.8% engage in waged-based employment; 52.1% are private business owners; 16.5% are self-employed people; and 27.6% are unpaid family workers.

By occupation, 48.7% of the province employed population are unskilled workers; 21.9% are skilled agricultural, foretry, and fishery workers; 12.3% service sector workers; 8.5% mechanical, craft, and trade workers; 7.6% professionals and managers; and 1% other ocupations (see Table 9.11).

[88] Hong Diep (2021). https://www.vietnamplus.vn/tiem-nang-phat-trien-cac-nguon-nang-luong-tai-tao-o-gia-lai/736232.vnp

[89] Gia Lai PPC (2020a)

[90] Gia Lai PPC (2020a)

[91] Gia Lai PPC (2020a)

Table 9.11 Annual Employed Labour Force by Occupation and Employment Status 2020

Annual Employed Labour Force	Total Population (people)	%
By employment status		
Waged-based employment	33,317	3.80
Private business owner	460,555	52.10
Self-employed people	146,371	16.50
Unpaid family workers	244,055	27.60
By occupation		
Unskilled workers	430,673	48.70
Skilled agricultural, foretry, and fishery workers	193,213	21.90
Service sector workers	108,599	12.30
Mechanical, craft, and trade workers	74,885	8.50
Professionals and managers	67,210	7.60
Other ocupations	9,718	1.00

Source: Gia Lai Province Statistics Office (2021)

The majority of ethnic minority labour force in Gia Lai province working in agriculture, foresty and fishery (95.6%). Meanwhile, the number of ethnic minority employees working in industry and service just took up insignificant figure with 2% and 2.5% respectively. Of which, around 96.5% ethnic minority workers does not have technical qualifications[92].

9.3.6 Poverty Reduction and Social Development Programs

By the end of 2020, the total number of poor households in the province was 19,958 corresponding to the proportion of 5.4% (a decrease of 1.7% compared to that of 2019). Of which, the number of poor ethnic minority households was 17,178 households (a fall of 5,200 households compared to the same period in 2019), accounting for 86.1% of the whole province's poor households. In addition, in 2020, the rate of rural households using hygiene water was 97% and the number of households accessing to the national electricity reached 99.9% of the total province's households[93].

- Governmental and Provincial Efforts

In the period 2015-2020, Gia Lai province had a number of achievements in poverty reduction through the projects within and outside of the framework of Program 30A and Program 135 (see Table 9.12).

Table 9.12 Results of National Targeted Programme for Sustainable Poverty Reduction in Gia Lai Province 2016-2020

Programs	Projects	Beneficiaries	Period	Budget (VND billion)
Program 30A (P30A)	Support for infrastructure investment	KBang, Kong Chro, Ia Pa, and Krong Pa districts	2016 to 2018	286.586

[92] CEMA and GSO (2020)

[93] Gia Lai PPC (2021)

Programs	Projects	Beneficiaries	Period	Budget (VND billion)
		Kong Chro district	2019 to 2020	52.188
	Support for production development and livelihood diversification and replication of poverty reduction models	KBang, Kong Chro, Ia Pa, and Krong Pa districts	2018	25.390
		Kong Chro district	2019-2020	12.204
	Supporting people at working age in poor, near poor, and ethnic minority households to work oversea on term-based basis.	KBang, Kong Chro, Ia Pa, and Krong Pa districts	2018	2.125
		Kong Chro district	2019-2020	1.212
Program 135 (P135)	Support for infrastructure investment	74 communes and 214 villages in extremely difficult conditions	2016-2017	641.807
		65 communes and 238 villages in extremely difficult conditions	2018-2020	
	Support for production development and livelihood diversification and replication of poverty reduction models	74 communes and 214 villages in the extremely difficult conditions	2016-2017	164.900
		65 communes and 238 villages in the extremely difficult conditions	2018-2020	
	Strengthen capacity for community and grassroots-level officers	Extremely difficult and border communes and extremely difficult villages	2016-2019	25.677
Production support, livelihood diversification and scaling up of poverty reduction models in non-P30A and non-P135 communes		Communes not being covered by P30A and P135	2016-2020	12.019
Communication and reducing information poverty		Provincial wide	2016-2020	15.127
Capacity building, monitoring and evaluation of the implementation of the National Targeted Programme for Sustainable Poverty Reduction		Provincial wide	2016-2020	7.920

Source: Gia Lai Provincial People's Committee (PPC 2020b)

- Non-Governmental Orgranisation Efforts

In terms of support from NGOs, in the period 2018-2020, Gia Lai province implemented 24 projects funded by international NGOs with a total committed value of approximately VND 110 billion (see Table 9.13). In addition, the province also received support from foreign organisations, individuals, and overseas Vietnamese with a total of VND 4,610 billion.

Table 9.13 International NGO projects in Gia Lai 2016-2020

Fields	Purposes	Number of Projects	Committed Funds (VND million)
Climate change response	Supporting local people to use effectively and sustainably water resources; and raising public awareness on climate change, natural disasters, and drought response	4	21,395
Biodiversity conservation	Preserving biodiversity in Kon Ha Nung plateau and Kon Ka King National park	2	23,877
Social problem solving	Supporting the disadvantaged, children, and local people who have difficult living condition	9	28,691
Health	Supporting the malaria prevention, and building a health station in Chu Krey commune, Kong Chro district	7	35,250
Culture	Implementing project “Cultural Heritage” with training activities, capacity building, facilitating the development of typical local products, and promoting tourism development	1	1,310
Rural development	Implementing project “Improving the quality of sustainable Robusta coffee production and trading in the period 2017-2019”, aiming at supporting operational activities for Tan Nong Nguyen Coffee Cooperative, Chu Se district and providing technical support, training, loans for cooperative members to develop coffee production and business in the period 2014-2018	1	977
Total			**109,546**

Source: Gia Lai PPC (2020c)

9.3.7 Future Socio-economic Development Planning

According to the socio-economic development plan in the period of 2021-2025 of Gia Lai province, the overall objective in the 5-year plan is to continue to develop socio-economic quickly, effectively and sustainably; improve the quality of economic growth; and accelerate economic restructuring. The province focuses on developing the fields of agriculture, processing industry, renewable energy, and tourism; effectively using financial resources and investment capital sources for economic, cultural and social development; prioritising in building pervasive infrastructure; and developing Pleiku city into a large city with high connectivity and strong pervasiveness. Some key targets for the period 2021-2025 are presented in the Table 9.14.

Table 9.14 Some Key Socio-Economic Targets of Gia Lai Province for the Period 2021-2025

Indicators	Targets by 2025
Average annual economic growth rate	8.6%
GRDP at current prices	VND 131,702 billion
- The proportion of agriculture, forestry, fishery sector	29.9%

Indicators	Targets by 2025
- The proportion of industry and construction sector	31.2%
- The proportion of services sector	35.4%
- The proportion of product taxes	3.5%
Average income per capita	VND 79.5 million
Export turnover	USD 850 million or an increase of 7.9% per year
Number of communes meeting new rural standards	120 communes or more
The rate of urbanisation	35%
The rate of poor households	A decrease of an annual average of 0.8%
- The rate of poor households (according to the poverty line for the period 2016 - 2020)	Less than 1%
- The rate of poor ethnic minority households	Below 5%
The natural population growth rate	1.1%
The rate of schools meeting national standards	68%
The rate of households using clean and hygienic water	98%
The rate of trained labourers	65%
The number of doctors per 1,000 people	0.9 doctors per 1,000 inhabitants
Health insurance coverage rate	94%
The annual area of newly planted forest	8,000 ha
Forest coverage	47.8%

Source: Gia Lai PPC (2021b)

9.3.8 Gender Issues

9.3.8.1 Overview of Gender in Gia Lai Province

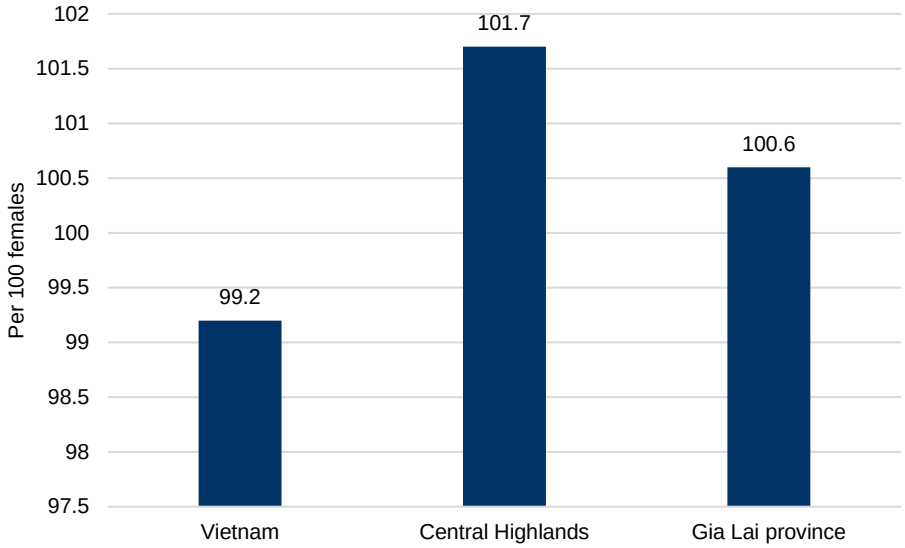
In 2020, the population of Gia Lai province was 1,541.8 thousand people. Of which, the female population was 768.7 thousand people (accounting for 49.9%) while the male's figure was 773.1 thousand people (accounting for 50.1%) (see Table 9.15). The population rate by gender of Gia Lai province is relatively as same as that of the Central Highlands while female population in the whole Vietnam accounts for a higher proportion (50.2% for female versus 49.8% for male).

Table 9.15 Population by Gender

Gender	Vietnam		Central Highlands		Gia Lai Province	
	Number (thousand people)	Percentage of Total Population (%)	Number (thousand people)	Percentage of Total Population (%)	Number (thousand people)	Percentage of Total Population (%)
Male	48,594.0	49.80	2,990.5	50.41	773.1	50.14
Female	48,988.7	50.20	2.941.6	49.59	768.7	49.86
Total	**97,582.7**	**100.00**	**5,932.1**	**100.00**	**1,541.8**	**100.00**

Source: GSO (2021)

In the period of 1960-2020, the sex ratio of Viet Nam was always less than 100, implying that male population was always smaller than female population[94]. The sex ratio of Vietnam in 2020 stood at 99.2 males per 100 females (see Figure 9.3). Among six socio-economic regions[95], the Central Highlands region and Northern Midlands and Mountain Areas region occupied the sex ratio of greater than 100, 101.7 and 101 respectively[96].



Source: GSO (2021)

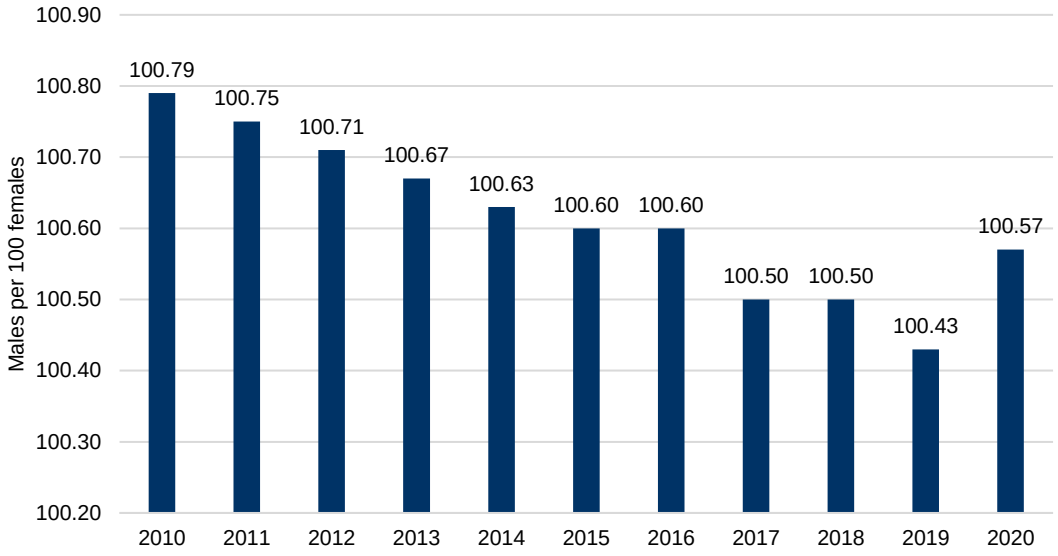
Figure 9.3 Sex Ratio in Vietnam, Central Highlands and Gia Lai Province 2020

From the period of 2010 to 2020, the sex ratio of Gia Lai province was always more than 100 (see Figure 9.4).

[94] GSO (2019)

[95] Vietnam has six main socio-economic regions including the North Midlands and Mountain Areas, the Central Highlands, the North Central and Central coastal areas, the South East region, the Mekong Delta, and the Red River Delta.

[96] GSO (2021)



Source: GSO (2021)

Figure 9.4 Sex Ratio in Gia Lai Province 2010-2020

9.3.8.2 Gender Equality Implementation in Gia Lai Province

After the issuance of the Law No. 73/2006/QH11 on Gender Equality in 2006, Gia Lai Provincial Party Committee and PPC have paid attention to gender equality and women's advancement, considering this matter as an important part in the socio-economic development plan of the province.

The PPC has issued legal documents, and medium-term and long-term plans to direct and implement the implementation of gender equality and women's issues in the province (see Table 9.16). The overall objective of these documents is to decrease the gender gap and improve women's status in some areas, sectors, and localities; and by 2020, basically ensuring gender equality between men and women in terms of opportunities, participation, and benefits in the political, economic, cultural, and social fields[97].

In 2016, Gia Lai PPC issued Decision No. 175/QD-UBND on the implementation plan of the National Program on Gender Equality in Gia Lai province for the period of 2016-2020. Annually, Gia Lai PPC issues the provincial plans to implement the gender equality program in the province and carry out Action Month (from the 15th of November to the 15th of December) on Promoting Gender Equality and Preventing Violence against Women and Girls in Vietnam.

Table 9.16 Major Policies Related to Gender Equality in Gia Lai Province

Year	Document Number	Main Contents
2008	Action Program No. 32-CTr/TU	The Action Program dated February 13, 2018 of Gia Lai Provincial Party Committee on the implementation of Resolution 11-NQ/TW of the Political Bureau of the Communist Party of Vietnam on the Work for Women in the Period of Accelerating Industrialisation and Modernisation.
2009	Decision No. 14/2009/QD-UBND	The Decision dated May 21, 2009 of Gia Lai PPC on "Action plan on Domestic Violence Prevention and Control Action for the period 2009-2015".

[97] Gia Lai PPC (2016)

Year	Document Number	Main Contents
	Decision No. 587/QD-UBND	The Decision dated September 18, 2009 of the Gia Lai PPC on promulgating the implementation plan of the Prime Minister's Decision No. 554/QD-TTg dated May 4, 2009 on approving projects of propagating, disseminating and educating the law for peasant women and ethnic minority women from 2009 to 2012.
2010	Decision No. 234/QD-UBND	The Decision dated on February 5, 2010 of the Gia Lai PPC on assigning members for the Committees for the Advancement of Women of Gia Lai province.
2011	Decision No. 489/QD-UBND	The Decision dated on July 20, 2011 of the Gia Lai PPC on the establishment of the Steering Committee of the project “Educating five million mothers bringing up well their children in the period 2010-2015”.
2012	Decision No. 175/QD-UBND	The Decision dated on April 26, 2012 of the Gia Lai PPC on approving the project “Support for women in vocational training and employment in the 2012-2015 period.
2016	Plan No. 3253/KH-UBND	The Plan dated on July 14, 2016 of the Gia Lai PPC on the implementation of the Prime Minister’s Decision No. 178/QD-TTg dated on January 28, 2016 promulgating the plan of the project "Strengthening the Party’s leadership in gender equality work and for the advancement of women in the new context".
	Plan No. 3307/KH-UBND	The Plan dated on July 18, 2016 of the Gia Lai PPC to guarantee the gender equality and women’s advancement cadres of Gia Lai province in the period of 2016-2020.
	Decision No. 742/QD-UBND	The Decision dated on October 7, 2016 of the Gia Lai PPC on the “Action plan for gender equality in Gia Lai province for the period 2016-2020”.
2017	Plan No. 223/KH-UBND	The Plan dated on January 17, 2017 of the Gia Lai PPC on the implementation of the “National strategy to prevent and respond to gender-based violence in Gia Lai province in the period of 2016-2020 and vision to 2030”.
	Plan No. 4585/KH-UBND	The Plan dated on December 26, 2017 of the Gia Lai PPC to implement the project “Propagating, educating, and supporting women to participate in solving some issues related to women in the period of 2017 - 2027 in Gia Lai province”.
	Decision No. 893/QD-UBND	The Decision dated on December 26, 2017 of the Gia Lai PPC on approving the project “Supporting women to start a business in the period of 2017-2025 in Gia Lai province”.
2018	Plan No. 124/KH-TU	The Plan dated on April 5, 2018 of Gia Lai Provincial Party Committee on the implementation of the Directive No. 21-CT/TW dated on January 20, 2018 of the Secretariat of the Communist Party of Vietnam on further promoting women work in the current global and national context.

Year	Document Number	Main Contents
	Plan No. 912/KH-UBND	The Plan dated on May 4, 2018 of the Gia Lai PPC to implement the project "Support gender equality in ethnic minority areas from 2018-2025 in Gia Lai province".
2021	Plan No. 492/KH-UBND	The Plan dated on May 4, 2021 of the Gia Lai PPC to implement the project "Reducing child marriage and consanguineous marriage in ethnic minority areas in the period of 2015-2025 in Gia Lai province".

Source: Gia Lai Portal (2021)

In 2020, the Women's Union of Gia Lai province organised various activities to raise community awareness on the COVID-19 prevention and control and enhance gender equality including:

- Broadcasting a radio program in Bahnar language, compiling communication materials in Gia Rai language, and using Zalo [98] chats to widely disseminate information related to COVID-19 prevention and control to its members;
- Mobilising its members and women to donate money, materials, and necessities to send to its members, poor women, ethnic minority women, and agencies directly serving the prevention and control of COVID-19 pandemic in the province with a total value of over VND two billion, and 236,119 masks;
- Compiling and distributing 35,000 leaflets on domestic violence and "black credit" (loans with usurious interest rate) prevention and control;
- Providing 100 bilingual flipbooks (in Kinh and Bahnar languages) to communication activities against child marriage and consanguineous marriage;
- Delivering 2,000 reusable cloth bags and 500 bilingual leaflets (in Kinh and Gia Rai languages) to propagate the prevention of plastic waste;
- Persuading nine under-marriage-age couples to comply with the State regulation on marriage ages; and
- Solving nine cases of domestic violence related to women (in Pleiku city, Chu Prong, Dak Po, Ia Grai, Chu Se, and Dak Doa districts), 12 cases of child sexual abuse (in Pleiku city, Chu Prong, Kbang, Krong Pa, Mang Yang, and Duc Co districts).

9.3.9 Human Rights Issues

This section reviews some main issues threatening to the practice of human rights in the provincial level in terms of human trafficking, child marriage, consanguineous marriage, child labour, migrant labour, and land right in Gia Lai province.

9.3.9.1 Human Trafficking

According to the review report on the implementation of the National Strategy on Gender Equality (NSGE) 2011-2020, from 2013 to 2019, 2,961 trafficked victims were rescued by functional authorities and/or returned by themselves. Most of these victims were female (2,891 people) and 18% (528) of them were under the age of 18[99].

[98] Zalo is a home-grown messaging app widely used by Vietnamese smartphone owners.

[99] Australian Aid, MOLISA & UNWOMEN (2021)

In the first half of 2020, Vietnam reported 60 human trafficking cases with 90 victims, mainly women and children, sold to foreign countries[100]. Most of the victims are women and children from poverty-stricken border areas where people are poorly educated.

In Gia Lai province, there were no cases of human trafficking and no victims of trafficking returned to the province reported in 2020[101]. Local authorities have made efforts to develop action programs to preventing the human trafficking issue in the province. Specifically, in 2020, Gia Lai Provincial Women's Union organised a communication program on ensuring border security and preventing women and children trafficking for 280 women who are chairwomen and vice chairwomen of the communal Women's Unions and core members in border communes of Ia Puch (Chu Prong district), Ia O (Ia Grai district), and Ia Dom (Duc Co district)[102].

9.3.9.2 Child Marriage and Consanguineous Marriage

Child marriage[103] is widely considered as a violation of human rights and a form of violence against girls. Child marriage affect not only the girls themselves, but also on households, communities and entire societies as specified:

> Child brides are at greater risk of experiencing a range of poor health outcomes, having children at younger ages when they are not yet ready to do so, dropping out of school, earning less over their lifetimes and living in poverty compared to their peers who marry at later ages. Child brides may also be more likely to experience intimate partner violence, have restricted physical mobility, and limited decision-making ability. Most fundamentally, child brides may be disempowered in ways that deprive them of their basic rights to health, education and safety[104].

Consanguineous marriage[105] can have many repercussions, such as high infant mortality rate and population decline. It is also one of the most profound causes for reduced longevity and persisting poverty among some ethnic groups[106].

In Gia Lai province, child marriage and consanguineous marriage still exist in some communities, especially ethnic minority communites, causing many consequences for young families and social communities[107]. Noticeably, the consanguineous marriage not only appear in rural, high mountainous areas, but also in good conditioning areas as Pleiku city[108]. Therefore, in 2015, Gia Lai province implemented the Scheme of "Reducing child marriage and consanguineous marriage in ethnic minority areas in the period 2016-2020"[109] with the aim of changing marriage behaviours of the ethnic minorities,

[100] Nguyen Quy (2020)

[101] Department of Labour, Invalids, and Social Affairs (DOLISA 2020)

[102] Vietnam's Women Union (2021)

[103] Consanguineous marriage is a union between two individuals who are related as second cousins or closer.

[104] Ending Child Marriage (2017).

[105] Child marriage or early marriage is the informal union entered by an individual before reaching the marriage age as stipulated by law.

[106] Phung Duc Tung et al. (2016)

[107] Thuy Dung (2021)

[108] Viet Nam Women's Union (2021).

[109] Gia Lai PPC (2021c)

as well as creating a consensus in the community, thereby contributing to improve the quality of population and human resources in ethnic minority areas.

After four years of implementing the scheme on reducing child marriage and consanguineous marriage, the province has reduced to 869 cases, a reduction of 0.3% compared to 2015 (1,132 cases) [110]. Moreover, the province has:

- Organised 101 training courses on communication, awareness raising, and behaviour change in marriage with 7,320 participants in district, commune, and city levels;
- Organised 1,393 communication sessions, and 647 counselling sessions on child marriage and consanguineous marriage;
- Carried out communication activities by movies, distributed bilingual handbooks in Vietnamese - Gia Rai, and Vietnamese - Bahnar languages, installed posters and flyers in localities, community houses, and cultural houses to raise people's awareness on child marriage and consanguineous marriage[111];
- Established and managed 310 clubs such as the club "Women with no husbands and children suffering from social evils and crimes, and without domestic violence"; the club "Criminal prevention and control"; the club "Women with the law" in 190 out of 220 communes and towns in 17 districts, towns and cities with 10,317 members; and
- Launched 89 clubs "Women say no to child marriage and consanguineous marriage" with 2,550 members who mainly have daughters and sons aged between 10 and 20 years old.

Significantly, on May 2021, Gia Lai PPC has issued Plan No. 492/KH-UBND on the implementation of the Scheme of "Reducing child marriage and consanguineous marriage in ethnic minority areas in the period of 2021-2025" (phase II) in Gia Lai province[112], with the targets of:

- Improving the capacity and skills in advocacy, counselling, and communication on 90% of all-levels officers of ethnic minority affairs and the commune socio-cultural officers on changing behaviour on child marriage and consanguineous marriage;
- Reduce an average of 2% to 3% per year in the number of child marriages and 3% to 5% per year in the number of consanguineous marriages in ethnic minority areas; and
- Raise the awareness of ethnic minority areas in implementing the provisions of the marital law.

And with the specific activities of:

- Organising communication, advocacy, counselling, awareness raising and behaviour changing activities of ethnic minorities on child marriage and consanguineous marriage;
- Compilation and distribution of communication materials and products on marriage and prevention of child marriage and consanguineous marriage in three languages (Vietnamese, Bahnar, and Gia Rai);
- Building, deploying, and replicating the pilot model and thematic models of "Interventions to reduce child marriage and consanguineous marriage";
- Training, retraining, and building capacity for officers doing ethnic works, reporters, and people participating in legal popularisation and education; and
- Organising the inspection, evaluation, preliminary and final review of the implementation plan.

[110] Viet Nam Women's Union (2021)

[111] Thuy Dung (2021)

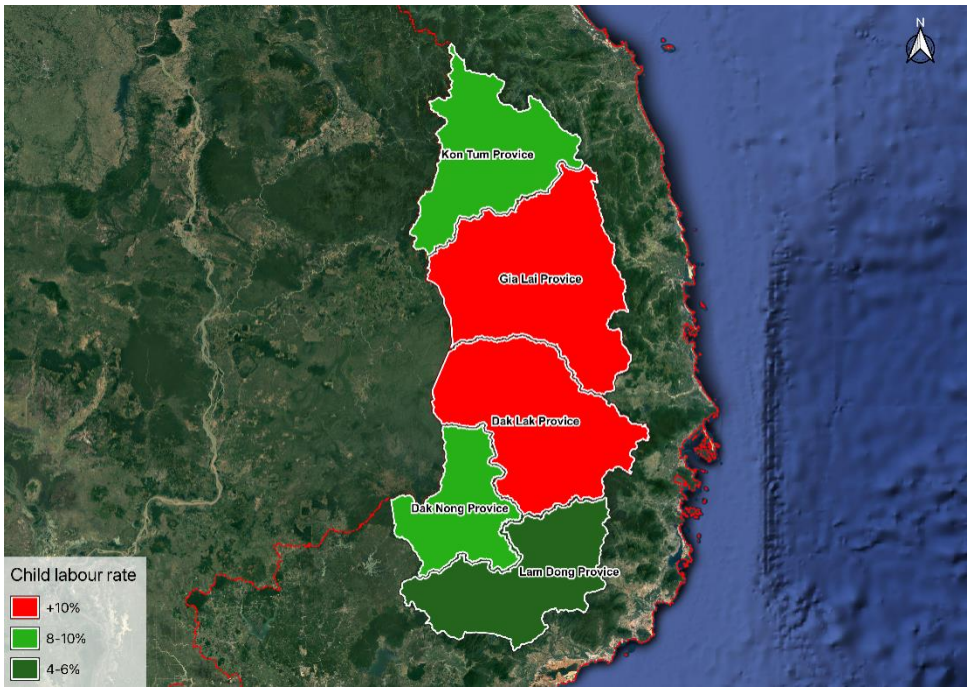
[112] Gia Lai PPC (2021d)

9.3.9.3 Child Labour

According to the definition of the Vietnam National Child Labour Survey 2018[113]:

> Working children are those aged 5-17 years who participate in production - business - service activities for at least one hour in any time in the reference week regardless whether for consumption or for sale, for remuneration or for no remuneration, working full time or part time, regularly or irregularly, legally or illegally. Children performing only domestic chores (for instance cooking, cleaning, washing) and/or small duties at school are excluded from the working children group.

As of 2018, the total number of children aged 5-17 years amounted to 19,254,271, accounting for 20.3% of the total population[114]. Of the total number of children nationwide, about 9.1% or 1,754,066 children aged 5-17 years were participating in economic activities. Working children worked in all three economic sectors of the national economy. In particular, 59.7% of them worked in the agriculture sector (forestry and fisheries), 22.9% worked in the services sector, 15.6% engaged in the industry and construction sector, and the remaining 1.8% were not classified. Of the economically active children, 1,031,944 were identified as children in child labour, accounting for 5.4% of the total number of children from 5-17 years old and 58.8% of those participating in economic activities. Gia Lai province had a high percentage of children in child labour which was more than 10% (see Figure 9.5).



Source: Adapted from ILO, GSO, and MOLISA (2020)

Figure 9.5 Child Labour Rate in the Central Highlands

In the period from 2016 to 2020, Vietnam developed and implemented a number of national programmes to address child labour issues through supporting children and their families in reducing poverty and accessing education[115] such as:

[113] ILO, GSO & MOLISA (2020)

[114] ILO, GSO & MOLISA (2020)

[115] ILO, GSO & MOLISA (2020)

- The National Programme on Child Protection for the period 2016 to 2020 under the Decision No. 2361/ QD-TTg by the Prime Minister dated December 22, 2015;
- The Programme on child labour prevention and reduction for the period 2016 to 2020 under the Decision No. 1023/ QD-TTg by the Prime Minister dated June 7, 2016;
- The Scheme to support children with disabilities to access community-based protection, care and education for the period 2018 to 2025 under the Decision No. 1438/ QD-TTg by the Prime Minister dated October 29, 2018;
- The Scheme to develop preschool education for the period 2018 to 2025 under the Decision No. 1677/ QD-TTg by the Prime Minister dated December 3, 2018; and
- The Scheme on mobilising social resources to support children in extremely disadvantaged communes in ethnic minority areas for the period 2019 to 2025 under the Decision No. 588/ QD-TTg by the Prime Minister dated May 17, 2019.

Recently, in 2020, the Prime Minister of Vietnam issued the Directive No.23/CT-TTg on strengthening measures to ensure the safeguarding of children's rights and child protection. Under this Directive, the Ministry of Labour, Invalid and Social Affairs was requested to develop a national action plan for children; and programs to prevent and reduce child labour[116]. In 2021, the Prime Minister issued the Decision No. 782/QD-TTg approving the program on prevention and reduction of illegal child labour in the 2021-2025 period, with orientations toward 2030. The program sets the objectives as follows[117]:

- Striving to reduce the rate of child and minor labourers aged between 5 and 17 to 4.9%;
- All children at risk of being engaged in child labour, child labourers, and children trafficked for labour exploitation will receive timely support and intervention and be put under management and monitoring upon the notification;
- Around 70% of children will be provided with information and knowledge about the prevention and reduction of child labour; and
- Reducing to the lowest level the rate of child and minor labourers doing heavy, hazardous, or dangerous work.

Child labour is also an emerging issue in Gia Lai province. Therefore, Gia Lai PPC had implemented Decision No. 715/QD-UBND on approving the Implementation plan of the program to prevent and reduce child labour in Gia Lai province for the period 2017-2020[118]. In which:

- Organising communication campaigns; building and duplicating documents and communication products; and organising education, counselling and communication activities directly in the community, schools, production and business establishments on prevention and reduction of children's participation in labour, children at risk, and children working in contravention of the law;
- Organising training on knowledge and skills to prevent, detect, intervene, and support children participating in and at risk of participating in labour; along with improving the capacity of inspection, examination and handling of violations of the illegal use of child labour for the contingent of cadres, civil servants, and public employees working on children at all levels and their collaborators;
- Training and educating on life skills and community integration skills; supporting education, vocational education, and suitable job introduction for children participating in labour, children at

[116] Directive No.23/CT-TTg

[117] Decision No. 782/QD-TTg

[118] Gia Lai PPC (2017)

risk, and children working in contravention of the law; and helping families and employers with target children; and

- Managing, monitoring, surveying and making statistics on the number of children participating in labour, children at risk, and children working in contravention of the law. Organising the inspection and supervision of the implementation of child labour prevention and reduction plans, especially inspecting and handling the observance of laws and policies on child labour at production facilities and businesses.

9.3.9.3.1 Migrant Labour

From 2013 to 2019, registrations show there were 342 foreign workers working in 25 companies or enterprises in Gia Lai province[119]. Around half of them (165 people or 48.3%) were from China, 65 people from India, and the remaining from other countries. By mid 2021, the whole province recorded 409 foreigners currently working for 37 enterprises and projects; of which, 342 workers (83.6%) have not yet been granted their work permits. There were 369 out of the 409 foreign workers employed in wind power projects, including 27 registered workers and 342 unregistered workers[120].

9.3.9.3.2 Land Rights

To implement land policies and support programs for ethnic minority households, during the past years, Gia Lai Province People's Committee has carried out housing, production land and residential land support schemes for approximately 1,500 participating ethnic minority households. As a result of these programs, over 6,000 ha of production land and more than 62.5 ha of residential land had been distributed to poor ethnic minority households[121].

In terms of land management, Gia Lai PPC has issued various documents to implement and manage land use in the locality (see Table 9.17).

Table 9.17 Land-Related Documents of Gia Lai Province

Year	Documents	Description
2014	Directive No. 04/CT-UBND	Implementation of the Law on Land 2013 in Gia Lai province
2014	Directive No. 14/CT-UBND	Land inventory status and land use mapping in 2014 in Gia Lai province
2014	Decision No. 21/2014/QD-UBND	Promulgating the compensation and support for resettlement when lands are withdrawn by the State under the regulations of the Law on Land 2013
2015	Decision No. 30/2015/QD-UBND	Promulgating the percentage of unit price of land rent and water surface rent without auction in Gia Lai province
2015	Decision No. 31/2015/QD-UBND	On promulgating regulations on land recovery, land allocation, land lease, or permission for land use purpose change for organizations, religious establishments, foreign-invested enterprises, foreign organisations with the diplomatic function, and overseas Vietnamese under inter-agency one-stop shop mechanism

[119] Dinh Yen (2019)

[120] Huynh Cong Dong (2021)

[121] Hoang Ha and Huu Hai (2021)

Year	Documents	Description
2016	Decision No. 15/2016/QD-UBND	Promulgating regulations on estimation, use and settlement of funding for organisation of compensation, support, resettlement when the state acquires land in Gia Lai province.
2016	Decision No. 42/2016/QD-UBND	Amending and supplementing a number of articles of the regulations on making cost estimates for organising compensation, support and re-implementation Settlement when the State acquires land in Gia Lai province issued together with Decision No. 15/2016/QD-UBND dated March 21, 2016.
2016	Decision No. 626/QD-UBND	Authorizing DPC to decide on land acquisition and approve plans for compensation and resettlement in Gia Lai province.
2017	Document No. 4433/UBND-CNXD	Strengthening land and mining management in Gia Lai province
2017	Resolution 85/NQ-HDND	Adjusting land use planning to 2020 and final period land use plan (2016-2020) in Gia Lai province
2018	Decision No. 09/2018/QD-UBND	Promulgating the regulations on compensation, support and resettlement when the State acquires land in Gia Lai province
2019	Resolution No. 201/NQ-HDND	Approving price list of all types of land in Gia Lai province in the period 2020-2024
2021	Different decisions	Approving land use planning in 2021 in districts, town, and city in Gia Lai province

Source: Gia Lai Portal (2021)

However, social conflict related to land ownership emerges in ethnic minority communities in the Central Highlands, including Gia Lai province and five others. Since 1975 until now, large and small land disputes in the Central Highlands can be summarized into thousands of cases. Complaints received by local government are 95% linked to land topics. By the end of 2018, in the Central Highlands, about 90 disputes and lawsuits related to land were still being resolved, out of 12 cases located in Gia Lai which account for 13% of the lawsuits. None of these 12 recorded cases are associated with Ia Pech and Ia Pech 2 Wind Farm Project.

Land acquisition and compensation processes for some projects may be related to conflicts and land disputes among population groups, or between people and the government. In addition, other culprits for land disputes also may include conflicts of interest in land relations, impossibility to determine land use rights and cultivation boundaries dispute[122].

9.4 Ia Grai District

9.4.1 Overview of Ia Grai District

Ia Grai is a border mountainous district located in the west of Gia Lai province[123]. It borders Chu Pah district to the North, Pleiku city to the East, Chu Prong district to the Southeast, Duc Co district to the South, and Ia H'Drai district of Kon Tum province to the Northwest. It shares a 12 km borderline with Cambodia to the West. The district town - Ia Kha is about 20 km from Pleiku city to the West, along the provincial road 664 (see Figure 9.6).

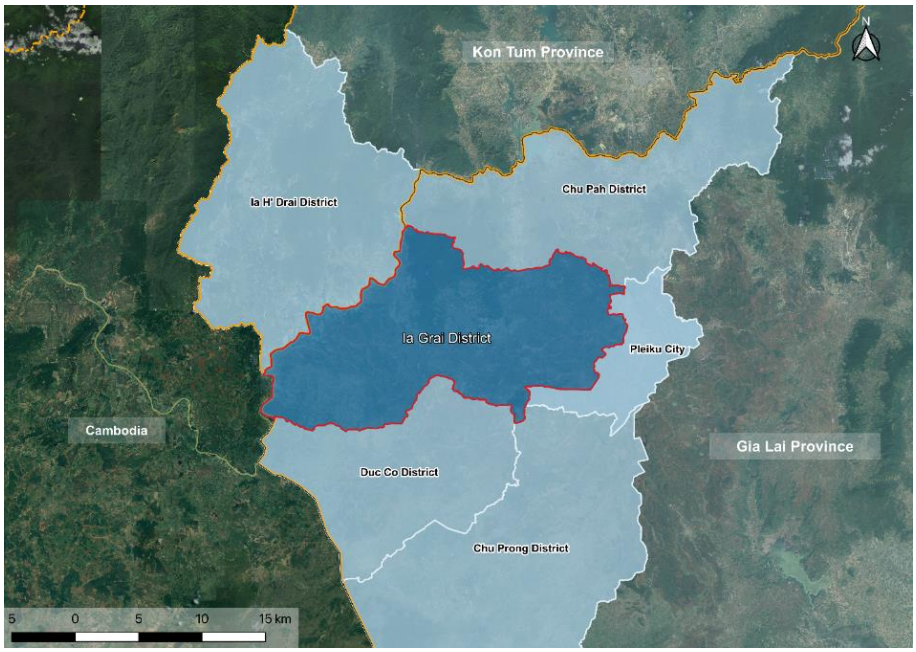
[122] Nguyen Thi Thanh Dung (2021)

[123] Gia Lai Provincial Portal (n.d)

Table 9.18 Ia Grai District Overview

Ia Grai District	
Number of town	1
Number of communes	12
Area	1,120 km^2 (2020)
Population	107,537 people
Poverty proportion	3.2% (2020)
Main ethnic groups	Kinh and Gia Rai
Main religions	Buddhism, Catholicism, and Protestantism
Average income per capita 2020	VND 40.2 million

Source: Ia Grai DPC (2020a); Ia Grai District Statistics Office (2021)



Source: QGIS

Figure 9.6 Geographical Location of Ia Grai District

Ia Grai has 13 commune-level administrative units including one commune-level town (Ia Kha) and 12 communes (Ia Chia, Ia Der, Ia Hrung, Ia Ba, Ia Krai, Ia O, Ia Pech, Ia Sao, Ia To, Ia Yok, Ia Grang, and Ia Khai)[124].

In 2020, the poverty rate of the whole district reached 3.2% (896 out of 27,815 households). The poverty reduction rate was 1.6% for the whole district and 3.2% for ethnic minority communities. All households

[124] Gia Lai Provincial Portal (n.d)

in the district access electricity. The rate of urban population accessing clean water in the district was 80% and the rate of rural inhabitants using hygienic water was 99.4%[125].

9.4.2 Demographic Information

9.4.2.1 Population

In 2020, the population of Ia Grai district was 107,537 people (27,815 households), an increase of 1,930 people compared to 2019 (see Table 9.19). The average household consisted of 3.9 people. In addition, 49.4% were males (53,114 people) and 50.6% were females (54,423 people). Noticeably, according to the statistical data 2019, about half of the district population were of ethnic minorities[126].

Table 9.19 Population of Ia Grai District by December 2019

Commune-Level Town/Commune	Households			Population		
	Total Number of Households	Number of Ethnic Minority Households	Percentage (%)	Total Population	Ethnic Minority Population	Percentage (%)
Ia Kha	3,888	315	8.10	11,539	1,014	8.79
Ia Sao	2,254	1,013	44.94	8,783	4,695	53.46
Ia Yok	2,224	228	10.25	7,826	1,086	13.88
Ia Hrung	1,399	509	36.38	5,264	2,254	42.82
Ia Ba	1,436	429	29.87	5,290	1,783	33.71
Ia Khai	981	943	96.13	4,686	3,681	78.55
Ia Krai	2,553	988	38.70	10,026	4,282	42.71
Ia Grang	949	672	70.81	4,260	3,259	76.50
Ia To	3,225	1,091	33.83	11,736	5,083	43.31
Ia O	2,676	1,453	54.30	11,159	6,604	59.18
Ia Der	2,503	1,917	76.59	11,335	8,333	73.52
Ia Chia	1,977	1,234	62.42	8,433	6,345	75.24
Ia Pech	1,306	808	61.87	5,270	4,031	76.49
Total	**27,371**	**11,600**	**42.38**	**105,607**	**52,450**	**49.67**

Source: Ia Grai DPC (2020b)

Labour force from 15 years old and above was 57,728 people as recorded in 2020, an increase of 1,758 people compared to that of 2019. Of which, 48,808 people were employed, an increase of 1,347 people over 2019 and accounting for 84.5% of the district labour force[127].

[125] Ia Grai DPC (2020c)

[126] Ia Grai DPC (2020b)

[127] Gia Lai DOLISA (2020)

9.4.2.2 Ethnicity

According to the survey (by Ia Grai DPC) results on the socio-economic status of 53 ethnic minorities in 2019, there were 26 ethnic minorities living in Ia Grai district. By December 31, 2019, the total number of ethnic minority population in Ia Grai district was 52,450 people, accounting for nearly 50% of the total population. Notably, in four communes of Ia Khai, Ia Grang, Ia Chia, and Ia Pech, the proportion of ethnic minority people amounted for more than 75% of the total population of the communes (see Table 9.19 above). Of the ethnic minority population, Gia Rai ethnic group amounted for the largest group (approximately 94%). In addition, Ia Grai also has a small number of other ethnic minorities migrated from the North, including Tay, Thai, Muong, Nung, Mong, and Dao (see Table 9.20). Other ethnic groups living in Ia Grai district had a fairly low number of population, less than 100 people per ethnicity.

Table 9.20 Population of Some Ethnic Minorities in Ia Grai District by April 2019

Ethnic Minorities	Gia Rai	Tay	Thai	Muong	Nung	Mong	Dao	Bahnar	Ede
Population	49,287	142	740	330	107	267	92	87	53

Source: CEMA and GSO (2020)

9.4.2.3 Religion

In 2020, Ia Grai district had 16,648 religious followers, in which 1,860 people follow Buddhism, 6,752 Catholic believers, and 8,036 Protestant adherents[128]. In the district, there are some Buddhist establishments such as Ngoc Lai temple (Ia Kha commune-level town), Ngoc Tan temple (Ia Yok commune), Ngoc Duong temple (Ia Sao commune), Van Thu pagoda (Ia Der commune), and Kieu Dam Di pagoda (Ia To commune).

9.4.3 Healthcare Facilities and Programs

Ia Grai district had one health center, two regional polyclinics, 13 health stations, and 160 hospital beds, along with 24 doctors, 52 physicians, 53 nurses, 31 midwives, and 11 pharmacists[129]. The district health center has relatively good medical facilities to serve 100-120 in-patients and 200-300 out-patients per day. The ratio of doctors per 1,000 people was approximately 0.3, lower than WHO standards (one doctor per 1,000 inhabitants). In addition, 100% of the communal health stations in the district had doctors and met national health standards. The proportion of population participating in health insurance in Ia Grai district reached 92%[130]. The rate of under-one-year children receiving full vaccination was 95%.

In 2020, Ia Grai district provided medical examination and treatment for 49,053 turns of people, with 46,278 people receiving support from health insurance[131]. Ia Grai district also recorded 1,936 surveillance cases of COVID-19 disease, in which all of them strictly complied by quarantine time as prescribed. There were nine cases of diphtheria in Ia O, Ia Hrung, Ia Grang, Ia Pech, and Ia Ba communes and Ia Kha commune-level town in 2020 and all cases were successfully treated. The district completed the vaccination campaign against diphtheria in all communes and town with the completion rate reaching 98.1%[132]. In addition, some common diseases in the district were recorded such as diarrhea, flu, sore throat, and sinusitis.

[128] Ia Grai DPC (2020a)

[129] Ia Grai District Statistics Office (2021)

[130] Ia Grai DPC (2020a)

[131] Ia Grai DPC (2020a)

[132] Ia Grai DPC (2020a)

9.4.4 Education

In the school year of 2020 - 2021, Ia Grai district has 47 schools in total (51.1% or 24 schools meeting national education standards[133]), with 868 classes (a decrease of 20 classes compared to school year of 2019-2020), and 24,928 pupils (including 12,517 female pupils and 12,411 males pupils), in which 12,729 pupils or 51.1 % were of ethnic minorities (see Table 9.21). In addition, there are also three upper secondary schools in Ia Grai district, which are under the management of the Gia Lai Department of Education and Training.

Table 9.21 Education System in Ia Grai District in the School Year 2020-2021

Educational level	Number of Schools	Number of Classes	Number of Pupils by Gender		Number of Pupils by Ethnicity		Total Number of Pupils
			Male	Female	Kinh	Ethnic minority	
Kindergarten	15	237	2,928	2,956	2,813	3,071	5,884
Primary	17	422	5,822	5,605	5,215	6,212	11,427
Lower secondary	15	189	3,661	3,956	4,171	3,446	7,617
Total	**47**	**868**	**12,411**	**12,517**	**12,199**	**12,729**	**24,928**

Source: Ia Grai DPC (2021b)

In the school year 2020-2021, the district had 1,034 teachers (191 teachers at kindergarten level, 527 teachers at primary level, and 316 teachers at lower secondary level), 119 school managerial staff (42 staff at kindergarten level, 50 at primary level, and 27 at lower secondary level), and 73 school staffs (five people at kindergarten level, 34 at primary level, and 34 people at lower secondary level)[134].

Challenges that the district's education sector are encountering are lack of teachers at the kindergarten, primary, and secondary levels (214 teachers for kindergartens, 71 for primary schools, and 43 for lower secondary schools) and inadequate classrooms. Although school facilities are relatively adequate for teaching and learning activities, some schools do not have enough classrooms for all-day learning programs.

9.4.5 Economy, Livelihoods and Employment

9.4.5.1 Economic Structure

In 2020, the total production value (at the constant 2010 price) in Gia Lai province was estimated at VND 10,244 billion, an increase of 12.5% compared to that in 2019. In which, the agriculture, forestry and fishery sector reached VND 4,120 billion, increasing 8.5%; construction - industry sector reached VND 3,427 billion, increasing by 12%; and trade - services sector reached 2,697 billion, increasing by 20%. The average annual income per capita reached VND 40.2 million, an increase of VND 6.2 million compared to 2015[135] but it is around 1.3 times lower than that at provincial level. The proportion of agriculture, forestry and fishery sector accounted for 38.9%; construction - industry sector accounted for 36.4%; and trade - services sector accounted for 24.7%.

[133] See futher Circular 19/2018/TT-BGDDT, Circular 17/2018/TT-BGDDT, and Circular 18/2018/TT-BGDDT on education quality control and recognition of meeting national standards for kindergartens, primary schools, and lower secondary and upper secondary schools respectively.

[134] Ia Grai DPC (2021b)

[135] Nguyen Van (2020)

9.4.5.1.1 Agriculture, Forestry, and Fishery

Agricultural production with the main crops such as coffee, cashew, rubber, pepper, and other short-term food crops plays an important role in the district economic structure. The total planted area of Ia Grai district in 2020 reached 48,840 ha, an increase of 0.1% compared with the same period of 2019. This includes 4,865.3 ha of cereals, 3,194.6 ha of starch crops, 994 ha of food crops, 127 ha of short-term industrial crops, 200 ha of other short-term industrial crops, 37,598 ha of long-term industrial crops, and 1,860.6 ha of fruit trees, medicinal plants, and other perennial crops. In addition, the food production increased by 2.4%, reached 22,428.7 tons[136].

Coffee is one of the focal perennial crops in the district. In 2020, the district replanted 498 ha of coffee plants; of which, local enterprises were responsible for 164 ha and the remaining 334 ha were planted by local households. The district applied innovative water-efficient irrigation practices in 400 ha of crops including over six ha of coffee, 240 ha of fruit trees, 30 ha of macadamia, 70 ha of pepper, and approximately 54 ha of vegetables and other crops. Many pests and diseases were recorded in local crops during 2020 such as fall armyworm affecting maize crops, coffee root mealybug, mosquito bug in cashew farming, and anthracnose infection in cashew plants.

The total number of cattle and poultry in 2020 reached 272,525 heads, an increase of 3% compared to 2019 (476 buffaloes, 14,610 cows, 36,000 pigs, 1,439 goats, 220,000 poultry, and 39,290 bee colonies). The district did not record any infectious animal diseases on buffaloes, cows, goats, and aquatic products, except the outbreak of African Swine Fever in Ia To commune from the beginning 2020 with total damage of 65 infected pigs weighted 3,628 kg.

The aquaculture area reached 403 ha, with a total production of 260 tons, an increase of 4% compared to 2019.

In 2020, Ia Grai district had recovered 153.7 ha of forestry land from local people, and planted 117.9 ha with 51,623 trees of many kinds[137]. The forest coverage rate in 2020 was 37.1%. Twelve campaigns on forest management and protection and forestry law dissemination were organised in Ia Grang, Ia Pech, Ia Chia, and Ia O communes with 699 participants. The district recorded one fire forest case in the forest area of 17,295 ha managed by the North Ia Grai Protection Forest Management Board, 27 cases of violation to Law of Forestry (an increase of six cases over 2019), and seven cases of forest destroy[138].

9.4.5.1.2 Industry

The district industry and construction value in 2020 was estimated at VND 3,427 billion, of which the industry value reached VND 2,243 billion, an increase of approximately VND 182.3 billion compared to VND 2,060.7 billion in 2019 and the construction value was VND 1,184 billion, an increase of VND 185.7 billion over 2019[139]. Some main industrial products included mechanical products (393 tons), construction stone (280,000 m^3), construction sand (11,200 m^3), capenter products (548 m^3), food milliong (23,815 tons), piped water (495,000 m^3), commercial electricity (2,763 million kWh), and microbiological manure (36,565 tons). By 2020, there were 111 non-state enterprises in Ia Grai district with 304 workers.

[136] Ia Grai DPC (2020a)

[137] Ia Grai DPC (2020a)

[138] Ia Grai DPC (2020a)

[139] Ia Grai DPC (2020a)

9.4.5.1.3 Trade and Services

Total retail and services in Ia Grai district in 2020 were about VND 2,786 billion, an increase of 18.8% compared to 2019. Some major retail products such as household goods, agricultural products, gasoline, fertilizers, and pesticides basically meet local needs[140].

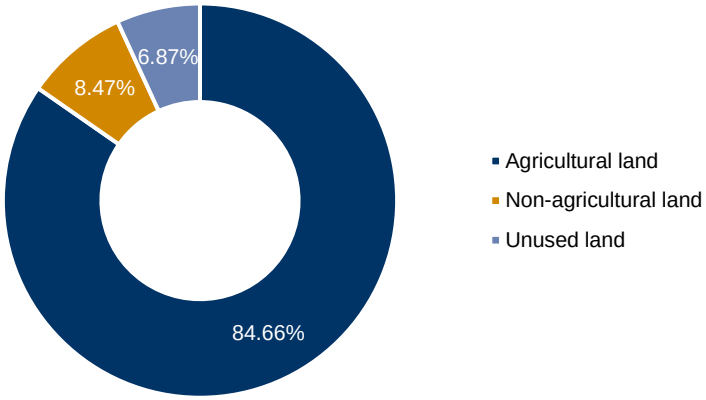
Ia Grai has many potentials for tourism development with diverse historical and cultural sites; however, in 2020, due to the impacts of COVID-19 pandemic, the number of tourists to the district reduced from 17,000 visitors in 2019 to 15,000 people, including 80 international tourists and 16,730 domestic visitors.

9.4.5.2 Main Types of Livelihoods

Land-based livelihoods are a main income source for local people. In recent years, the price of agricultural products has dropped resulting in the unemployment of workers at rubber plantations and occupational change among farmers. They are forced to migrate to work at the other provinces in the South. They mainly work in industrial parks or self-employ while those who keep relying on agricultural production have to switch from pepper to coffee and other fruit trees. In addition, livestock raising has not been developed. Regarding service sector, the circulation of goods is restricted due to the impact of the COVID-19 pandemic, reducing the growth rate of the sector[141].

9.4.6 Land Use

The total landmass of Ia Grai district in 2020 is 111,959.86 ha[142]. Agricultural land accounts for 84.7%. It surpasses other types of land in the district (see Figure 9.7). Meanwhile, non-agricultural land including lands for residency, security, defence, industrial zones, commercial services, non-agricultural production, extraction, infrastructure development, waste management, religion, office, graveyard, public use, and natural assets accounts for 8.5%. In addition, the remaining 6.9% of the total landmass is unused land[143].



Ia Grai PPC (2021a)

Figure 9.7 Land Use Structure of Ia Grai District 2020

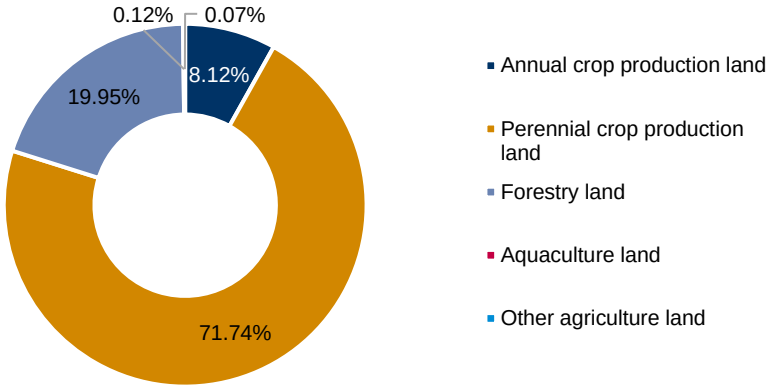
[140] Ia Grai DPC (2020a)

[141] ERM colsultation with Ia Grai DPC (2021)

[142] Ia Grai DPC (2021a)

[143] Ia Grai District Statistics Office (2021)

As for agricultural land, more than one third (71.7%) are for planting perennial trees. Around 20% are forestry land and 8.1% are for annual crops. The remaining (21.2%) are aquaculture land and other agricultural lands (see Figure 9.8).



Source: Ia Grai PPC (2021)

Figure 9.8 Agricultural Land Structure of Ia Grai District 2020

9.4.7 Future Socio-economic Development Planning

In the period 2020-2025, Ia Grai district strives to achieve the annual economic development rate of 11% and above and the average income per capita at VND 55.4 million per year[144].

In order to develop high-tech farming production for sustainable development, Gia Lai's agricultural extension program[145] for the period 2021-2025 with total investment of VND 100 billion is approved with a focus on the main following activities:

- Develop 100 hectares of vegetables and flowers of all kinds, applying scientific and technological advances in production;
- Form about 2,000 ha of concentrated vegetable production areas in accordance to VietGAP and Global Good Agricultural Practice (GlobalGAP) standards.
- Organising about 300 classes on agricultural techniques and good agricultural practices for farmers, especially those who reside in remote and ethnic minority areas;
- Converting 500 hectares of inefficient rice land to crops with higher economic value such as biomass maize, vegetables, beans, and fruit trees in order to improve land use efficiency;
- Building 34 agricultural extension models on the use of machinery in agricultural production; and
- Exploiting the potentials of water surface to strongly develop freshwater aquaculture on an area of 4,400 m^3 in the system of rivers, streams and reservoirs.

In addition, Ia Grai district continues to pay attention to exploiting the potential advantages of the land rich in organic agriculture, ecological diversity, and cultural depth to create tourism products and promote tourism development, stimulating socio-economic growth.

[144] Minh Ly and Ksor Tuoi (2020)

[145] Hong Diep (2021)

9.4.8 Supporting Programs for Livelihood Development and Ethnic Minority Development

In 2020, Ia Grai DPC actively implemented ethnic policies to support ethnic minority communities in the localities on socio-economic development[146] (see Table 9.22).

Table 9.22 Implemented Ethnic Minority Policies in Ia Grai District 2020

No.	Document	Description
1	Decision No. 755/QD-TTg dated 20 May 2013 by the Prime Minister	Approving policies to support residential land, production land, and domestic water for poor ethnic minority households and poor households in extremely difficult villages.
2	Decision No. 498/QD-TTg dated 14 April 2015 by the Prime Minister	Approving the project to reduce child marriage and consanguineous marriage in ethnic minority areas in the period of 2020-2025.
3	Decision No. 12/2018/QD-TTg dated 6 March 2018 by the Prime Minister	Approving on selection criteria for recognition of prestigious people and policies for prestigious people among ethnic minorities.
4	Decision No. 2085/QD-TTg dated 31 October 2016 by the Prime Minister	Approving specific policies to support socio-economic development in ethnic minority and mountainous areas for the period 2017-2020.

Source: Ia Grai DPC (2021)

9.4.9 Archaeological, Cutural Heritage, and Religious Sites

Some famous cultural and historical sites in the localiy are Mo waterfall (Ia Khai commune), Nine Floor waterfall (Ia Ba commune), Le Kim waterfall (Ia To commune), Se San 4 hydroelectric lake village (Ia O commune), pine hill area (Ia Der commune), Chu Nghe Victory (Ia Krai commune), and A Sanh wharf (Ia Khai commune) (see Figure 9.9).

Source: Internet

Figure 9.9 Nine Floor Waterfall at Ia Ba Commune, Ia Grai District

[146] Ia Grai DPC (2020a)

9.5 Overview of Communes within the Area of Influence

9.5.1 Ia Pech Commune

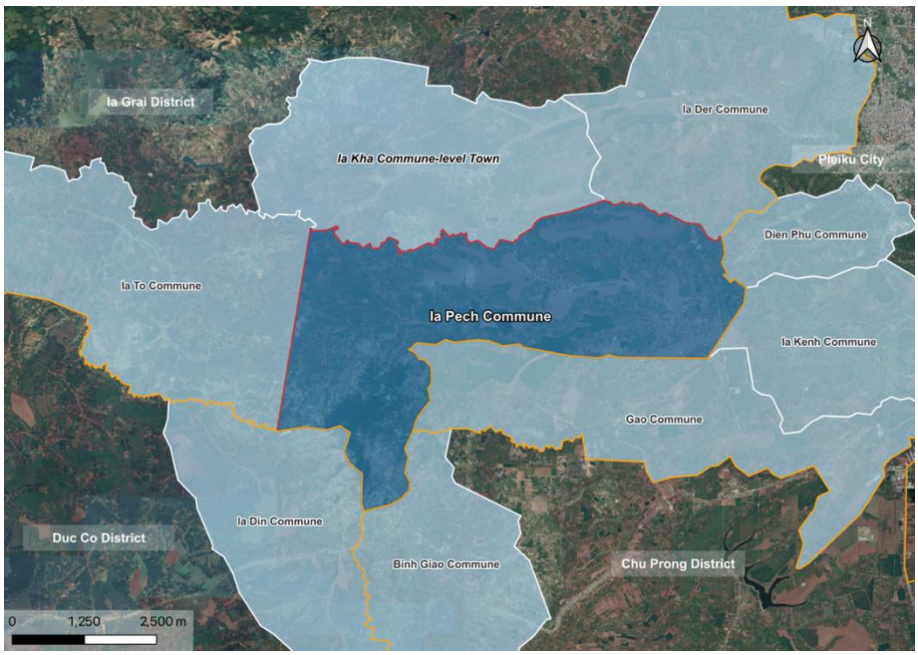
Ia Pech commune is located in the Southeast of Ia Grai district, about 7km away from the centre of Ia Kha commune-level town. In term of geographical location, Ia Pech commune borders Ia Der commune and Ia Kha commune-level town to the North, Duc Co and Chu Prong districts to the South, Ia To commune and a part of Ia Kha commune-level town to the West, and a part of Ia Der commune of Ia Grai district and Dien Phu commune of Pleiku city to the East (see Figure 9.10).

The commune has seven administrative villages including Nang Long-Osor, Sat Tau, O Gia, De Chi, Ku Tong, O Grang, and O Pech. Of which, O Grang and De Chi villages border natural forests.

Table 9.23 Ia Pech Commune Overview

Ia Pech Commune	
Number of villages	7
Area	93 km^2
Population	5,380 people
Poverty proportion	2.7% (35 households)
Main ethnic groups	Gia Rai and Kinh
Main religions	Buddhism, Catholicism, and Protestantism

Source: Ia Grai District Statistics Office (2021); Ia Grai DPC (2020)



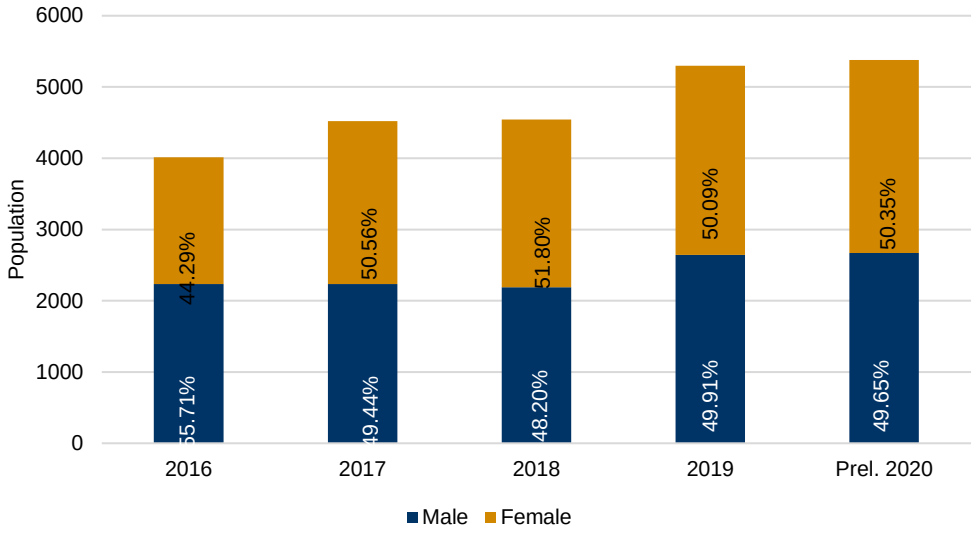
Source: QGIS

Figure 9.10 Geographical Location of Ia Pech Commune

9.5.1.1 Demographic Information

Population

According to the population statistics 2020, Ia Pech commune had a total population of 5,380 people, an increase of 1.3% compared to that of 2016[147]. Average household size of the whole commune was estimated at 4.3 people. The male and female distribution rate was 49.7% and 50.3% respectively (see Figure 9.11). The communal population density was 59 people/km^2 in 2020, lower than the district average (96 people/km^2)[148].



Source: Ia Grai District Statistics Office (2021)

Figure 9.11 Population Distribution by Gender in Ia Pech Commune 2016-2020

Ethnicity

Ethnic minorities, mainly the Gia Rai indigenous minority group, accounted for 62.1% of the total population of the commune according to the statistical data 2020. Ia Pech commune has many ethnic groups living together and all people live in harmony and solidarity on the basis of respecting the individual cultural identities of each ethnic group. There is no conflict among ethnicities in this ethnicity-mixed commune (ERM's meeting with Ia Pech CPC, 28 August 2021).

Religion

In 2020, there were 148 households with 426 people following Catholicism; 51 households with 184 people following Protestantism; and eight households with 30 people following Buddhism[149].

9.5.1.2 Healthcare Facilities and Programs

Ia Pech commune has a health station with four staff providing basic health care services to local people. In 2020, there were two cases of diphtheria recorded in Ku Tong and O Pech villages. The district health center coordinated with the CPC to organise two rounds of diphtheria vaccination for the whole commune population with 8,428 doses. Statistically, there were 3,903 visits for medical

[147] Ia Grai District Statistics Office (2021)

[148] Ia Grai District Statistics Office (2021)

[149] Ia Pech CPC (2020)

examination and treatment at Ia Pech commune health station. The rate of children under one year old receiving fully vaccination reached 98.6% or 144 out of 146 children.

Since July 2021, Ia Pech was classified as Zone I[150] commune. Free health insurance has been no longer valid to all local people, except for children under six years old and those who belong to poor and near poor households or households with meritorious services to the revolution (KII, female respondent, Women's Union of Ia Pech Commune, 31 August 2021). The commune authorities encounter many difficulties in mobilising local people to voluntarily register health insurance program due to their limited awareness on health care and low income conditions (ERM's meeting with Ia Pech CPC, 28 August 2021).

9.5.1.3 Education

In the school year 2020-2021, Ia Pech commune had three schools with 63 teachers from kindergarten to lower secondary level and 46 classes with the total number of 1,160 pupils[151] (see Table 9.24). The commune does not have a school at upper secondary level. Pupils travel a distance of 12-13 km to attend an upper secondary school in the district (KII, male respondent, Gia Rai ethnicity, O Gia village, Ia Pech commune, 30 August 2021).

Table 9.24 Education System in Ia Pech Commune in the School Year 2020-2021

Level	Number of Schools	Number of Classes	Number of Teachers	Number of Pupils
Kindergarten	1	11	12	435
Primary	1	28	30	413
Lower secondary	1	7	21	312
Total	**3**	**46**	**63**	**1,160**

Source: Ia Grai District Statistics Office (2021)

9.5.1.4 Economy, Livelihoods and Employment

- Agriculture, Forestry, and Fishery

[150] Zone I communes in ethnic minority and mountainous areas are communes having the percentage of ethnic minority households in the total number of households at 15% or more and meeting one of two requirements listed below: (1) Having a poverty rate of less than 10%; or (2) Being recognised as meeting new rural standards.

Zone III communes in ethnic minority and mountainous areas are communes having the percentage of ethnic minority households in the total number of households living stably in the community at 15% or more; which have still not been recognised as meeting new rural standards; and have one of the following two criteria: (1) Having a poverty rate of 20% or higher (particularly in communes in the Mekong River Delta with a poverty rate of 15% or higher or more than 150 poor households are ethnic minority households); (2) Having a poverty rate of 15% to less than 20% (particularly for communes in the Mekong River Delta, the poverty rate ranges from 12% to less than 15%) and meeting one of the following criteria: (a) More than 60% of the total poor households in the commune are ethnic minority households; (b) 20% or more of ethnic minority people between the ages of 15 and 60 years cannot read or write in the common language; (c) The number of employees who have jobs but have not received training for three months or more accounts for more than 80% of the total number of employed workers; or (d) The road from the district center to the commune center is more than 20 km long, of which more than 50% of the total length of the roads have not been asphalted or concreted.

Zone II communes belonging to ethnic minorities and mountainous areas are the remaining communes after the Zone III and Zone I communes have been identified.

[151] Ia Grai District Statistics Office (2021)

In 2020, the total cultivated area was estimated at 3,601 ha. The commune implemented two models of drip irrigation for coffee and black pepper invested by Gia Lai Department of Science and Technology. There were also several cultivation projects approved by the Ia Grai DPC to be implemented in the commune (six projects of growing aloe Vera in an area of 1.4 ha in De Chi and O Grang villages, four projects of growing mushrooms in an area of 1 ha, and other projects of growing macadamia in an area of 30 ha, Thai jackfruit and avocado in an area of 126.5 ha), contributing to job creation for people as well as local economic development. In addition, the commune Farmer's Union has implemented some livelihood development models with the approach "good farmers guide others in practicing livelihood models". The model "mulberry and silkworm farming" has been recently piloted in some Kinh households and will be replicated in other households in the upcoming time to improve their land-based livelihoods (ERM's meeting with Ia Pech CPC, 28 August 2021).

The total herd of cattle and poultry in the commune in 2020 was 11,247 heads including 10 water buffaloes, 1,225 cows, 150 goats, 475 pigs, 8,347 chickens and ducks, 890 dogs, and 150 swarms of bees.

In terms of forestry land, there were 870.89 ha of land planned for forest planting managed by Ia Pech CPC in 2020 (no change in comparison to 2019). Of which, 607.61 ha have been covered by forest, while 263.28 ha have not been planted yet.

In 2020, the aquaculture production area of the commune was 10 ha.

- Industry, Trade, and Services

Due to the impactS of the COVID-19 pandemic, in 2020 the industry, trade, and service sector of the commune was severely affected. Currently, the commune has 97 small private business establishments trading in food, beverage services, groceries, motorbike repair, and mechanical garages[152].

According to statistics 2020[153], the whole commune had three business establishments in agricultural products; two establishments in construction materials; two petrol and oil stores; five motorcycle repair shops; one electromechanical repair shop; two shops repairing broken saws and lawn mowers; one karaoke service business household; two households running Internet service business; one mini football court business household; 25 food service households, and 53 grocery stores of all kinds.

- Main Livelihoods

The majority of local households rely on agricultural production with rice and coffee planting as main crops. For most rural households, land endowment plays a significant role in household economic development. Local land fund for cultivation and livestock raising is increasingly reduced because some households divide their cultivation land for children and some sell a part of their land for household expenditure. As a result, in the recent years, local people tend to find employment in Binh Duong and Ho Chi Minh City due to lack of production land.

In addition, local farmers still struggle with science and technology application in farming practices due to limited educational background and embedded traditional cultivation customs. Many households still maintain self-sufficiency living while changes in climatic and land conditions significantly affects their agricultural productivity and land-based livelihoods.

Local villagers collect bamboo shoots and honey by season in natural forests, which is about 10km away from the commune centre and not near to the Project site. In the upcoming time, the commune authorities wish to develop herb planting under the forest canopy to improve local livelihood (ERM's meeting with Ia Pech CPC, 28 August 2021).

[152] Ia Pech CPC (2020)

[153] Ia Pech CPC (2020)

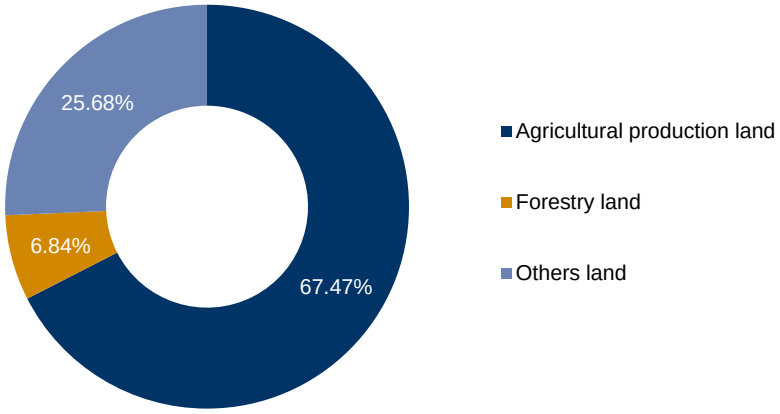
According to statistical data provided by the Ia Pech CPC (2020), the average annual income per capita of the whole commune reached VND 26 million, which is much lower than that at the district level (VND 40.2 million) and at the provincial level (VND 51.9 million).

9.5.1.5 Infrastructure and Public Services

The inter-commune road system has been relatively in good conditions but 90% of inter-village roads (1,885 km) are muddy and slippery that need to be improved. All seven villages of the commune are connected to the national electricity grid and 100% of local households access electricity. In term of water supply, water drops taken from mainly from underground veins and underground water from dug wells are the main sources for local use. All 100% of local household accessing hygienic water. There is no market in the commune due to low population density. However, local small businesses meet local needs and the commune is quite near to the district centre so local people can easily access the official market for higher shopping needs. Solid waste is mainly treated by burning or filling because the waste collection services have been still unavailable in the locality (ERM's meeting with Ia Pech CPC, 28 August 2021).

9.5.1.6 Land Use

The total natural landmass of the Ia Pech commune was 9,252.4 ha, making up 8.1% of Ia Grai district's natural land area. According to the land use status of Ia Grai district by the end of 2020, the communal total landmass included 6,317.7 ha of agricultural production land, 1,337.8 ha of forestry land, and 1,596.9 ha of other types of land[154] (specially used land, homestead land, and unused land) , accounting for 67.5%, 25.7%, and 6.8% respectively (see Figure 9.12).



Source: Ia Grai District Statistics Office (2021)

Figure 9.12 Land Use of Ia Pech Commune 2020

9.5.1.7 Archaeological, Cutural Heritage, and Religious Sites

There is no cultural or historical site in Ia Pech commune (ERM's meeting with Ia Pech CPC, 28 August 2021). For Gia Rai ethnic communities, forest plays an important role in both their physical and spiritual life in the commune. Particularly, the ceremony of worshiping the Forest God is traditionally organised in Ia Cor spring located in O Grang and De Chi village, which is a long-standing traditional ceremony of the Gia Rai people in the commune[155] (see Figure 9.13).

[154] Ia Grai District Statistics Office (2021)

[155] The Nam (2021)

Source: Internet

Figure 9.13 The Ceremony of Worshiping the Forest God in Ia Pech Commune

9.5.2 Ia Kha Commune-Level Town

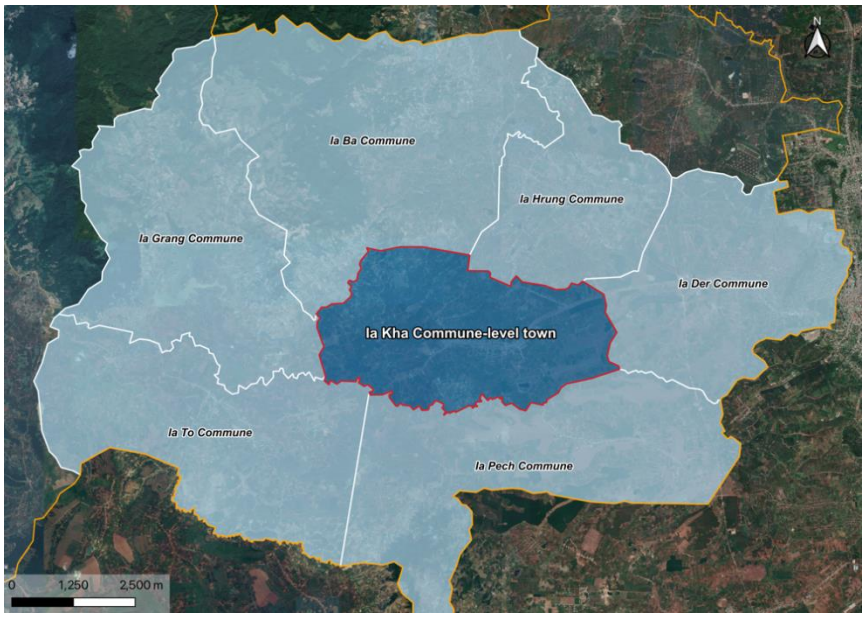
Ia Kha commune-level town is the centre of Grai district. Ia Kha commune-level town borders Ia Hrung and Ia Grang communes to the North, Ia Pech commune to the South, Ia Der commune to the East, Ia Grang and Ia To communes to the West. Regarding the town's administrative units, the town has seven residential groups (from residential group 01 to residential group 07), and eleven villages namely Thang Trach 1, Thang Trach 2, Thang Quang, Village 1, Village 2, Village 3, Kep, Yam, B 'Rach, B'Re, and O Bo 1[156] (see Figure 9.14).

Table 9.25 Ia Kha Commune-Level Town Overview

Ia Kha Commune	
Number of villages	7
Area	29 km^2
Population	11,639 people
Main ethnic groups	Gia Rai and Kinh
Main religions	Buddhism, Catholicism, and Protestantism
Average income per capita	VND 29 million (2017)

Source: Ia Grai District Statistics Office (2021)

[156] Wikimapia (n,d)

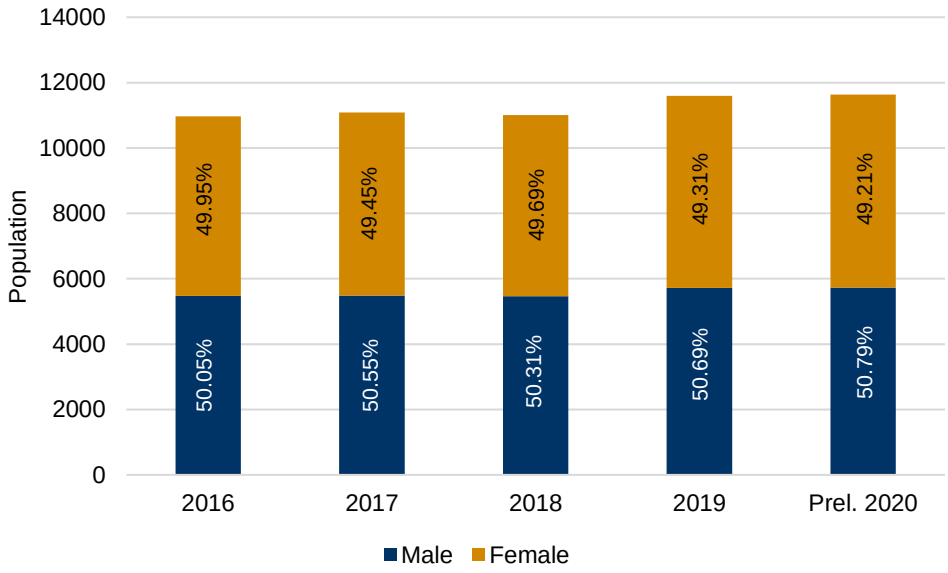


Source: QGIS

Figure 9.14 Geographical Location of Ia Kha Commune-level Town

9.5.2.1 Demographic Information

According preliminary population statistics 2020, Ia Kha commune-level town had a total population of 11,639 people, an increase of 1.1% compared to that of 2016[157]. The male and female distribution rate was 50.8% and 49.2% respectively (see Figure 9.15). The population density of Ia Kha commune-level town was 401 people/km^2 in 2020, much higher than the district average (96 people/km^2)[158]. Ia Kha commune-level town is home to the majority of Gia Rai ethnic minority group. Buddhism is relatively popular with the highlight of the Ngoc Lai temple.



Source: Ia Grai District Statistics Office (2021)

[157] Ia Grai District Statistics Office (2021)

[158] Ia Grai District Statistics Office (2021)

Figure 9.15 Population Distribution by Gender in Ia Kha Commune-Level Town 2016-2020

9.5.2.2 Healthcare Facilities and Programs

Regarding the town's healthcare system, Ia Kha medical center and Ia Grai Health Center are both located in the Ia Kha commune-level town[159].

9.5.2.3 Education

In the school year 2020-2021, Ia Kha commune-level town had five schools with 132 teachers from kindergarten to lower secondary level and 92 classes with the total number of 2,514 pupils[160] (see Table 9.26). In addition, one upper secondary school is located in Ia Kha commune-level town, which is under the management of the Department of Education and Training of Gia Lai province.

Table 9.26 Education System in Ia Kha Commune-Level Town in the School Year 2020-2021

Level	Number of Schools	Number of Classes	Number of Teachers	Number of Pupils
Kindergarten	1	18	17	420
Primary	2	52	69	1,310
Lower secondary	2	22	46	784
Total	**5**	**92**	**132**	**2,514**

Source: Ia Grai District Statistics Office (2021)

Some schools in the locality includes Huynh Thuc Khang upper secondary school, Hung Vuong lower secondary school, Ia Grai District Boarding School, Kim Dong Primary School, Nguyen Hue Primary School, Kindergarten March 17, and Hoa Mi Kindergarten[161].

9.5.2.4 Economy, Livelihoods and Employment

Previously, Ia Kha's economy mainly relied on agriculture. However, in recent years, the town's economic structure has changed markedly. Specifically, the trade and service network in the town has been built, consolidated, and occupied a high proportion in the town's economic structure. In 2017, trade and service sector took up 46% while industry and construction sector accounted for 39.7% and agriculture-forestry only occupied 14.3% in the town's economic structure. Along with the development of industries, the per capita income has been increasing, estimated at VND 29 million per year in 2017[162].

9.5.2.5 Infrastructure and Public Services

Ia Kha commune-level town has developed comprehensively in all socio-economic fields, particularly in infrastructure. Specifically, the town has been invested in building a centralised administrative area, upgrading and expanding traffic roads, installing drainage systems, public lighting, road lights, and park

[159] Wikimapia (n,d)

[160] Ia Grai District Statistics Office (2021)

[161] Wikimapia (n,d)

[162] Minh Thoan & Phuong Loc (2017)

construction. The roads system in the town have been built and upgraded to make the traffic network in the town seamless and convenient for local people's travel needs[163].

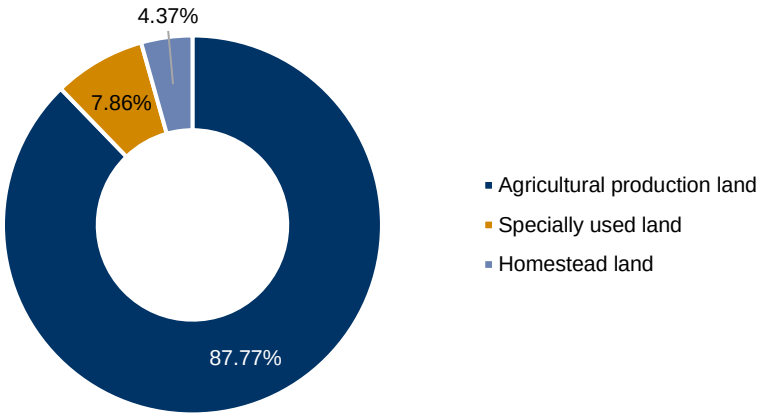
Currently, over 80% of the roads in Ia Kha commune-level town are basically solidified[164], serving well for people's travel, business and economic development with some prominant trafic route of the town such as:

- Hung Vuong Street (Provincial Road 664) is the main road connecting the town with other communes and districts;
- The Provincial road 664 - Sesan 4 is the second route of provincial road 664 used for large trucks over ten tons;
- Nguyen Du Street connects the town and Ia Pech commune;
- Cach Mang Thang Tam Street connects Ia Ba and Ia Hrung communes;
- Thi Sach Street connects the district production area and several small roads.

Currently, the traffic throughout the town is being repaired, with lines and sidewalks for many streets. The whole town is equipped with two trafic light spot and many yellow light spots placed in important intersections connecting with other communes[165].

9.5.2.6 Land Use

The total natural landmass of the Ia Kha commune-level town was 2,923.27 ha, making up 2.6% of Ia Grai district's natural land area. According to the land use status of Ia Grai district by the end of 2020, the communal total landmass included 2,365.37 ha of agricultural production land, 211.86 ha of specially used land, and 264.03 ha of homestead land[166] (see Figure 9.16). Notably, Ia Kha commune-level town has no area of forestry and aquaculture production.



Source: Ia Grai District Statistics Office (2021)

Figure 9.16 Land Use of Ia Kha Commune-Level Town 2020

[163] Minh Thoan & Phuong Loc (2017)

[164] Ha Duc, R'pien (2019)

[165] Wikimapia (n,d)

[166] Ia Grai District Statistics Office (2021)

9.5.2.7 Archaeological, Cutural Heritage, and Religious Sites

Some prominent cultural heritage as well as archaeological sites are Ku Toong lake, the Waterfall stream, the Ia Grai District Square, Residential 1 park, Residential 14 park, Residential 7 park, and Ngoc Lai temple[167] (see Figure 9.17). The distantce from the closet cultural heritage site (Ngoc Lai temple) to the Project component is approximately 5.5 km.

Source: Internet

Figure 9.17 Ngoc Lai Temple in Ia Kha Commune-Level Town

9.5.3 Ia Der Commune

Ia Der is a mountainous commune of Ia Grai district with the total natural area of 6,073.5 ha. Ia Der commune has 13 villages (see Table 9.27). Ia Der commune borders with Pleiku city and other communes of Ia Grai district, so it is convenient for socio-economic development. Ia Der commune borders Ia Sao commune to the North, Ia Pech commune to the South, Ia Hrung and Ia Kha commune-level town to the West, and Pleiku city to the East[168] (see Figure 9.18).

Table 9.27 Ia Der Commune Overview

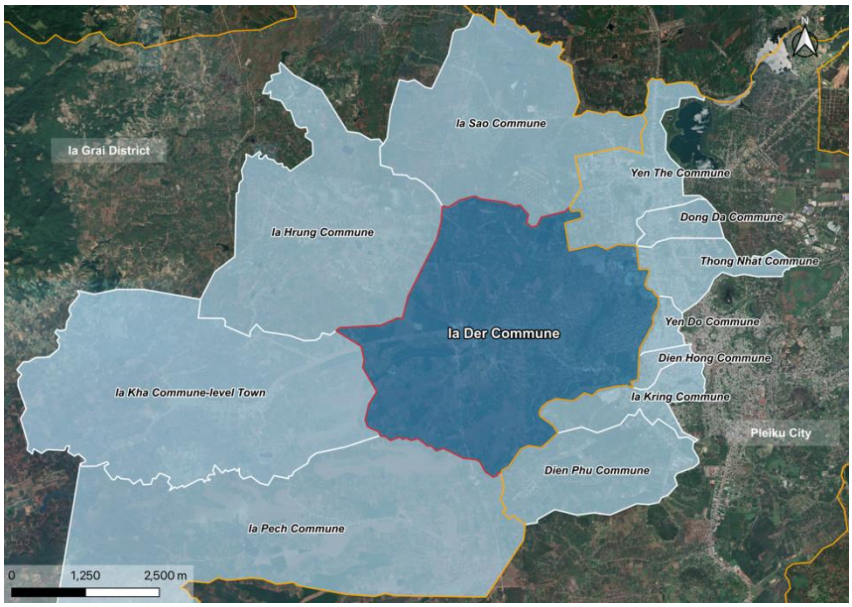
Ia Der Commune	
Number of villages	13
Area	61 km^2
Population	11,573 people
Poverty proportion	2.9% (2020)
Main ethnic groups	Gia Rai and Kinh
Main religions	Buddhism, Catholicism, and Protestantism

[167] Wikimapia (n,d)

[168] Ia Grai District Statistical Office (2021)

Average income per capita 2020	VND 41 million

Source: Ia Grai District Statistics Office (2021)



Source: QGIS

Figure 9.18 Geographical Location of Ia Der Commune

9.5.3.1 Demographic Information

According preliminary population statistics 2020, Ia Der commune had a total population of 11,573 people, an increase of 1.3% compared to that of 2016[169]. The male and female distribution rate was 48.1% and 51.9% respectively (see Figure 9.19). The communal population density was 190 people/km^2 in 2020, about twice as the district average (96 people/km^2)[170]. The Gia Rai ethnic group accounts for 92% of the total population of the commune[171].

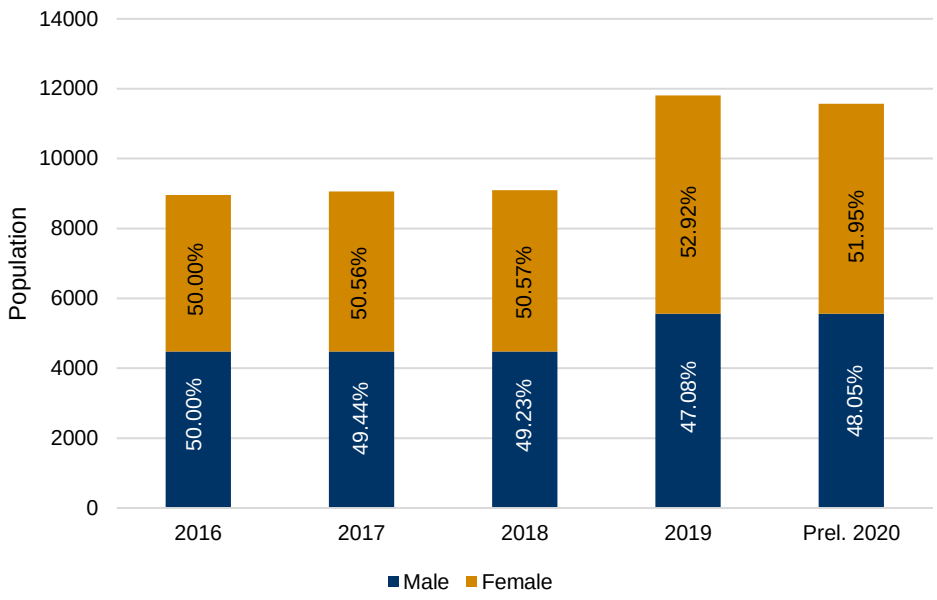
The Plei Breng Evangelical Chapter (Vietnam - Southern Protestant Church) in Plei Breng 1 village of Ia Der commune currently has more than 1,000 Gia Rai ethnic followers in three villages of Breng 1, 2, and 3[172].

[169] Ia Grai District Statistics Office (2021)

[170] Ia Grai District Statistics Office (2021)

[171] Ia Grai District Statistical Office (2021)

[172] Thuy Dung (2020)



Source: Ia Grai District Statistics Office (2021)

Figure 9.19 Population Distribution by Gender in Ia Der Commune 2016-2020

9.5.3.2 Healthcare Facilities and Programs

The commune only have one commune health station located at Blang 1 village[173].

9.5.3.3 Education

In the school year 2020-2021, Ia Der commune had four schools with 90 teachers from kindergarten to lower secondary level, and 68 classes with the total number of 1,701 pupils[174] (see Table 9.28). The commune does not have any school at upper secondary level.

Table 9.28 Education System in Ia Der Commune in the School Year 2020-2021

Level	Number of Schools	Number of Classes	Number of Teachers	Number of Pupils
Kindergarten	1	16	12	365
Primary	2	42	56	953
Lower secondary	1	10	22	383
Total	**4**	**68**	**90**	**1,701**

Source: Ia Grai District Statistics Office (2021)

9.5.3.4 Economy, Livelihoods and Employment

In the period 2015-2020, Ia Der commune achieved a number of achievements in economic development, especially in livestock production. In the husbandry sector, the annual targets always met or exceeded the annual plan. In 2020, the total herd of cattle and poultry had 27,915 heads[175].

[173] Ia Grai district health center statistical data (n,d)

[174] Ia Grai District Statistics Office (2021)

[175] Thanh Nhat (2020)

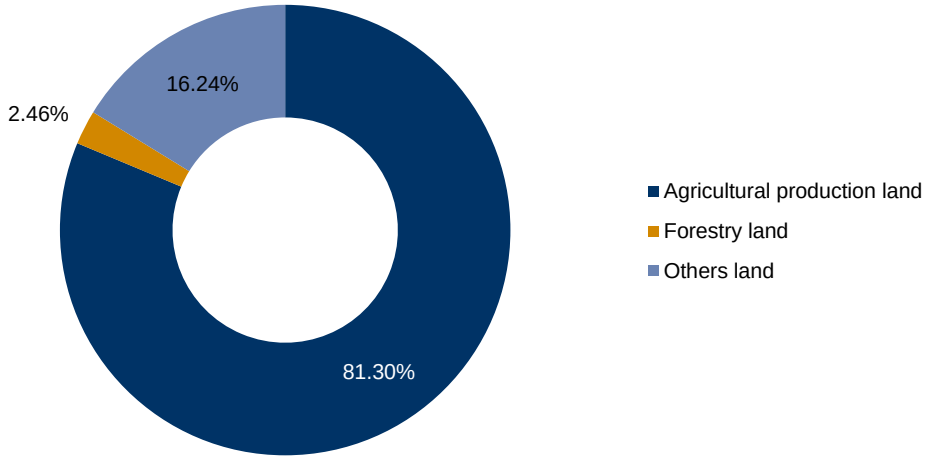
The budget revenue in the commune increased by 24.3% per year on average. The per capita income of the commune in 2020 reached VND 41 million per person, an increase of VND 14 million per person compared to that in 2015. Meanwhile, the poverty rate of the commune in 2020 decreased to 2.9%.

9.5.3.5 Infrastructure and Public Services

In the period 2015 - 2020, infrastructure in Ia Der commune was invested to be upgraded and expanded. About 14 km of roads were repaired with the total investment capital in the area at nearly VND 29.8 billion. The Commune Party Committee has focused on implementing the National Target Program for New Rural Development[176]. Thereby, the commune was recognised as meeting new rural standards in 2018 and two ethnic minority villages met new rural standards[177].

9.5.3.6 Land Use

The total natural landmass of the Ia Der commune was 6,073.5 ha, making up 5.4% of Ia Grai district's natural land area. According to the land use status of Ia Grai district by the end of 2020, the communal total landmass included 4,938.0 ha of agricultural production land, a small amount of 149.0 ha of forestry land, and 986.5 ha of other types of land[178] (specially used land, homestead land, and unused land) (see Figure 9.20).



Source: Ia Grai District Statistics Office (2021)

Figure 9.20 Land Use of Ia Der Commune 2020

9.5.3.7 Archaeological, Cutural Heritage, and Religious Sites

An cultural attraction in the commune is Jut village - a craft village of making ethnic musical instruments[179], the 30 years old three-leaf pine forest (see Figure 9.21).

[176] National Target Program for New Rural Development: The program aims to improve the economy and living standards of Vietnam's rural areas. To be recognised as a "new rural commune", there are 19 main criteria to be compulsorily met, including (1) planning and planning implementation, (2) communication information, (3) irrigation, (4) electricity, (5) school, (6) cultural facilities and infrastructure, (7) rural market, (8) post, (9) residential houses, (10) income, (11) household poverty, (12) labour force structure, (13) type of production organisations, (14) education, (15) health care, (16) cultural lives, (17) environment, (18) system of social organisation, (19) security and social order.

[177] Thanh Nhat (2020)

[178] Ia Grai District Statistics Office (2021)

[179] Gody.vn (n,d)

Source: Internet

Figure 9.21 Jut Village in Ia Der Commune

9.5.4 Ia Hrung Commune

9.5.4.1 Overview of Ia Hrung Commune

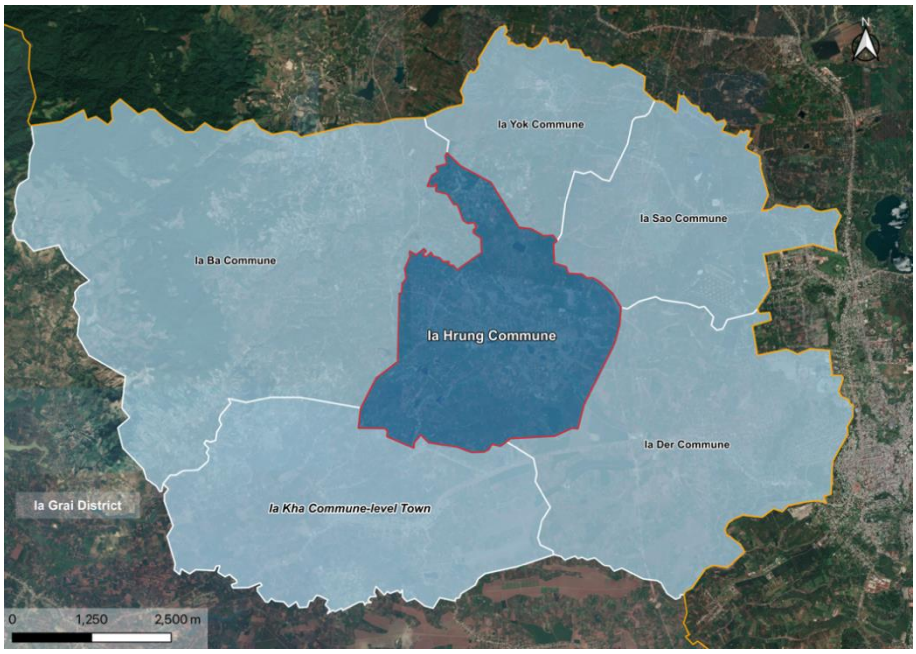
Ia Hrung commune is a mountainous commune of Ia Grai district. Ia Hrung commune boders Ia Yok and Ia Sao commune to the North, Ia Kha commune-level town to the South, Ia Ba commune to the West, and Ia Der commune to the East (see Figure 9.22).

Regarding the administrative units of the commune, there are five ethnic minority villages (namely Grit village, Mai village, Me village, Ngai Ngo village, Ut 1 village) and seven Kinh ethnicity dominant village (namely village 1,2,3,4, Kim Thanh village, Thanh Ha 1, and Thanh Ha 2).

Table 9.29 Ia Hrung Commune Overview

Ia Hrung Commune	
Number of villages	12
Area	43 km^2
Population	5,373
Poverty proportion	6.7% (2018)
Main ethnic groups	Gia Rai and Kinh
Main religions	Buddhism, Catholicism, and Protestantism
Average income per capita 2017	VND 40 million

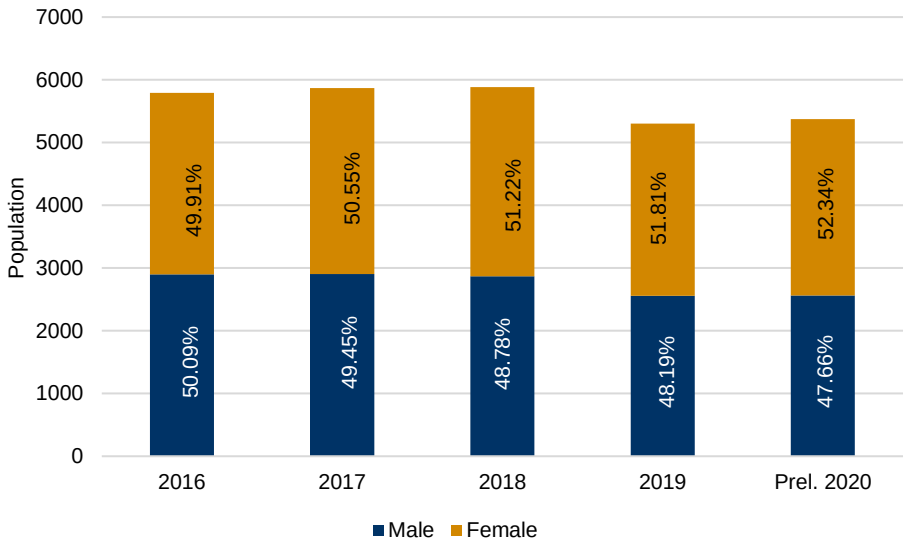
Source: Ia Grai District Statistics Office (2021)



Source: QGIS

Figure 9.22 Geographical Location of Ia Hrung Commune

According preliminary population statistics 2020, Ia Hrung commune had a total population of 5,373 people, a decrease of nearly 1% compared to that of 2016[180]. The male and female distribution rate was 47.7% and 52.3% respectively (see Figure 9.23). The communal population density was 125 people/km^2 in 2020, slightly higher than the district average (96 people/km^2)[181].



Source: Ia Grai District Statistics Office (2021)

Figure 9.23 Population Distribution by Gender in Ia Hrung Commune 2016-2020

[180] Ia Grai District Statistics Office (2021)

[181] Ia Grai District Statistics Office (2021)

By 2017, the population of ethnic minorities in the commune reached more than 500 households or over 2,000 people, accounting for about 34% of the entire commune's population living in five ethnic minority villages. They mostly are of Gia Rai ethnicity[182].

9.5.4.2 Healthcare Facilities and Programs

Ia Hrung commune has one communal health station which is one of the 222 communal health stations and health centers in Gia Lai province that recieve internet connection from Viettel and vaccination app[183].

9.5.4.3 Education

In the school year 2020-2021, Ia Hrung commune had three schools with 86 teachers from kindergarten to lower secondary level, and 60 classes with the total number of 1,737 pupils[184] (see Table 9.30). The commune does not have any school at upper secondary level.

Table 9.30 Education System in Ia Hrung Commune in the School Year 2020-2021

Level	Number of Schools	Number of Classes	Number of Teachers	Number of Pupils
Kindergarten	1	11	13	345
Primary	1	30	30	714
Lower secondary	1	19	43	678
Total	**3**	**60**	**86**	**1,737**

Source: Ia Grai District Statistics Office (2021)

9.5.4.4 Economy, Livelihoods and Employment

By 2017 statistics, Ia Hrung commune has about 2,700 ha of coffee, more than 200 ha of rice, over 80 ha of pepper, and 62 ha of rubber. Regarding the number of cattles, there were over 1,500 cows, about 7,000 bee colonies, and 25,000 poultry. To build a specialised farming area for sustainable industrial crops, people in Ia Hrung commune have invested a lot of money, applied scientific and technical advances to crop production. The whole commune has nearly 200 good production and business farmers. The average annual income per capita 2017 is VND 40 million[185].

In 2017, Ia Hrung commune met all of the 19 required criteria in new rural construction program. Reducing poverty rate and increasing income for local people are key tasks in constructing rural area. Hence, the commune increased investment sources to reduce poverty according to the new criteria of multidimensional poor households. As a result, the poverty rate of the commune in 2018 was 6.7%, a significant decrease compared to the figure of 29% in 2011[186].

[182] Hoang Minh (2017)

[183] VNreview (2017)

[184] Ia Grai District Statistics Office (2021)

[185] Gia Lai Newspaper (2017)

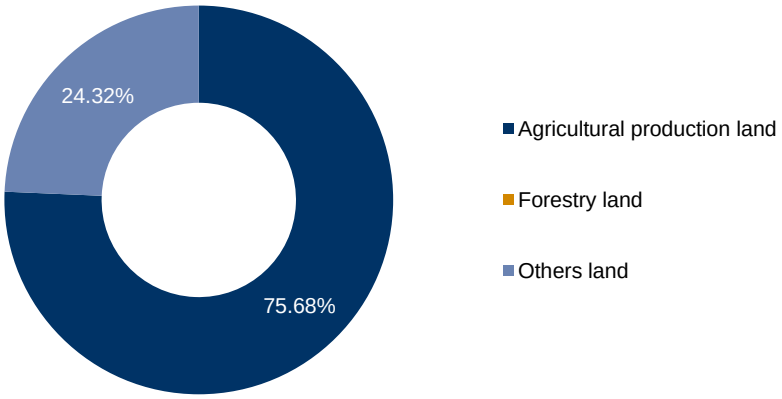
[186] Kim Chau – Le Thu – Dang Tra (2018)

9.5.4.5 Infrastructure and Public Services

The whole commune has hardened 12 km of communal and inter-commune roads; more than 16 km of village roads; 13 km of alleys, and 14 km of main roads in the field. All schools have national standard facilities; 100% of villages have cultural houses and places for community activities[187].

9.5.4.6 Land Use

The total natural landmass of the Ia Hrung was 4,581.9 ha, making up 4.1% of Ia Grai district's natural land area. According to the land use status of Ia Grai district by the end of 2020, Ia Hrung total landmass included 3,467.5 ha of agricultural production land, and 1,114.4 ha of other types of land[188] (specially used land, homestead land, and unused land). Ia Hrung does not have forestry land (see Figure 9.24).



Source: Ia Grai District Statistics Office (2021)

Figure 9.24 Land Use of Ia Hrung Commune by 2020

9.5.4.7 **Archaeological, Cultural Heritage, and Religious Sites**

There is no available information related to cultural or historial sites in Ia Hrung commune.

9.6 Lliving Conditions of Surveyed Households

9.6.1 Demographic Information

9.6.1.1 Surveyed Population

The population of the 63 surveyed households is 290 people[189] (see Table 9.31). By geographical location, a large proportion of surveyed households (65.5% or 41 households with 190 people) are

[187] Phan Thuong and Phuong Loc (2018)

[188] Ia Grai District Statistics Office (2021)

[189] The surveyed 290 population include (1) those who are registered in the household record book and living in the households; (2) those who are registered in the household record book but are not currently living in the households; and (3) those who are not registered in the household record book but are currently living in the households.

In presenting the data, it is noticeable that people whose names are recorded in the formal household registration book (which has to be kept and continually updated in Vietnam) but who are not living with the family, are included in the demographic statistics but are not included in household expenditure and income statistics. This includes for example, females who have married recently and moved into a separate dwelling with their husbands, or those who are working in other cities/provinces and are not

residing in Nang Long-Osor village[190], 22.4% (15 households with 65 people) in Sat Tau village[191], and 12.1% (seven households with 35 people) in O Gia village[192].

These 63 households are potentially affected households. Out of these 63 households, 23 households are affected by land acquisition. Further details are discussed in 9.6.10.1

Table 9.31 Surveyed Households and Population by Village

Province	District	Commune	Village	All Surveyed Households (N=63)		All Surveyed Population (N=290)	
				N	%	N	%
Gia Lai	Ia Grai	Ia Pech	Nang Long-Osor	41	65.08	190	65.52
			Sat Tau	15	23.81	65	22.41
			O Gia	7	11.11	35	12.07
Total				**63**	**100.00**	**290**	**100.00**

Source: Socio-economic survey conducted by ERM, August 2021

9.6.1.2 Household Size

Analysis of family size has implications on quality of life including health, nutrition, educational attainment of children, social status of families as well as their ability to adequately cater for the needs of their families. Of the 63 surveyed households, the average household size is 4.6 people per household with the range of two to eight people per family (see Table 9.32 and Figure 9.25). This pattern is similar to Gia Rai group and Kinh group.

Household size of the surveyed households is higher than the average household at the district level (3.9 people per household) and commune level (4.3 people per household). The tradition of intergenerational cohabitating in extended families may have a direct impact on family size for the surveyed households.

Table 9.32 Average Household Size of the Surveyed Households

Household Size	Gia Rai Group (N=43)	Kinh Group (N=20)	All Surveyed Households (N=63)
Average Family Size (people)	4.60	4.60	4.60
Minimum Family Size (people)	3	2	2

contributing to household income or expenditure. However, those listed as students living in other areas are still included in household expenditure calculations and have been reported.

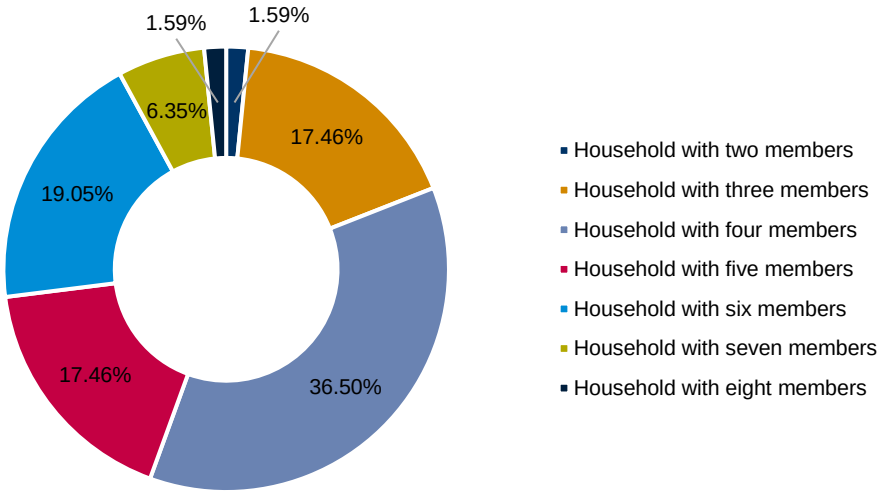
[190] Nang Long and Osor villages were merged into Nang Long-Osor in 2020 with around 110 households. Most of village households are of Gia Rai ethnicity and the remaining belong to Kinh and other ethnicities (KII, female respondent, Gia Rai ethnicity, Nang Long-Osor village, 27 August 2021).

[191] Sat Tau village has a total of 170 households including 50 Gia Rai households and 120 households from other ethnicities such as Bahnar, H're, Kinh, and others (KII, male respondent, Gia Rai ethnicity, Sat Tau village, 29 August 2021).

[192] O Gia village has a total of 133 households with around 300 people, including 90 Gia Rai households and 43 households of Kinh and Thai ethnicities KII, male respondent, Gia Rai ethnicity, O Gia village, 30 August 2021).

Household Size	Gia Rai Group (N=43)	Kinh Group (N=20)	All Surveyed Households (N=63)
Maximum Family Size (people)	8	7	8

Source: Socio-economic survey conducted by ERM, August 2021



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.25 Household Size of the Surveyed Households

9.6.1.3 Age Group

It is common to split the surveyed population into three broad age groups the under 15 years old group, the 15 to 60 brackets, and the over 60 years old group. Statistically, 28.3% of the surveyed population are of the first group (under the age of 15), 64.1% in the 15 to 60 year old group, and 7.6% in the elderly group (over 60 years old) (see Table 9.33). A large share of the population in the 15 to 60 bracket is seen as essential to maintain economic and social stability of the surveyed villages.

Table 9.33 Surveyed Population by Age Group

Age Group	N (290)	%
Under 15 years old	82	28.28
From 15 to 60 years old	186	64.13
Over 60 years old	22	7.59

Source: Socio-economic survey conducted by ERM, August 2021

9.6.1.4 Length of Local Residence

The average length of residency in family of the surveyed population is 17.4 years with the range of residency from one year to 72 years. The length of residency in the village of the surveyed population[193] (see Table 9.34) also ranges from one to 72 years with the average length of 20.6 years. The length of resident of Gia Rai group nearly double that of Kinh group (24.3 years versus 12.3 years). This result is consistent with findings from KIIs. According to the village representatives through KIIs, Gia Rai

[193]The data sample is 258 people - five people of two households who are not living in the village were not included.

people are regarded as indigenous minority who have settled in these surveyed villages for a long time through many generations. Meanwhile, Kinh and other ethnicities such as Muong, Thai, and Dao are migrating from other localities (KII, male respondent, Gia Rai ethnicity, Nang Long-Osor village, 27 August 2021). Long length of residence may be associated with more local support, local friendships and participation in local organisations at the individual level, resulting in increased social integration.

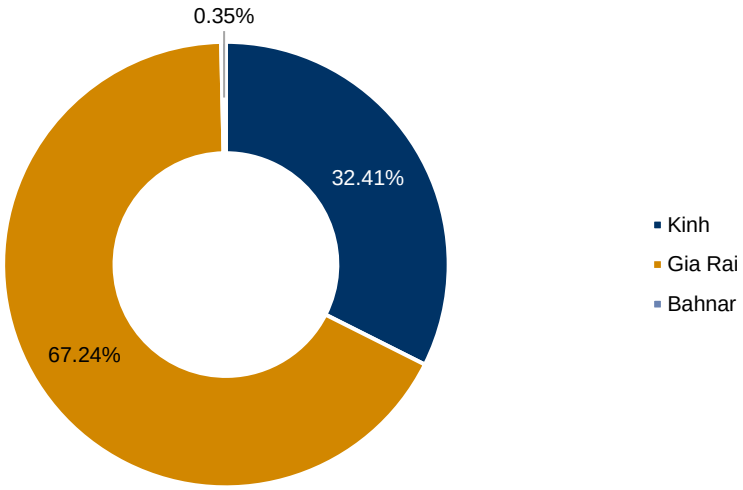
Table 9.34 Length of Residency in Village of the Surveyed Population

Length of Residence in Village	Gia Rai Group (N=198)	Kinh Group (N=87)	Surveyed Population (N=285)
Average years of residence in the village	24.30	12.26	20.62

Source: Socio-economic survey conducted by ERM, August 2021

9.6.1.5 Ethnicity

Most of the surveyed population are Kinh and Gia Rai ethnic groups, in which Gia Rai group claimed 67.2% while Kinh ethnic group had a smaller figure with 32.4% (see Figure 9.26). Only one person is of Bahnar ethnic group, accounting for 0.4%. This Bahnar person moved to a Gia Rai household via interethnic marriage and therefore will be analysed under their Gia Rai family.



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.26 Surveyed Population by Ethnicity

Gia Rai community in the surveyed commune share some typical characteristics of ethnic minorities in the Central Highlands (i.e. customs and festivals and matriarchy practices) and have distinctive features of this ethnicity in terms of social and cultural values (i.e language and costume).

- Language

Gia Rai is a Malayo-Polynesian language spoken by the Gia Rai people in the Central Highlands. Gia Rai has its spoken and written language. In 1981, the People's Committee of Gia Lai - Kon Tum province issued Decision No. 03/QD-UB dated October 28, 1981 on "Publishing the set of compiled alphabets for ethnic characters", which changed the traditional script of the Gia Rai. On October 28, 2011, due to the inappropriateness of this alphabet, Gia Lai PPC issued Decision No. 30/2011/QD on "Publishing

the Gia Rai and Bahnar alphabet and pronunciation system" which was the traditional script of the Gia Rai and Bahnar people[194].

Gia Rai language has been taught at school for primary pupils. Most of young people do not how to write in Gia Rai language, except some of the elderly. Local villagers in the surveyed commune mostly use Gia Rai language when talking to relatives in family, in cultural and religious activities (song, dances and worships) but use Vietnamese at the village meetings, when communicating with the Vietnamese or with other ethnicities not Vietnamese, at schools, and at other public spaces such as the market, shop, and post (KII, female respondent, Gia Rai ethnicity, Nang Long-Osor, 27 August 2021).

- Livelihoods

In the past, Gia Rai ethnic group predominantly relied on cultivating upland rice as their main crop. They raised common livestock such as buffaloes, cows, pigs, dogs, and chickens and also breed horses and elephants. In addition, hunting, collecting non-timber forest products (NTFPs), and fishing have been considered as supplementary livelihoods for local Gia Rai people. In current time, Gia Rai people begins to grow wet rice and some high-value industrial crops such as coffee, rubber, pepper, cashew in some low-lying areas. They still maintain NTFPs collection and fishing but not frequently.

- Social Relations

Gia Rai people live in villages similar to Kinh people's village. In the village, the village head and the elders have great prestige and take the role of managing all collective activities, who always receive local respect for their wisdom and advice. Each village has a tall communal house called *"Nhà Rông"* or Rong house.

Like other ethnic minorities, the village patriarch is the most prestigious and powerful individual in Gia Rai communities. The village patriarch is normally male even though some minority communities, especially Gia Rai practice matrilineal tradition. This person is elected to this position by the villagers because of his reputation with the community and responsible for handling issues and disputes arising in life in accordance to customary law. In many cases, the village head must go through the patriarch's opinion on issues related to customs and traditions of Gia Rai people (KII, male respondent, Nang Long-Osor village, 27 August 2021).

- Matrilineal Tradition

Gia Rai ethnic group follows the matrilineal tradition in which women are freely to choose their lover and take the initiative in marriage. After the wedding ceremony, the groom returns to his wife's house and is not allowed to inherit any property. On the contrary, married daughters can move out and live separately from their parents and even be able to receive a portion of the property. The youngest daughter is normally responsible for caring parents while older daughters can live separately after marriage. Children follow their mother's surname. Men play a more important role in the community but women are more influent within the family[195]. Gender relations in Gia Rai community have been in the changing process in which the men's position in family has been improved. There is no difference between female and male in the family as both are engaged in production activities and making decisions related to household affairs.

- Marriage

Regarding marriage of the Gia Rai people, customary law forbids people of the same family and mother line from marrying. Men and women can freely choose their partners, in which women are normally active in selecting their spouse. The wedding custom is rather simple, without any material obligations, and is initiated by the bride's family.

[194] Socialist Republic of Viet Nam Government Portal (n,d)

[195] Socialist Republic of Viet Nam Government Portal (n,d)

The mother is highly respected and well-treated when it comes to their pregnancy. The women in Gia Rai community are not allowed to do hard work while they are pregnant. This is attributed to the fact that they are afraid of childbirth mortality. When giving birth, a woman must abstain from many things such as not eating normal cooked rice but only eating bamboo rice (*com lam*), avoid eating meat, and only consume vegetables.

The KII findings showed that child marriage and consanguineous marriage do not occur in Nang Long-Osor and Sat Tau villages of Ia Pech commune but still exist in O Gia village with a modest number of cases. This positive result is perceived to be attributed to communication activities by the local authorities at different levels to raise community awareness on adverse effects of child marriage and consanguineous marriage.

- Religion

The Gia Rai mostly are non-religious but they believe that a human is a creature living in the world of gods. Gia Rai people mainly worship House God, Village God, Water God, and God of Kings.

- The house's god (called *Yang sang* in Gia Rai language): This god is believed to protect the house and is worshiped inside the house. When a new house is built, the ritual of stabbing buffaloes and planting rice must be carried out accordingly.
- The village god (called *yang ala boon* in Gia Rai language) and the water god (called *yang ia* in Gia Rai language): These gods protect the village and the lives of all people. They are worshiped at the wharf and the foothills.
- The god of kings (called *Yang po tao* in Gia Rai language): This god is worshiped for good weather and bumper crops.

There is a considerable proportion of Gia Rai people living in Gia Lai province practicing Protestantism. One of the impacts of Protestantism on the Gia Rai ethnic people in Gia Lai province is to contribute together with the State to help local people gradually give up the nomadic practice, from hunting and gathering to sedentary cultivation, and reduce and abolish many ancient traditions relating to their beliefs during the production and harvest seasons (i.e buffalo sacrifice festival and long funerals). Many Protestant compatriots have been also trained in wet-rice farming techniques[196]. However, some long standing traditions such as worshiping the gong festival or rice offering have been gradually not practiced among Gia Rai community following Protestantism.

- Customs and Festivals

Gia Rai ethnicity has many cultural activities associated with their spiritual life. Some of the biggest rituals are the grave removal ceremony, buffalo sacrifice festival, and water wharf worshipping ceremony. The findings from FGDs highlighted main features of these ceremonies as presented below:

Grave removal ceremony is a festival meant to see off the souls of the dead to their ancestors but this festival has been no longer widely organised in the surveyed commune over time. Instead of that, local people organise funeral customs every two months by dancing around the coffin and playing ritual dance music on traditional instruments. They dance and sing a song urging to the deceased to rest in peace (KII, male respondent, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 27 August 2021).

Buffalo sacrifice festival is the most prominent cultural activity among ethnic minority communities, especially Gia Rai community in their wishes for a prosperous harvest and happy life. This Gia Lai festival is held on the occasion of celebrating inauguration of the communal house, a ceremony to pray for security, a ceremony to remove bad omen or bad luck for the whole village or to give thanks to the gods. The festival is held from the twelfth lunar month of the previous year to the third month of the next

[196] Trang Thi Hang (2020)

year. Villagers keep on dancing vibrantly and drinking in the boisterous and harmonious combination of gongs, flutes, and drums sounds. During the festival, people enjoy eating traditional delicious foods such as buffalo meat, bamboo-tube rice as well as drinking stem wine together (KII, female respondent, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 27 August 2021).

Water wharf ceremony: Water drops for Gia Rai ethnic minority is a very unique cultural symbol, associated with the cultural and spiritual life of the people and considered as the common treasure of the God presented. Each ethnic minority village has a drop of water made up of groundwater veins from the pristine primeval hills forest. The water circuit is discovered when it leaks on the ground, then the villagers use long bamboo pipes leading to where the ground forms the step, allowing the water to pour down. Water drops has been currently taken through plastic pipes, iron faucet valves, and cement ground. Often water drops are transparent, cool, not rippled dirty, and does not smell strange and flow all year round[197]. Some local people store water drops in wine gourds for drinking.

Local villagers hold a waterfront ceremony every year after the harvest season to pray for good rain, good crops, and a warm and happy life. They normally clean up surrounding areas of the water wharf. The offering may be simply a chicken or a pig, but it is a sacred ritual (FGD, ethnic minority group, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 29 August 2021).

Nowadays, although some households in the village have had dug well for domestic water, local villagers still fetch water at the water wharf every afternoon. This is the most meaningful and happy time of the day when villagers gather at the water wharf, do laundry, fetch water, bath for children, and share to each other their own stories in a day.

Gong music is very much a part of these traditional festivals of Gia Rai community. Gong performances are also reserved for occasions that mark special meaning in the course of human affairs such as welcoming new-borns into the world, accompanying marriage ceremonies, reminding newlyweds to practice cultural traditions, celebrating the building of a new house, mourning the dead at funerals, and announcing the departure of a dead person's soul for the land of the dead.

For Gia Rai ethnicity, gongs not only represent the wealth of the owner (especially in the past) but are also an indispensable item in traditional festivals, particularly the funerals. Therefore, Gia Rai people have always considered this instrument as a treasure preserved by all the generations. Gia Rai young generation preserve this cultural identity by learning how to use gongs from the elder (KII, male respondent, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 27 August 2021).

- Costume

Men in Gia Rai ethnic group normally wear an indigo scarf, wrapping on the head with one end left in the ear, or neatly wrapped like a turban of Kinh people. The traditional clothes of Gia Rai men are loincloths. Gia Rai women wrap their hair with a bun at the nape of their neck or neatly wrapped around the top of their head. The skirt used for women is long, tube-shaped, and made from large cloth wrapping around the body and tied under a belt. The shirt is short, long-sleeved, or sleeveless and has the same pattern with the skirt. Most of Gia Rai surveyed women do not know how to weave traditional fabric so they tend to buy clothes and traditional costume from Kinh or Gia Rai stores in the locality (FGD, women's group, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 29 August 2021).

- Housing

Houses of the Gia Rai people are long, or sometimes small but all are stilt house with the main door in the North[198]. The long stilt house is made of wood, bamboo, and sawn timber planks. Gia Rai people

[197] Pham Duc Long (2020)

[198] Socialist Republic of Viet Nam Government Portal (n,d)

build their long stilt houses in the North-South direction. Each house has a length of about 20 – 50 m and a width of 4 – 5 m[199].

9.6.1.6 Religion

Most of the surveyed population list themselves as having no religious affiliation[200], accounting for 91.7% while the remaining have the two different faiths: Buddhism (3.5%) and Catholicism (4.8%) (see Table 9.35).

Table 9.35 Surveyed Population by Religion

Religion	N (290)	%
No religion	266	91.72
Catholicism	14	4.83
Buddhism	10	3.45

Source: Socio-economic survey conducted by ERM, August 2021

9.6.1.7 Language

More than half of the 290 surveyed population (160 Gia Rai people or 55.2%) can speak both Gia Rai and Vietnamese fluently. Around 32.4% or 94 people can only speak Vietnamese and all of them are of Kinh ethnicity. About 35 people or 12.1% of the surveyed population who can speak only Gia Rai language are of Gia Rai ethnicity. Some of them are either under school age (16 people) or illiterate (13 people). Furthermore, one person who is of Bahnar ethnicity and is living in a Gia Rai family, can speak three languages, including Bahnar, Vietnamese, and Gia Rai (see Table 9.36).

Table 9.36 Languages Used by the Surveyed Population

Language	N (290)	%
Vietnamese	94	32.42
Gia Rai	35	12.07
Vietnamese and Gia Rai	160	55.17
Vietnamese, Gia Rai, and Bahnar	1	0.34

Source: Socio-economic survey conducted by ERM, August 2021

9.6.1.8 Marital Status

By analysing surveyed population's marital status, their vulnerabilities and living qualities can be further exposed. More than half of the surveyed population is married, accounting for 55.9% or 162 people, and about one-third of the surveyed population (33.8% or 98 people) is under marriage age[201] (see

[199] Ksor Nam (2020)

[200] According to the Law No. 02/2016/QH14 dated 18 November 2016 issued by National Assembly on Religion and Folk Belief, as stated in Paragraph 1 of Article 6, every person has the right to freedom of religion and folk belief and the right to follow or not to follow a religion.

[201] The 2014 Marriage and Family Law of Vietnam regulates that the marriage age is 18 years or older for females and 20 years or older for males. Those who are under the age stipulated as the law for marriage are classified as the "under marriage age" group.

Table 9.37). A small proportion of the surveyed population defines their marital status as single[202], accounting for 7.3%. Furthermore, seven people of Gia Rai ethnicity (one male and six females) or 2.4% of the surveyed population are widowed[203] while one person of Gia Rai ethnicity (accounting for 0.3%) is single mother[204]. In addition, one male person (accounting for around 0.3%) get married before the marriage age[205] and this person is of Gia Rai ethnic group.

Table 9.37 Surveyed Population by Marital Status

Marital Status	N (290)	%
Married	162	55.86
Under marriage age	98	33.79
Single	21	7.26
Widowed	7	2.41
Married under marriage age	1	0.34
Single parent	1	0.34

Source: Socio-economic survey conducted by ERM, July 2021

The findings from KIIs revealed that child marriage and consanguineous marriage do not exist in Nang Long-Osor and Sat Tau villages thanks to Ia Pech commune's communication campaigns to raise community awareness of the negative impact of these practices; however, a few numbers of cases are still recorded in O Gia village. There are various factors contributing to the existence of early marriage including parent's ignorance, socio-economic and cultural conditions (KII, female respondent, Ia Pech commune, 31 August 2021). Mixed ethnicity marriage is not common in the surveyed households. Of the 63 surveyed households, there are three mixed ethnicity households which one male of Bahnar ethnic group married to a Gia Lai spouse, and two males of Kinh ethnic group married to two other Gia Rai spouses. All of them moved to their spouses' families after marriage.

9.6.2 Education

For education, the analysis was based on data from 251 people, in which data from 39 people (including 36 children under schooling age and three people whose educational levels are not clearly identified by the interviewees) were not included.

9.6.2.1 Literacy

The literacy rate in the surveyed population is relatively high with 90.4% (227 people) while the rest 9.6% (24 people) are illiterate (see Table 9.38). Out of the 24 illiterate population, eight people are identified as household heads accounting for 33.3%, of which two of them are female. By ethnicity, all illiterate people are of Gia Rai ethnicity. By working age group, of the 24 illiterate people, 10 people are of working age (ranging from 30 to 54 years old) while the rest 14 people are over the working age (from 56 to 72 years old).

[202] Female aged 18 years or over and male aged 20 years or over who are not married are identified as single.

[203] A person becomes widowed because of the loss of his or her spouse through death.

[204] A person becomes divorced when his or her marriage has been legally dissolved.

[205] Child marriage or early marriage is the informal union entered by an individual before reaching the marriage age as stipulated by law.

Table 9.38 Surveyed Population by Literacy

Literacy	Gia Rai Group (N=172)		Kinh Group (N=79)		Surveyed Population (N= 251)	
	N	%	N	%	N	%
No	24	13.95	0	0.00	24	9.56
Yes	148	86.05	79	100.00	227	90.44

Source: Socio-economic survey conducted by ERM, August 2021

9.6.2.2 Educational Attainment

Most of the surveyed literate people (89.9% or 204 people) have been attending or completed general education, specifically 24.7%, 46.3%, and 18.9% at primary, lower secondary, and upper secondary levels respectively (see Table 9.39). For vocational education, one Gia Rai person is following while one other Gia Rai person and two Kinh people finished the program, accounting for 1.7%. In addition, 2.2% or five surveyed people reached college level, of which, two people (including one Gia Rai and one Kinh person) dropped out and three people completed the study program (including one Gia Rai person and two Kinh people). Regarding university level, there are three Gia Rai people pusuing tertiary education and seven people (including one Gia Rai person and six Kinh people) as univeristy graduates. It is worth noting that two Gia Rai people (accounting for 0.9%) can read and write Vietnamese even though they have not attended any format education programs. For postgraduate education, the survey recorded two Kinh people who completed the program (accounting for 0.9%).

Table 9.39 Surveyed Population by Educational Attainment

Educational Attainment	Gia Rai Group (N=148)		Kinh Group (N=79)		Surveyed Population (N= 227)	
	N	%	N	%	N	%
Literate without schooling	2	1.35	0	0.00	2	0.88
Primary education	45	30.41	11	13.92	56	24.67
Lower secondary education	73	49.32	32	40.51	105	46.26
Upper secondary education	20	13.51	23	29.11	43	18.94
Vocational school education	2	1.35	2	2.53	4	1.74
College education	2	1.35	3	3.80	5	2.20
University education	4	2.70	6	7.59	10	4.43
Postgraduate education	0	0.00	2	2.53	2	0.88

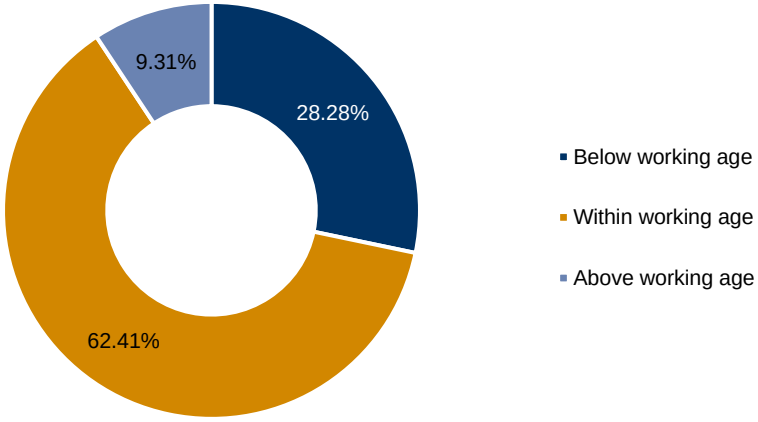
Source: Socio-economic survey conducted by ERM, August 2021

9.6.3 Employment

9.6.3.1 Labour Force

9.6.3.1.1 Working Age Population

Nearly two-thirds of the surveyed people (62.4% or 181 people) are of working-age population[206] (see Figure 9.27). Furthermore, about 28.3% or 82 people (including 49 males and 33 females) are below working age and do not engage in work. Specifically, 36 people are under school age and 46 people are pupils in primary or lower secondary schools. The remaining population (9.3%) are of over working age group, 82 people and 27 people respectively.



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.27 Surveyed Population by Working Age Group

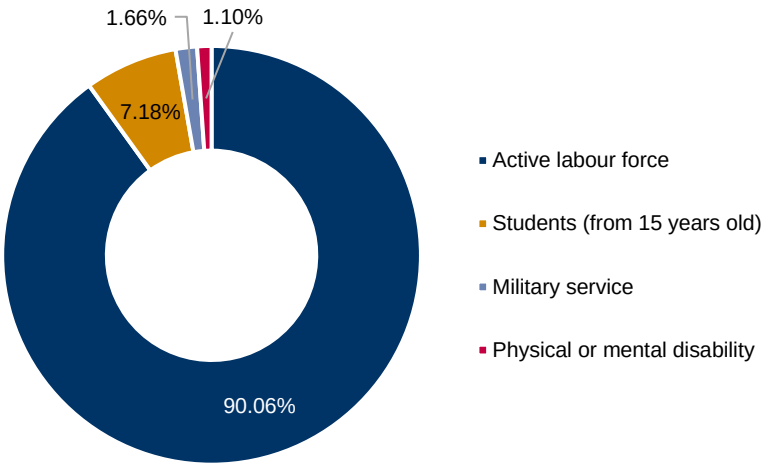
In terms of educational attainment of the working age population[207], 10 people are illiterate, 19 people at primary level, 90 people at lower secondary level, 40 people at upper secondary level, four people at vocational training, five people at college, nine people reaching university, and two people at postgraduate level.

9.6.3.1.2 Active Labour Force

The 181 people of working age population comprise of 163 people (90.1%) active in the labour force as they are able and likely to work and 18 people (9.9%) are not engaging in work. These 18 people are identified as students (13 people or 7.2%), soldiers (three people or 1.6%), and people with disabilities (two people or 1.1% including one person suffering from stroke and another one with brain trauma) (see Figure 9.28). A low proportion of an economically inactive population suggests a low prevalence of the population involved in housework, and a low rate of young people aged 15 years and over currently attending school, which can be a consequence of dropping out among young people in ethnic minority groups.

[206] Under the Vietnam's Labour Code: (1) Below working age (below 15 years old); (2) Working-age population consists those aged 15 and 55 years old for females and 15-60 for males, considered able and likely to work; (3) Above working age (over 55 years old for females and 60 years old for males).

[207] The remaing two people with the educational status were not clearly identified.



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.28 Active Labour Force of the Surveyed Working Age Population

Notably, there are 21 out of 27 over-working-age people (aged 56 to 71 years) engaged in work accounted for 77.8%. These people are engaged in cultivation (19 people), husbandry (one person), and company employment (one person). This makes a total of 184 people in the surveyed active labour force, accounting for 63.5% of the total surveyed population.

9.6.3.2 Main Livelihoods

Among 184 people in the surveyed active labour force, two people are doing unpaid work such as housewives and four people (including two Kinh and two Gia Rai) are unemployed. The unemployment is mainly attributed to limited educational background and lack of confidence. Hence this section analyses employment of the 178 surveyed labour force and briefly describes livelihood activities of the surveyed households based on the results of the FGDs, KIIs, and household surveys.

Analysis of main livelihoods in the surveyed area showed that local people's livelihoods are not dynamic as agriculture still occupies a major position in their livelihood typology, and on-farm income accounts for the largest share of household income. Low access to education and lack of capital may be great contributors to a less dynamic livelihood strategy of local people. Statistically, the largest percentage of the 178 working people is engaged in land-based livelihoods (82.6% or 147 people), with the majority engaged in cultivation (see Table 9.40). Wage-based livelihoods have a smaller number of population with 23 people or 12.9%. Meanwhile, eight people or 4.5% generate their household income from enterprise-based livelihoods.

Table 9.40 Main Livelihoods of the Surveyed Working Population

Main Livelihoods		N (178)	%
Land-based	Cultivation	145	81.46
	Husbandry	2	1.12
Wage-based	Public servant	10	5.62
	Company worker	9	5.07
	Day labourer	4	2.24
Enterprise-based	Small business	8	4.49

Source: Socio-economic survey conducted by ERM, August 2021

Child labour has been not recorded among surveyed households. However, children's engagement in household farming and day labour are still observed in their locality (FGD, women's group, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 29 August 2021). Little information has been shown to estimate the precise number of child labour in the surveyed community. This issue is normally associated with early drop out due to household difficulties and even child marriage.

9.6.3.2.1 Land-based Livelihoods

A total of the 147 surveyed people (82.6% of the total 178 working people) consider land-based livelihoods as their main occupation. Cultivation (i.e. coffee, avocado, durian, and pepper planting) is the most common work among the surveyed population with 81.5% or 145 people (see Table 9.41 and Figure 9.29). They are more likely to be engaged in producing cash crops or industrial crops such as coffee, avocado, durian, and pepper. Noticeably, only two people consider husbandry as their main occupation although there are about 31 surveyed households reportedly owning livestock such as chicken, cows, and pigs. This implies that livestock raising seems not to be a significant livelihood in the locality. Livestock raising is not developed due to lack of grazing areas so villagers mainly graze buffaloes and cattle in rubber plantation. They primarily raise poultry and cattle as supplementary food for their daily meals.

Generally, there are no significant differences in the cultivation methods between both surveyed ethnic groups. However, Kinh households normally produce high-yield crops thanks to significant investment in fertilisers and labour (FGD, agriculture group, Kinh and Gia Rai ethnicities, Sat Tau village, Ia Pech commune, 31 August 2021).

Table 9.41 Surveyed Working People with Land-based Livelihoods

Land-based livelihoods	N (178)	%
Cultivation	145	81.46
Husbandry	2	1.12

Source: Socio-economic survey conducted by ERM, August 2021

Cow cage

Vegetables vines

Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.29 Cultivation and Husbandry in the Surveyed Villages

9.6.3.2.1.1 Agricultural Production

- Cultivation and Husbandry Area

Through the household interviews, most of the surveyed households affirmed that they have their own land for agricultural production with areas ranging from 50 m^2 to 130,000 m^2. Their production area is about 1-5 km away from their residence. Specifically, there are 56 households (88.9%) having agricultural land and three households (4.8%) owning forestry land. The average agricultural area is 16,071 m^2 per household while the average of forestry land is 14,367 m^2 per household. The findings from KIIs in Nang Long-Osor, Sat Tau, and O Gia villages indicated that there is no community production area in the surveyed villages.

- Agricultural Equipment and Vehicles

Statistically, around 54% of the total 63 surveyed households asserted that they own agricultural equipment and vehicles. Specifically, the local farmers utilise mostly lawn mower, spray machine, digging machine, and transplanting machine to support their agricultural production.

- Main Crops

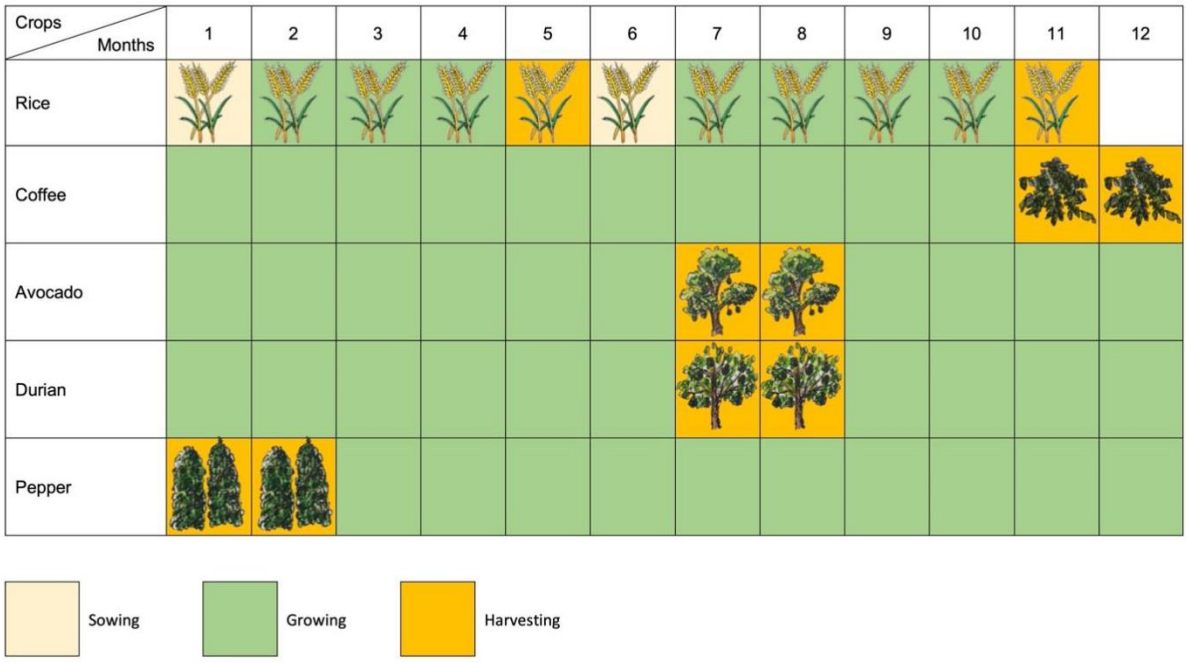
The survey results indicated that staple crop in the locality are rice and coffee. In addition, pepper, cashew, durian, and rubber are also planned for income generation (see Table 9.42). Normally, in order to enhance crop efficiency further, pepper, cashew, and durian are intercropped with coffee. Other less popular types of crop in the surveyed area are jackfruit and passion fruit. It should be noted that one Kinh household applied a genetically modified durian crop in his household's cultivation. Table 9.42 and Figure 9.30 depict the calendar and some details of some main crops in the survey area.

Table 9.42 Main Crops in the Surveyed Communes

Main Crops	Consumption	Price (per kg)	Production volume	Harvest time
Rice	For domestic use only	For domestic use only	Two crops per year: winter-spring crop from January to May and seasonal rice crop from June to November. The average production is about five quintals per 1,000 m^2	Rice crops are harvested in May and November.
Coffee	Coffee is sold to fertilizer agents or agricultural product traders.	VND 30,000 to 35,000	Three tons per 10,000 m^2	A coffee plant could bear beans after three years of planting, and it is normally harvested once a year from November to December.
Avocado	Avocado is sold to agricultural product traders.	VND 10,000 to 14,000	One to three quintals per 1,000 m^2	After three to five years of planting, farmers can harvest the fruit to sell. Harvest time normally falls in July and August every year
Durian	Durian is sold to agricultural product traders.	VND 30,000	One to two quintals per 10,000 m^2 (intercropped with coffee plants)	Durian is often harvested from July to August according to lunar

Main Crops	Consumption	Price (per kg)	Production volume	Harvest time
				calendar, particularly after seven years of planting
Pepper	Pepper is sold to agricultural product traders.	VND 70,000 to 80,000	One quintal per 10,000 m^2	Local farmers collect pepper in January and February after two years of planting

Source: Socio-economic survey conducted by ERM, August 2021



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.30 Crop Calendar of Some Main Crops in the Surveyed Commune

- Main Livestock

During field observations, husbandry is not the main livelihood of the people in the locality. Main livestock includes cows, pigs, goats, chickens, ducks, and buffaloes that are raised in a household scale for mainly domestic use as a nutrition source and for offering in ritual ceremonies. According to local people, due to the lack of grazing area, their grazing site are mostly in rubber plantation.

9.6.3.2.1.2 Advantages and Disadvantages in Agricultural Production

Agriculture is the backbone of the surveyed households' economy. Local agricultural production in the surveyed areas is identified as favourable with natural capital (convenient geographical location and favourable natural conditions), human capital (training on knowledge and skills in farming), and social capital (community support) specifically:

- Trainings on crop production and livestock husbandry provide local farmers with knowledge and skills; however, these trainings have yet regularly organised;
- A number of local households are members of the local Farmer's Union and they receive one to two annual programs on seeding and breeding support the Union;
- Local farmers gradually shift from upland rice-based cropping systems to wet rice cultivation;

- Local farmers are gradually conscious in applying science and technology in agricultural production practices;
- Local farmers use highly new seed varieties for effective production;
- Skills and knowledge in cultivation are continuously exchanged and shared among local farming households;
- The practice of labour exchanges among farming households saves production time and cost and increase community solidarity; and
- Agricultural production areas are close to local residence areas.

However, agricultural production activities in the surveyed villages are facing challenges related to inadequate irrigation water, lack of agricultural innovations, low access to financial services, and other issues.

- Inadequate irrigation water to sustain crop production is due to the shrinkage of water resources such as rivers or springs. This is closely linked to survival for many farming households. Water shortage occurs from January to May, especially in March and April.
- Lack of agricultural innovations, such as the diffusion of new agricultural technologies and the introduction of improved seeds and tools are also a limitation affecting local farmers. This make farmers to be prone to certain setbacks such as low yield or unproductive cultivation method. Although some annual trainings on agricultural production had been conducted by local functional agencies, unfortunately, the number of these trainings are decreasing in the context of COVID-19 pandemic.
- Local people find difficulties in applying science and technology advances in cultivation practices due to limited educational background and embedded traditional customs. Some people still maintain self-sufficiency living while there are changes related to climate conditions and land quality.
- The dependency on agricultural cycles places small famers in a dilemma situation of a never-ending cycle of debts. Specifically, in order to obtain inputs such as seedlings and fertiliser at the beginning of the seeding season, they have to borrow money from different sources and consequently once the crops harvested famers promptly sell the crops even when the prices are lower - to repay the debt.
- Livestock raising is not developed due to lack of grazing areas.
- Other challenges are recorded during the study including low profit from cultivation, fluctuating agricultural product prices, pests and diseases.

9.6.3.2.2 Wage-based Livelihoods

Apart from the major occupation in farming, some local people sustain their livelihood by wage employment. Of the 178 surveyed working people, only 23 people or 12.9% people are engaged in wage employment. A number of 10 people or 5.6% are working as public servants, followed by company workers with 5.1% or nine people. Meanwhile, the remaining four people, accounting for 2.2% work as day labourers (see Table 9.43).

Table 9.43 Surveyed Working People with Wage-based Livelihoods

Wage-based Livelihoods	N (178)	%
Public servants	10	5.62
Company workers	9	5.07
Day labourers	4	2.24

Source: Socio-economic survey conducted by ERM, August 2021

Public servants are currently residing and working in the localities as teachers and government officials. Company workers mainly work for rubber plantations in the locality or companies in Ho Chi Minh City, Dong Nai or Binh Duong province.

Day labour jobs are normally manual work such as seasonally waged agricultural worker (i.e. coffee picking, weeding, and harvesting), day labourers for wind farm projects, rubber tapping (from April to November with the income of VND 3,000,000 to 4,000,000 per month), and bricklayers. Most of these jobs earn them an unskilled wage. These kinds of jobs are not constant and may not generate a secure yearly or even monthly income. Their wage is often paid after every working day, and day workers do not have any guarantee or contract. The recorded daily wage ranges from VND 100,000 to 200,000. By gender, depending on the workload a woman can earn at most VND 180,000 per day while the highest wage rate for male is VND 200,000.

9.6.3.2.3 Enterprise-based Livelihoods

Enterprise-based livelihoods are not common among local people. Only eight people or 4.5% confirmed small business as their main labour common businesses in the locality. They manage grocery store, welding shop, and local food shop (see Table 9.44).

9.6.3.3 Supplementary Livelihoods

About 18.5% or 33 out of 178 working people have a supplementary occupation. Most of them work as day labourers and cultivation, accounting for 45.5% and 36.4% or 15 and 12 people respectively. Local farmers even own the land on which they work, the tools and equipment they use but their income from agricultural production is insufficient to sustain their household living. They have to seek for extra income sources as day labourers in the locality or out of their residence. Day labourers are seasonal agricultural workers who are both women and men labouring in the crop fields such as weeding, branch chopping, and pesticide spraying. In addition, other recorded occupations include husbandry, public employment, and small business occupying a small proportion of 15.2%, 6.1% and 3% respectively (see Table 9.44).

Table 9.44 Surveyed Working Population with Supplementary Livelihoods

Supplementary Livelihoods	N (33)	%
Day labourer	15	45.45
Cultivation	12	36.36
Husbandry	5	15.15
Public servant	2	6.06
Small business	1	3.03

Source: Socio-economic survey conducted by ERM, August 2021

9.6.4 Income and Expenditure

This section analyses the financial capital of the surveyed households in terms of income, expenditure, and debts. Data from 63 households with 272 people was included in this analysis - 18 people not living in their families and not contributing to household income were not included in the analysis.

9.6.4.1 Income

9.6.4.1.1 Average Monthly Household Income

The average monthly income of the 63 households as recorded during the past year is VND 13,853,434 per household and VND 3,208,700 per capita (see Table 9.45). The lowest monthly income per household is VND 833,333 (one Gia Rai household mainly generating income from agricultural production and wage-based work). Meanwhile, the highest monthly income per household is VND 153,333,333 (one Kinh household with income source from agricultural production).

Table 9.45 Average Monthly Incomes per Household and per Capita

Monthly Household Incomes	Amount (VND)
Average monthly income per household	13,853,434
Average monthly income per capita	3,208,700
Minimum monthly household income	833,333
Maximum monthly household income	153,333,333

Source: Socio-economic survey conducted by ERM, August 2021

9.6.4.1.2 Household Income Structure

Statistically, land-based livelihoods contribute the most significant proportion (83.5%) to the household income structure as most of the surveyed working population are engaged in land-based employment (see Table 9.46). The corresponding insignificant shares of the household income structure are 8%, 7.8%, and 0.7% for enterprise-based livelihoods, wage-based livelihoods, and other sources (i.e. financial support from children, social allowance and selling rubber wood).

Table 9.46 Average Monthly Household Income Structure

Income Sources	Amount (VND)	Percentage of Livelihood Contribution on Average Monthly Household Income (%)
Land-based livelihoods	11,566,138	83.49
Enterprise-based livelihoods	1,112,725	8.03
Wage-based livelihoods	1,076,291	7.77
Other sources	98,280	0.71

Source: Socio-economic survey conducted by ERM, August 2021

9.6.4.2 Expenditure

9.6.4.2.1 Average Monthly Household Expenditure

The average monthly expenditure of the 63 surveyed households as recorded during the past year is VND 6,256,037 per household and the VND 1,449,009 per capita (see Table 9.47). The lowest monthly household expenditure is VND 541,667 recorded in a Gia Rai household while the highest monthly household expenditure is VND 33,083,333 recorded in a Kinh household.

Table 9.47 Average Monthly Expenditures per Household and per Capita

Monthly Household Expenditures	Amount (VND)
Average monthly expenditure per household	6,256,037
Average monthly expenditure per capita	1,449,009
Minimum monthly household expenditure	541,667
Maximum monthly household expenditure	33,083,333

Source: Socio-economic survey conducted by ERM, August 2021

A number of unexpected or irregular expenses are recorded among 63 surveyed households. Over the last 12 months, two households spent around VND 150 million for housing refurbishment with an average annual expenditure of around VND 75 million per household (see Table 9.48). In addition, four households spent a total of VND 98 million for serious health treatment with an average expense of over VND 24 million per household. Furthermore, up to 45 surveyed households invested a total of over VND 3.5 billion in production, equivalent to around VND 78 million per household.

Table 9.48 Irregular Expenditures of the Surveyed Households

Irregular Expenditures	Details	
Housing refurbishment	Total Amount (VND)	150,000,000
	Number of Households	2
	Average annual expenditure per household (VND)	75,000,000
Serious medical treatment	Total Amount (VND)	98,000,000
	Number of Households	4
	Average annual expenditure per household (VND)	24,500,000
Production investment	Total Amount (VND)	3,517,800,000
	Number of Households	45
	Average annual expenditure per household (VND)	78,173,333

Source: Socio-economic survey conducted by ERM, August 2021

9.6.4.2.2 Household Expenditure Structure

"Food and daily commodities" and "debt interest payment" are the top spendings in the average monthly household expenditure structure, accounting for 40.9% and 22.6% respectively. The remaining (36.5%) is the combination of "daily expenses", "clothing, entertainment, and "community activities", "health care", "expense for member living away from households", and "education" (see Table 9.49).

Table 9.49 Average Monthly Household Expenditure Structure

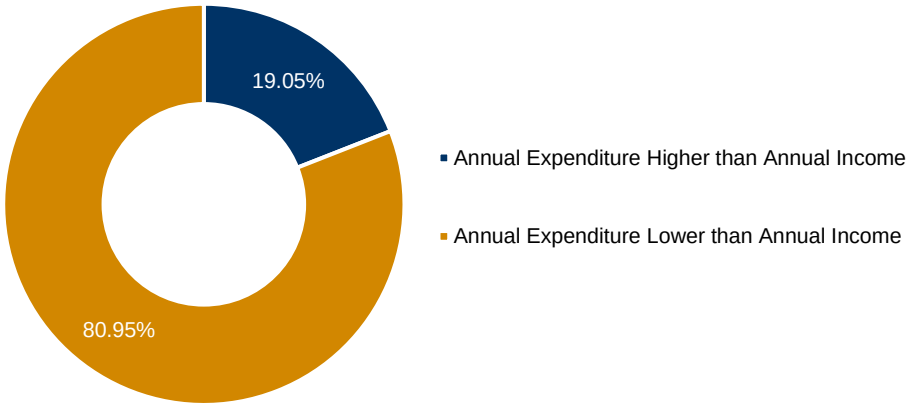
Expenditure Sources	Amount (VND)	Percentage of Spending Items on Average Monthly Household Expenditure (%)
Food and daily commodities	2,557,937	40.89
Debt interest payment	1,412,942	22.59
Daily expenses	1,185,741	18.95

Expenditure Sources	Amount (VND)	Percentage of Spending Items on Average Monthly Household Expenditure (%)
Clothing, entertainment and community activities	463,690	7.41
Education	306,217	4.89
Health care	177,130	2.83
Expense for member living away from households	152,381	2.44

Source: Socio-economic survey conducted by ERM, August 2021

9.6.4.3 Income and Expenditure Balance

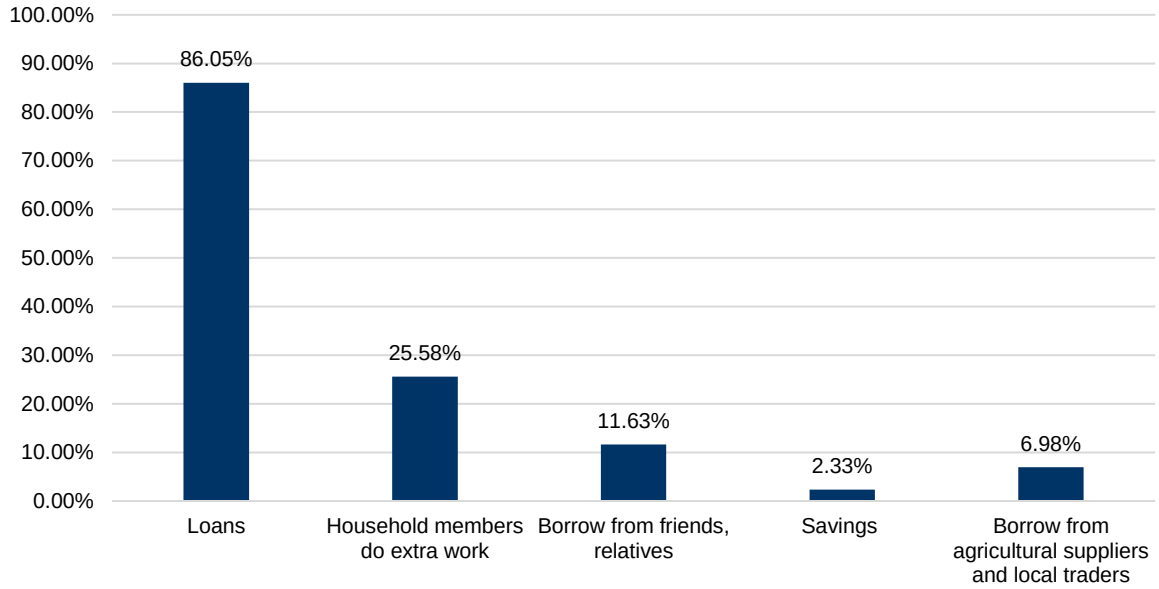
When comparing annual household expenditure against income, it is worth noting that annual expenditure of 51 out of the 63 surveyed households is lower than their income, accounting for 80.9%. Of these 51 households, Gia Rai households outnumbers Kinh households (34 versus 17 households respectively). Around 19.1% or 12 households have their expenditure exceed their annual income (see Figure 9.31).



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.31 Household Income and Expenditure Balance

Reportedly, around 68.2% or 43 households confirmed that they had financial shortage within the last three years while the remaining 20 households stated that their income and expenditure was quite balanced. To shorten their financial gap, they accessed various sources of support. Loans and getting extra work are primary sources (86.1% and 25.6% respectively). In addition, borrowing from friends and relatives, and using savings are solutions to cover their expenditure, accounting for 11.6% and 2.3% respectively. Other sources recorded among the surveyed households are borrowing money from agriculture suppliers and local traders, accounting for nearly 7% (see Figure 9.32). Local farmers need to buy inputs for their coffee farms such as seeds and fertilisers. However, most of them are in lack of capital for production investment. They ask local traders to sell agricultural inputs without instant payment. When their crops are harvested, they sell their products to local traders and then pay back debts with interest (FGD, agriculture group, Kinh and Gia Rai ethnicities, Sat Tau village, Ia Pech commune, 31 August 2021).

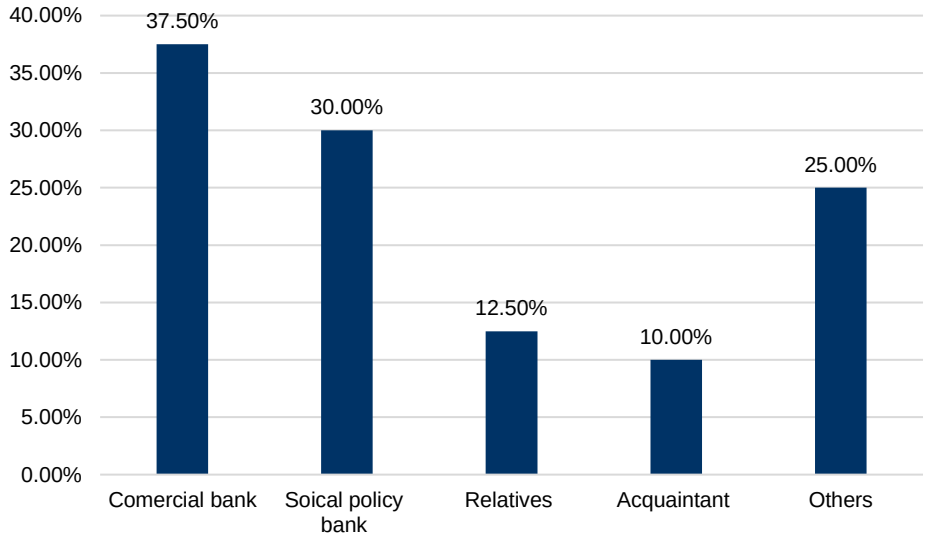


Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.32 Sources of Household Finance Support

9.6.4.4 Debts

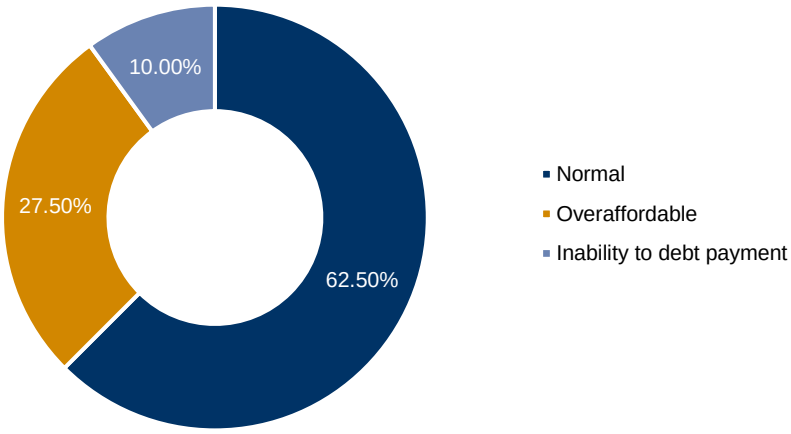
Of the 43 surveyed households having insufficient income, 93% (40 households) are reported to be in debt while the rest households are not. Reportedly, commercial banks are the most opted preference with 37.5% (see Figure 9.33). This is followed by social policy banks with 30%. It can be explained that the limited amount of loans delivered by social policy banks cannot fully meet local need for production investment, which force them to get loans from commercial banks. In addition, relatives and acquaintances are also reported as a source for financial aid with the corresponding figures of 12.5% and 10%. Moreover, villagers also get loans from fertiliser agents, local traders, grocery owners, or coffee traders (25%).



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.33 Sources of Loans among the Surveyed Households

Of 40 households with debts, 33 households provided their specific amount of debts which was worth a total of over VND 5.3 billion. In particular, an average debt per household is approximately VND 163 million. Regarding the pressures generated by debts, nearly two thirds of the surveyed households, who are in debt (62.5% or 25 households), stated that their debt pressure on their family is quite normal, whereas 27.5% or 11 households affirmed that debt payment is beyond their capacity (see Figure 9.34). Notably, 10% or four households (three Gia Rai and one Kinh households) confirmed that they are not able to pay the loans.



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.34 Level of Financial Pressure by Loans

9.6.5 Health

9.6.5.1 Common Health Issues and Risks

The number of people suffering health issues over the past 12 months occupies nearly one third (31% or 90 people) of the surveyed population. Significantly, the majority have at least one health issue with 75.6% or 68 people, while about 18.9% or 17 people have two health issues. Lastly, a number of five surveyed people (two Gia Rai and three Kinh people) have over three health issues (two with three diseases and three with four diseases) (see Table 9.50).

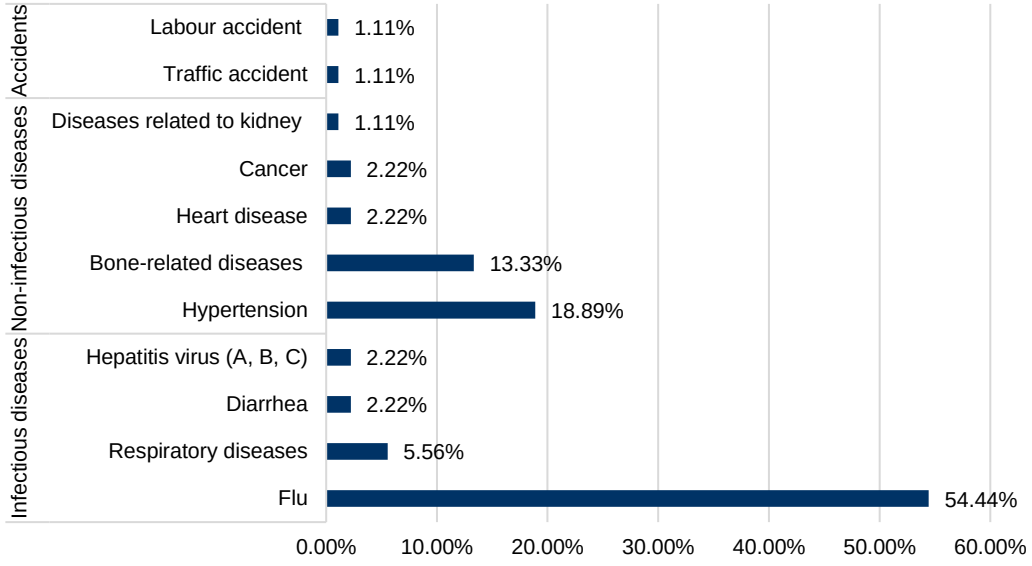
Table 9.50 Surveyed Population with Health Issues

Health Issues	N	%
People with one health issue	68	75.56
People with two health issues	17	18.89
People with three health issues	2	2.22
People with four health issues	3	3.33

Source: Socio-economic survey conducted by ERM, August 2021

Among 90 surveyed people having health problems, the most common infectious disease is flu with 49 people or 54.4% and the most common non-infectious diseases include hypertension (17 people or 18.9%) and bone-related diseases (12 people or 13.3%) (see Figure 9.35). Some other infectious and non-infectious diseases are reported including diarrhoea, hepatitis virus (A, B, C), respiratory diseases, heart diseases, kidney-related diseases, and cancer. For accidents, only one Kinh person (1.1%) suffered from traffic accidents and another Kinh person got occupational accident (1.1%) during the past 12 months.

Other diseases including stomach-related diseases, headache, haemorrhoids, geriatric sicknesses, herniated disc, sciatic nerve and stroke are reported among 25 people including 13 Gia Rai and 12 Kinh people (27.8%) during the household interviews.



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.35 Types of Common Diseases among the Surveyed Population

In addition, a small number of the 290 surveyed people are reported with unhealthy living habits. Specifically, nine people (including six Gia Rai people and three Kinh people) are addicted to tobacco, accounting for 3.1%. Meanwhile, two other people (including one Gia Rai and one Kinh person) are recorded as alcoholics, occupying 0.7% of the surveyed population.

9.6.5.2 Visit to Health Establishments

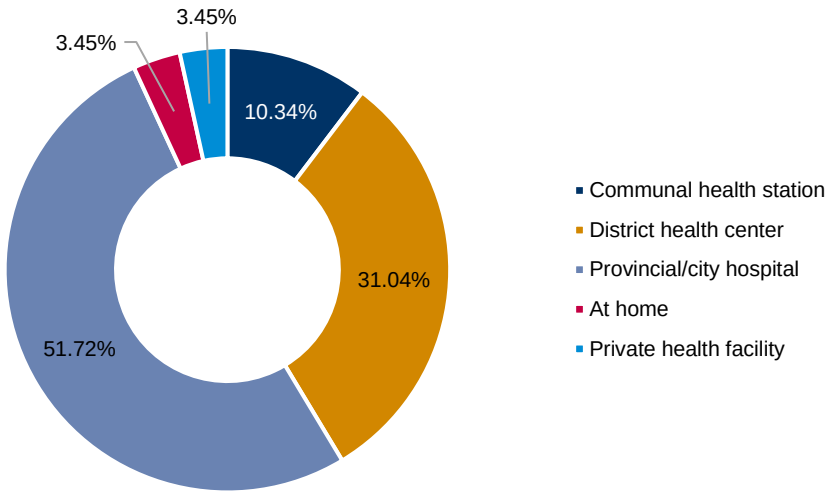
Most of the surveyed households choose to visit district health establishment for health check-ups and treatment, accounting for 55.6% or 35 households (including nine Kinh households and 26 Gia Rai households) (see Table 9.51). This is followed by provincial or city hospitals with 44.4% or 28 households. In addition, communal health stations are the surveyed households' selection when they have any minor sicknesses with 36.5% or 23 households. A small number of surveyed households choose to visit central hospitals, private health establishments, and pharmacies with the corresponding figures of 1.6%, 7.9% and 7.9%.

Table 9.51 Visit to Health Establishments by the Surveyed Household

Visit to Health Establishments	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	%
District health centre	26	60.47	9	45.00	35	55.56
Provincial or city hospital	15	34.88	13	65.00	28	44.44
Communal health station	21	48.84	2	10.00	23	36.51
Private health establishment	5	11.63	0	0.00	5	7.94
Pharmacy	3	6.98	2	10.00	5	7.94
Central hospital	0	0.00	1	5.00	1	1.59

Source: Socio-economic survey conducted by ERM, August 2021

Out of the 63 surveyed households, 46% of them or 29 households (including 22 Gia Rai households and seven Kinh households) had their youngest members delivered or born within the past five years of 2017 - 2021. The selection of giving birth at health establishments may ensure a low-risk pregnancy instead of home birthing. The majority of the surveyed households selected the provincial or city hospitals and district health centres as the place of birth for their youngest members, accounting for 51.7% and 31% respectively (see Figure 9.36). In addition, some surveyed households are recorded giving birth to their children in communal health stations (10.3%) and private health facilities (3.5%). Notably, there is one Gia Rai baby born at home in 2018 (3.5%).



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.36 Birthplaces of the Youngest Family Members Born within the Last Five Years (2017-2021)

9.6.5.3 Healthcare Treatment Practice

Traditional health treatment is not popular among the surveyed households. Only 7.9% or five households confirmed as having traditional medical treatment. In details, three Kinh households use traditional medicine or herbs for sauna to self-treat minor sicknesses such as fever, flu, and headache. Meanwhile, two Gia Rai households practice traditional medicine treatments known as worshiping spirits. The discussion with Gia Rai ethnic group showed that Gia Rai people also visit traditional healers for bone-related health problems (FGD, ethnic minority group, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 29 August 2021).

9.6.6 Access to Infrastructure and Public Services

9.6.6.1 Commune Health Station

The quality of local health stations is assessed in terms of medicine quality, staff's attitude, and medical equipment. Almost 33.3% of inhabitants who benefited from health care services reported the quality of the commune health station to be "good" to "very good" (see Table 9.52). Meanwhile, 25.4% of the surveyed inhabitants perceived the quality of local health station to be "bad" and "very bad" due to lack of specialised medicine and equipment and unwelcoming attitude to patients out of normal working hours (Male respondent, 46 years old, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 30 August 2021).

The Ia Pech commune health station can provide basic health care services to local people such as family planning, infant immunization, and treatment of some injuries (i.e. minor cuts or burns). For other complicated health issues, villagers visit health establishments at the provincial and district levels, which are about 12-30 km away from the locality (FGD, ethnic minority group, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 29 August 2021).

Table 9.52 Evaluation of Local Health Stations by the Surveyed Household

Local Health Station Evaluation	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N		N	%
Very good	1	2.33	2	10.00	3	4.76
Good	12	27.91	6	30.00	18	28.58
Normal	15	34.88	6	30.00	21	33.33
Bad	11	25.58	3	15.00	14	22.22
Very bad	1	2.33	1	5.00	2	3.17
No opinion	3	6.98	2	10.00	5	7.94

Source: Socio-economic survey conducted by ERM, August 2021

9.6.6.2 Local Schools

The local schools' quality is evaluated in terms of teaching and learning facilities, teaching quality, and the school surrounding environment. The fact that nearly 50% of respondents showing their evaluation as satisfied to highly satisfied to the quality of local schools (kindergarten, primary, and lower secondary schools) indicated that conditions of local schools are ensured (see Table 9.53 and Figure 9.37). This figure doubles the number of respondents showing their negative feedback to the quality of local schools (17.5%). They explained that the primary school in the locality have not been safe enough for recreational activities as the school yard has not been concreted. In addition, local schools still lack tables, chairs, computers, classrooms, and playground.

Table 9.53 Evaluation of Local Schools by the Surveyed Household

Local School Evaluation	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	%
Very good	0	0.00	2	10.00	2	3.17
Good	17	39.53	11	55.00	28	44.44
Normal	16	37.21	5	25.00	21	33.33
Bad	10	23.26	1	5.00	11	17.46
Very bad	0	0.00	0	0.00	0	0.00
No opinion	0	0.00	1	5.00	1	1.60

Source: Socio-economic survey conducted by ERM, August 2021

Primary school

Kindergarten

Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.37 Schools in the Surveyed Commune

9.6.6.3 Local Electricity Supply

Reportedly, all surveyed households are connected to the national electricity grid. Approximately 55.6% of the surveyed respondents ranked the electricity quality as “very good” and “good” while other 11.1% of the surveyed respondents rated it as “poor’ and “very poor” due to unstable electricity supply source and high electricity price (see Table 9.54).

Table 9.54 Evaluation of Electricity Supply by the Surveyed Household

Electricity Supply Evaluation	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	%
Very good	4	9.30	2	10.00	6	9.52
Good	18	41.86	11	55.00	29	46.05
Normal	15	34.88	6	30.00	21	33.33
Bad	5	11.63	1	5.00	6	9.52
Very bad	1	2.33	0	0.00	1	1.58
No opinion	0	0.00	0	0.00	0	0.00

Source: Socio-economic survey conducted by ERM, August 2021

9.6.6.4 Local Roads

Solid infrastructure, specifically well-constructed and well-maintained roads are key to the functioning of a local economy, especially farming households. Generally, most of the surveyed residents in Ia Pech commune are likely to be satisfied with the rural road system with 42.8% rating as good and 4.8% voting as very good (see Table 9.55 and Figure 9.38). Conversely, a remarkable number of the interviewees perceived the quality of the existing road system to be bad (22.2%) and very bad (1.6%). Poor rural road conditions may be attributed to heavy trucks to transport construction materials serving for industrial projects in the locality and low investment, leading to rapid degradation in the local road system. Furthermore, some branches of roads to production areas have not been concreted, making

difficulties in local people's mobility (FGD, ethnic minority group, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 29 August 2021).

Table 9.55 Evaluation of Local Roads by the Surveyed Household

Local Road Evaluation	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	%
Very good	2	4.65	1	5.00	3	4.78
Good	15	34.88	12	60.00	27	42.84
Normal	15	34.88	3	15.00	18	28.57
Bad	10	23.26	4	20.00	14	22.22
Very bad	1	2.33	0	0.00	1	1.59
No opinion	0	0.00	0	0.00	0	0.00

Source: Socio-economic survey conducted by ERM, August 2021

Hardened road

Soil road to production area

Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.38 Road System in the Surveyed Commune

9.6.6.5 Local Water Supply

Groundwater from dug wells and drops of water are regarded as the main water sources for local lives. From the survey findings, drops of water from underground veins is the main source for Gia Rai households' use. Meanwhile, no Kinh household using drops of water is recorded. For Gia Rai households, drops of water is invaluable asset given by the nature, which is preserved through the water offering ceremony organised annually in the locality. The majority of the surveyed respondents perceived that the quality of water supply is good (39.7%) and very good (3.2%), contributing to maintain local daily activities and hygiene condition in their households (see Table 9.56). Only 9.5% of the surveyed respondents complained about water shortage in the dry season which happens normally from January to May.

Table 9.56 Evaluation of Local Water Supply by the Surveyed Household

Water Supply Evaluation	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	%
Very good	1	2.33	1	5.00	2	3.17
Good	16	37.21	9	45.00	25	39.68
Normal	16	37.21	9	45.00	25	39.68
Bad	6	13.95	0	0.00	6	9.53
Very bad	0	0.00	0	0.00	0	0.00
No opinion	4	9.30	1	5.00	5	7.94

Source: Socio-economic survey conducted by ERM, August 2021

9.6.6.6 Local Waste Collection Services

Waste management practices in the surveyed commune remain relatively rudimentary when local households treat waste themselves by burning and burying in their residential or production areas. Because of the absence of solid waste collection service in the locality, most of the surveyed respondents did not evaluate this service (71.4%). For those who giving responses on the existing waste collection and management, 7.9% feel unpleased about livestock waste discharge on the roads (see Table 9.57). Reportedly, the local Women's Union and Youth Union sometimes organise waste collection and clean-up activities in the village roads, which helps to keep general environmental sanitation in the surveyed locality.

Table 9.57 Evaluation of Local Waste Collection Services by the Surveyed Household

Local Waste Collection Services Evaluation	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	%
Very good	0	0.00	0	0.00	0	0.00
Good	4	9.30	2	10.00	6	9.52
Normal	7	16.28	0	0.00	7	11.11
Bad	1	2.33	2	10.00	3	4.76
Very bad	0	0.00	2	10.00	2	3.17
No opinion	31	72.09	14	70.00	45	71.44

Source: Socio-economic survey conducted by ERM, August 2021

9.6.6.7 Internet and Telecommunication Services

A considerable proportion of respondents did not evaluate the local internet network and telecommunication services in the surveyed commune (37 respondents or 58.7%) as they do not use or have no opinion about these services. Among the households experiencing these services, 15.9% rated it as "normal", 14.3% ranked as "good", and 1.6% voted as "very good". Meanwhile, only 9.5% of the surveyed respondents gave low evaluation on these services because of the unstable transmission quality (see Table 9.58).

Table 9.58 Evaluation of Internet and Telecommunication Services by the Surveyed Household

Evaluation of Internet and Telecommunication	Gia Rai Group (N= 43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	%
Very good	0	0.00	1	5.00	1	1.59
Good	5	11.63	4	20.00	9	14.29
Normal	8	18.60	2	10.00	10	15.87
Bad	4	9.30	2	10.00	6	9.52
Very bad	0	0.00	0	0.00	0	0.00
No opinion	26	60.47	11	55.00	37	58.73

Source: Socio-economic survey conducted by ERM, August 2021

9.6.6.8 Local Markets

There is no official market in the Ia Pech commune so local households get food and daily stuffs in local groceries, temporary markets, or from mobile vendors. For further needs, they have to go shopping in the district market, which is about 5-7 km away from their residence. Statistically, most of the respondents (63.5%) did not give their evaluation to the existing temporary markets or stores in the locality. For those who giving responses, 20.6% perceived their quality to be bad (see Table 9.59).

Table 9.59 Evaluation of Local Markets by the Surveyed Household

Local Markets Evaluation	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	N
Very good	0	0.00	0	0.00	0	0.00
Good	0	0.00	1	5.00	1	1.59
Normal	6	13.95	1	5.00	7	11.11
Bad	9	20.93	4	20.00	13	20.63
Very bad	1	2.33	1	5.00	2	3.18
No opinion	27	62.79	13	65.00	40	63.49

Source: Socio-economic survey conducted by ERM, August 2021

9.6.6.9 Drainage System

The majority of the surveyed respondents 77.7% did not give any evaluation for the local drainage system. Meanwhile, the numbers of interviewees feeling satisfied and dissatisfied about this section are equal with 4.8% or three people for each (see Table 9.60). Reportedly, the drainage system in the locality is not fully equipped and regularly cleared, which leads to the inefficient operation.

Table 9.60 Evaluation of Drainage System by the Surveyed Household

Drainage System Evaluation	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	N
Very good	0	0.00	0	0.00	0	0.00

Drainage System Evaluation	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	N
Good	2	4.65	1	5.00	3	4.78
Normal	7	16.28	1	5.00	8	12.70
Bad	1	2.33	2	10.00	3	4.78
Very bad	0	0.00	0	0.00	0	0.00
No opinion	33	76.74	16	80.00	49	77.74

Source: Socio-economic survey conducted by ERM, August 2021

9.6.7 Land, Housing and Household Assets

9.6.7.1 Land

The 63 surveyed households possess different types of land including agriculture production land[208], forestry land[209], and non-production land[210] (residential and gardening land) (see Table 9.61).

Table 9.61 Different Types of Land Holdings and Average Land Area

Land Types	Average Land Area per Household (m^2)
Residential and gardening land	2,916
Agricultural production land	16,071
Forestry land	14,367

Source: Socio-economic survey conducted by ERM, August 2021

9.6.7.1.1 Agricultural Production Land

A high percentage of the surveyed households own agricultural production land for crops production, accounting for 88.9% or 56 households, in which over one third of these households (67.9% or 38 households) have a land use right certificate (LURC) for their land holding. The largest land plot is 130,000 m^2 while the smallest is 50 m^2. The average agricultural production land recorded is around 16,071 m^2 per household (see Table 9.62).

Table 9.62 Annual Crops Land Ownership of the Surveyed Households

Agricultural Land for Annual Crops	Surveyed Households (N=56)
Average area per household (m^2)	16,071
Number of households with LURCs	38
The largest area (m^2)	130,000

[208] 55 out of the 63 surveyed households provide their exact information about their agricultural production land area (38 Gia Rai and 17 Kinh households).

[209] Three out of the 63 surveyed households provide their exact information about forestry farming land area (two Gia Rai and one Kinh households).

[210] 49 out of the 63 surveyed households provide their exact information about their residential land area (40 Gia Rai and 9 Kinh households).

Agricultural Land for Annual Crops	Surveyed Households (N=56)
The smallest area (m^2)	50

Source: Socio-economic survey conducted by ERM, August 2021

9.6.7.1.2 Forestry Land

Only three households got access to farming forestry land, occupying 4.8%, in which all of these three households confirmed that they have LURCs for their land. The average area per household is 14,367 m^2, of which the largest land area is 33,000 m^2 and the smallest area is only 100 m^2 (see Table 9.63).

Table 9.63 Farming Forestry Land Ownership of the Surveyed Households

Agricultural Land for Farming Forestry	Surveyed Households (N=3)
Average area per household (m^2)	14,367
Number of households with LURCs	3
The largest area (m^2)	33,000
The smallest area (m^2)	100

Source: Socio-economic survey conducted by ERM, August 2021

9.6.7.1.3 Residential and Gardening Land

Around 81% of the 63 surveyed households (or 51 households) own residential and gardening land with the average land per household of 2,916 m^2 (see Table 9.64). Of these households, the largest area is 10,000 m^2 while the smallest is only 10 m^2. Furthermore, the percentage of households with LURCs is 76.5% or 39 households. Twelve households have their land owned traditionally (two households), inherited from ancestors (six households), or recognised by the local authorities (four households). The remaining 12 households do not have residential and gardening land.

Table 9.64 Residential and Gardening Land Ownership of the Surveyed Households

Residential and Gardening Land	Surveyed Households (N=51)
Average area per household (m2)	2,916
Number of households with LURCs	39
The largest area (m2)	10,000
The smallest area (m2)	10

Source: Socio-economic survey conducted by ERM, August 2021

9.6.7.2 Housing

9.6.7.2.1 House Ownership

All of the 63 surveyed households privately own their houses. However, it should be noted that five households have their house built on their relative's land plots. Notably, among the 63 surveyed households, 12 households, accounting for 19%, built their houses on agricultural production land since they do not own any residential and gardening land area. Regarding the number of houses each surveyed household owns, most of the households possess one house (96.8% or 61 households). In addition, one Kinh household owns two houses and the remaining one Gia Rai household owns three houses.

9.6.7.2.2 Length of Residence in House

The average length of residence in the house of the surveyed households is about 20.3 years. In addition, the minimum and maximum residence years were two and 70 years respectively (see Table 9.65).

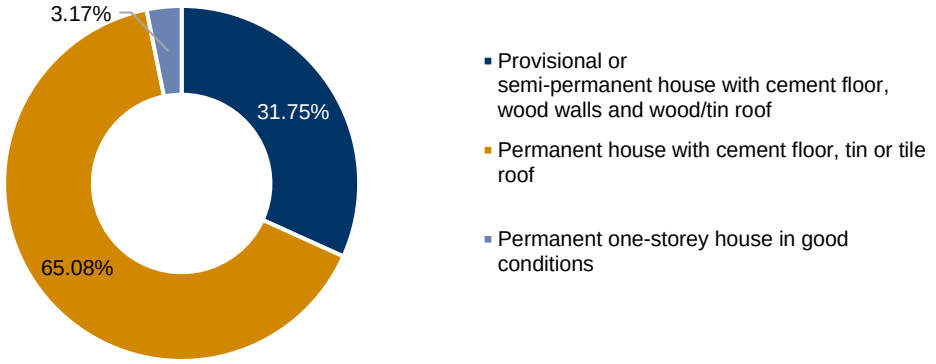
Table 9.65 Length of Residence in House

Length of Residence in House	Gia Lai Group (N=43)	Kinh Group (N=20)	All Surveyed Households (N=63)
Average years of residence in the house	25.33	10.90	20.29
Minimum years of residence in the house	2	3	2
Maximum years of residence in the house	70	22	70

Source: Socio-economic survey conducted by ERM, August 2021

9.6.7.2.3 Housing Types

About 68.3% of surveyed households have their houses classified as permanent (65.1% permanent houses with cement floor, tin or tile roof, and 3.2% permanent one-storey houses) (see Figure 9.39). The remaining records 31.7% of households with semi-permanent with cement floor, wood walls and wood or tin floor.

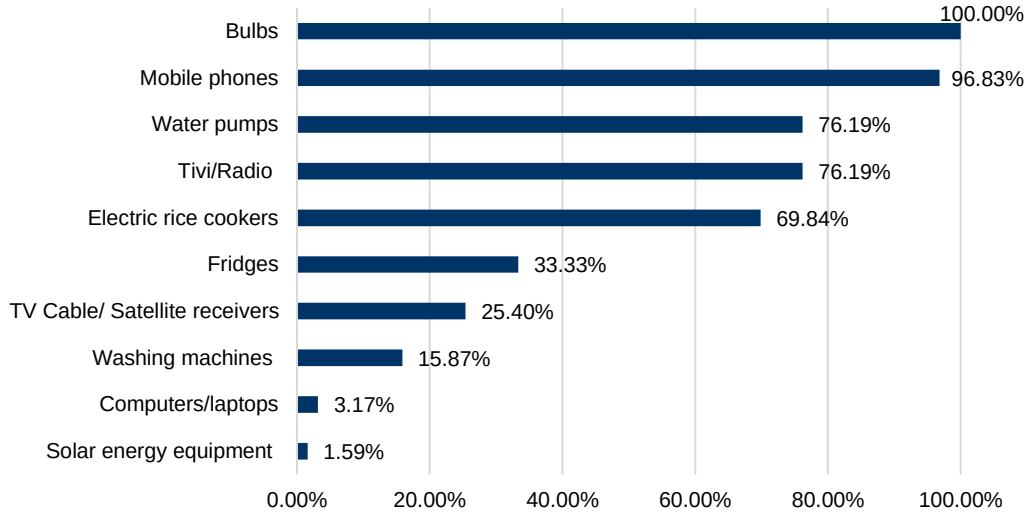


Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.39 Different Housing Types Owned by the Surveyed Household

9.6.7.2.4 Household Utilities

The majority of the surveyed households own common household appliances such as lightning bulbs, mobile phones, water pumps, television, and electric rice cooker (see Figure 9.40). Apart from that, the surveyed households also own fridge (33.3%), TV cable (25.4%), washing machines (15.9%), computers (3.2%), and solar energy powered equipment (1.6%).

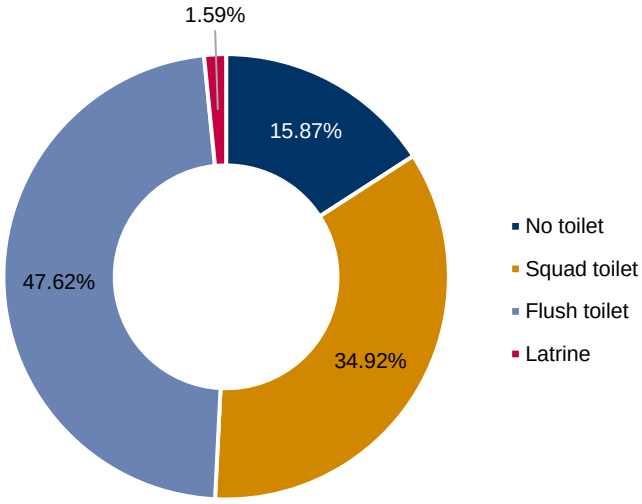


Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.40 Household Utilities Owned by the Surveyed Household

9.6.7.3 Toilet

Statistically, nearly half of the surveyed households have access to flush toilets, accounting for 47.6% (see Figure 9.41). In addition, over one-third (34.9%) use squad toilets and only 1.6% use latrines while the remaining 15.9% of the surveyed households do not have any private toilets. As a result, they defecate in their garden areas, in fields or in the forest, or some households share toilets with their relatives or neighbours. In addition, a considerable number of surveyed households do not have private bathroom, hence bathing activities are taken places at local water wharfs.



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.41 Toilet Conditions among the Surveyed Households

9.6.7.4 Sources of Drinking Water

A large proportion of the surveyed households (68.3%) use groundwater sources such as dug wells and bore wells for daily use. In addition, 38.1% use water drops, which is a traditional water source for

the Gia Rai people rooted from underground veins (see Table 9.66). About 4.8% fetch water from river, spring, and lake in the locality for domestic use.

Table 9.66 Water Sources of Surveyed Households for Daily Use

Water Sources for Daily Use	N (63)	%
Groundwater from dug wells	32	50.79
Groundwater from bore wells	11	17.46
Drops of water	24	38.10
River, spring, and lake	3	4.76

Source: Socio-economic survey conducted by ERM, August 2021

Regarding water source for drinking, most surveyed households (77.8%) use groundwater (58.7% use dug wells and 19.1% possess bore wells) as the piped water system is not available in the surveyed villages. In addition, they also access multiple additional sources of water such as drops of water (28.6%), water from river, spring, lake nearby their house (6.4%), and 20 litre water bottles (1.6%) (see Table 9.67 and Figure 9.42).

Table 9.67 Water Sources of Surveyed Households for Drinking

Water Sources for Drinking	N (63)	%
Groundwater from dug wells	37	58.73
Groundwater from bore wells	12	19.05
Drops of water	18	28.57
River, spring, and lake	4	6.35
20 litre bottled water	1	1.59

Source: Socio-economic survey conducted by ERM, August 2021

Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.42 Drops of Water in Ia Pech Commune

9.6.7.5 Sources of Cooking Energy

Over three quarters of the surveyed households asserted that they use firewood for daily cooking activities, accounting for 77.8% (see Table 9.68). The surveyed households collect firewood from production areas or surrounding areas nearby their house. Around 69.8% or 44 households use gas, and 44.4% or 28 households use electricity for cooking.

Table 9.68 Cooking Energy Sources of the Surveyed Households

Cooking Energy Sources	N (63)	%
Firewood	49	77.78
Gas	44	69.84
Electricity	28	44.44

Source: Socio-economic survey conducted by ERM, August 2021

9.6.7.6 Access to Natural Resources

Among the 63 surveyed households, 17 households (including 16 Gia Rai households and one Kinh household) accessed the natural resource areas for non-timber forest product (NTFP) collection or grazing activities, accounting for 27%. Specifically, 13 Gia Rai households collect NTFPs and four households (23.5% or three Gia Rai households and one Kinh households) access natural areas for livestock grazing.

Reportedly, 52.9% or nine Gia Rai households reported some common NTFPs that they collect from nature namely bamboo shoots, wild cassava leaves, forest vegetables, and bee honey (see Table 9.69). Some of these products are seasonal such as bamboo shoots (from July to August), bee honey (from March to April) while others are all year round. The NTFPs are mainly collected in coffee or pepper farms and along streams or rivers, which are about 1-3km away from local residence. Local households also catch fish in local streams. About 23.5% of households graze their livestock in the natural spaces. In addition, the surveyed households catch wild animals such as wild rats and collect wood for cooking with the corresponding figures of 17.7% and 11.8%.

Table 9.69 Access to Natural Resources

Natural Resources	Gia Rai Group (N=16)		Kinh Group (N=1)		Surveyed Households (N=17)	
	N	%	N	%	N	%
Food	9	56.25	0	0.00	9	52.94
Grazing	3	18.75	1	100.00	4	23.53
Wild animals	3	18.75	0	0.00	3	17.65
Wood	2	12.50	0	0.00	2	11.76

Source: Socio-economic survey conducted by ERM, August 2021

Regarding the importance of the forest, 9.5% or six respondents claimed that the forest has a significant role in their lives as a place providing food and fresh air, saving water source, and making the climate equable while the remaining respondents did not give any responses.

9.6.7.7 Household Assets

All of the 63 surveyed households own residential houses, and 98.4% or 62 households possess land plots for both agricultural production and residence purposes. Approximately 71.4% or 45 households raise animals or poultries at home, and 54% or 34 households have agricultural equipment serving for

farming activities. About 3.2% of the surveyed households have ponds or lakes, and another 3.2% have savings (see Table 9.70). In addition, regarding household vehicles, all of the surveyed households own motorbikes, 19.1% possess bicycles, and one Kinh household (1.6%) owns a car.

Table 9.70 Ownership of Household Assets

Households Assets	N (63)	%
Residential house	63	100.00
Motorbikes	63	100.00
Land plots	62	98.41
Animal or Poultry	45	71.43
Agricultural equipment	34	53.97
Bicycle	12	19.05
Pond	2	3.17
Savings	2	3.17
Car	1	1.59

Source: Socio-economic survey conducted by ERM, August 2021

9.6.8 Vulnerability

Vulnerable groups or individuals refers to people who, by virtue of factors beyond their control, may be more likely to be adversely affected by the Project's environmental and social impacts; and may be more limited than others in their ability to claim or take advantage of Project benefits[211]. This disadvantaged or vulnerable status may stem from an individual's or group's race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, or other status[212].

Under Vietnamese law[213] (i.e. Decree No. 136/2013/ND-CP, Decree No. 99/2018/ND-CP, and Decree 20/2021/ND-CP), vulnerability categorises are officially recognised and eligible for various social benefits from the Government, including:

- Orphans with ages up to 16 years old without nurture or with ages between 16 and 22 pursuing formal education, vocational education, professional secondary education, college education or first higher education degrees;
- Individuals contracted HIV/AIDS, living in poor households and having no stable monthly income namely salary, wage, pension, social security benefit, monthly social security;
- Individuals with severe disabilities and individuals with very severe disabilities;
- Elderly of 80 years of age or older without pension, monthly social security benefits or monthly social benefits;

[211] Asian Infrastructure Investment Bank's (AIIB) Environmental and Social Standards (ESS) 2

[212] Paragraph 12 of International Finance Corporation (IFC) Performance Standard (PS) 1

[213] The recommended categorisation of vulnerable households is specifically developed based on the Vietnamese law (ie Decree No. 136/2013/ND-CP, Decree No. 99/2018/ND-CP, and Decree 20/2021/ND-CP on specifying categories of vulnerability that are officially recognised and are eligible for various social benefits from the Government) and outcomes of the socio-economic baseline survey. Should surveyed households match these criteria, they will be classified as vulnerable.

- Single parents of poor households with children under 16 years of age or having children from 16-22 undertaking tertiary education (undergraduate, colleges or vocational schools);
- People who devoted themselves to the National Revolution (including relatives of patriotic martyrs, war invalids, and war participants who are Orange Agent victims); and
- Poor households.

In this study, the surveyed households are classified as vulnerable if they are limited in their ability to take advantage of any development programmes or related benefits. This section analyses the vulnerability of surveyed households as a consequence of their gender, age, physical or mental disability, and disadvantage due to economic or social status.

9.6.8.1 Classification of Vulnerable Group

Based on the international standards, national regulations, and outcomes of socio-economic baseline survey, vulnerable households in this study are defined if they meet at least one of the following criteria:

- Poor or near-poor households certified by the Government;
- Households with orphans or abandoned children under 16 years old or with ages between 16 and 18 pursuing education;
- Households including elderly over 60 years of age living alone;
- Households including elderly people over 80 years old without social welfare or insurance;
- Elderly-headed households (i.e. elderly people over 60 years old living separately from their sibling or as main labourers);
- Households with physically or mentally disabled family members without regard to the level of disability;
- Households with members infected with HIV/AIDS;
- Households with members suffering from chronic diseases, born with congenital abnormalities or limited learning ability;
- Poor single parent households raising children under the age of 16 or children aged 16-18 and attending school;
- Households headed by individuals without stable jobs or long term unemployed;
- Households with an illiterate breadwinner; or
- Female-headed households.

9.6.8.2 Profile of Vulnerable Group

A small amount of the 63 surveyed households (nine households or 14.3%) with a total population of 34 people including 14 Kinh people (of four households) and 20 Gia Rai people (of five households) are identified as vulnerable (see Table 9.71). The average household size of the nine vulnerable households is four people per household with the range of two to six people per family, lower than the average household size of all surveyed households (nearly five people per household).

Table 9.71 Vulnerable Households in the Surveyed Commune

Types of Households	Gia Rai Group (N=43)		Kinh Group (N=20)		All Surveyed Households (N=63)	
	N	%	N	%	N	%
Vulnerable households	5	11.63	4	20.00	9	14.29
Non-vulnerable households	38	88.37	16	80.00	54	85.71

Source: Socio-economic survey conducted by ERM, August 2021

The surveyed households in the vulnerable group may match more than one vulnerable criterion. Of these nine vulnerable households, seven households are identified with one vulnerability criteria (77.8%), and two households have two vulnerabilities (22.2%).

Among the nine vulnerable households, the percentage of households identified as poor and near-poor households are dominant with 77.8% (seven households). In addition, there are two elderly headed households (22.2%), one female headed household (11.1%), and one household with physically disabled members (11.1%) (see Table 9.72). The list of nine households with vulnerabilities is provided in Appendix J.

Table 9.72 Surveyed Households by Vulnerability Category

Types of Vulnerability	Gia Rai Group (N=5)		Kinh Group (N=4)		Surveyed Households (N=9)	
	N	%	N	%	N	%
Poor households	1	20.00	0	0.00	1	11.11
Near poor households	4	80.00	2	50.00	6	66.67
Elderly headed households	0	0.00	2	50.00	2	22.22
Female headed households	0	0.00	1	25.00	1	11.11
Households with physically disabled members	0	0.00	1	25.00	1	11.11

Source: Socio-economic survey conducted by ERM, August 2021

Most of the surveyed vulnerable households (eight out of households or 88.9%) rely on land-based livelihoods. Land ownership plays a key role in livelihood sustain and development. The average residential and gardening land area is 4,109 m^2 per household. The average agricultural production land area of the vulnerable group[214] is 7,957 m^2 - much lower than that of all surveyed households (16,071 m^2).

9.6.8.3 Household Economic Conditions

Of the vulnerable group, the average monthly incomes per household and per capita[215] are VND 7,708,519 and VND 2,668,333 respectively. By ethnicity, the average monthly income of Kinh vulnerable households exceeds that of Gia Rai households (VND 13,148,333 versus VND 3,356,667 respectively). The lowest monthly vulnerable household income is recorded at VND 2,083,333 (of one Gia Rai household in Nang Long-Osor village relying on agricultural cultivation and seasonal employment). Meanwhile, the highest monthly income is VND 17,916,667 (of one Kinh household in Sat Tau village generating their household income from agriculture cultivation and financial support from children or relatives) (see Table 9.73).

[214] Data was calculated based on information provided by seven vulnerable households

[215] Data was calculated based on information provided by nine vulnerable households with 27 family members living in and contributing to household income - the other seven people not living in these families are excluded from the data analysis.

Table 9.73 Average Monthly Income of Vulnerable Households

Average Monthly Household Income	Gia Rai Group (N=5)	Kinh Group (N=4)	Surveyed Households (N=9)
Average monthly income per household (VND)	3,356,667	13,148,333	7,708,519
Average monthly income per capita (VND)	883,333	7,513,333	2,668,333
Minimum monthly household income (VND)	2,083,333	5,000,000	2,083,333
Maximum monthly household income (VND)	5,000,000	17,916,667	17,916,667

Source: Socio-economic survey conducted by ERM, August 2021

Regarding the income structure, land-based livelihoods are considered the main income source of the vulnerable households, accounting for 89.7% of the average monthly household income (see Table 9.74). This is followed by enterprise-based sources with a small proportion of 8.5% of the vulnerable households' monthly income. Meanwhile, wage-based livelihoods only contribute 1.2% to the vulnerable households' monthly income. In addition, around 0.6% of household income comes from social allowance or financial support from other family members.

By ethnicity, land-based livelihoods are still the main income source of the vulnerable households in the two ethnicity groups. The proportion of Gia Rai vulnerable households relying on this source is slightly higher than that of Kinh vulnerable households (92.7% verus 88.7% respectively). Kinh vulnerable households do not earn their living by wage-based livelihoods while this type of livelihood is the second source of monthly income in Gia Rai vulnerable households (4.8%).

Day labour is a common work to vulnerable groups to improve their household income. They normally work as day labourers in the crop fields such as weeding, pruning, branch chopping, and pesticide spraying with a daily income of VND 180,000. On average, they work 3-4 days or 7 days per month for Kinh households. They do not work out of the province because they cannot afford transport and accommodation costs and some of them have to take care of small children. They cannot work for companies because they are afraid that they do not have enough time to take care of their production activities and they are not qualified for company employment (FGD, vulnerable group, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 30 August 2021).

Table 9.74 Average Monthly Income of Vulnerable Households by Ethnicity

Income Sources	Gia Rai (N=5)	Kinh (N=4)	Surveyed Households (N=9)
Land-based livelihoods	92.74	88.73	89.70
Enterprise-based livelihoods	2.48	10.48	8.54
Wage-based livelihoods	4.78	0.00	1.16
Other sources	0.00	0.79	0.60

Source: Socio-economic survey conducted by ERM, August 2021

Livelihood diversification is perceived as a strategy to poverty reduction. However, among the vulnerable group, over a half of the vulnerable households (55.6%) source their income mainly from a single livelihood (four households with land-based livelihoods and one household with enterprise-based livelihoods). Meanwhile, the remaining four households (44.4%) have two livelihoods (two households with land-based and enterprise-based livelihoods, one household with land-based and wage-based livelihoods, and one household with land based livelihoods and financial support from famlily members).

Around 77.8% (seven households) confirmed their financial shortage status within the last three years while the remaining 22.2% stated the opposite. These seven households are reported to be in debt and they borrow money from relatives, acquaintances, commercial banks, social policy banks, and fertilizer

agents. Notably, two of them perceived their debt pressure to be beyond their capacity while the remaining can manage their debt payment.

9.6.8.4 Access to Public Services

According to the perception of nine vulnerable respondents, most of these vulnerable households are satisfied with electricity supply, rural road system, local schools, and water supply in the commune. The quality of healthcare is considerably perceived to be bad and very bad (33.3%) due to limited medicine and equipment available at the local health station. For waste collection services, internet and telecommunication services, markets, and drainage system, most vulnerable households did not provide their evaluation during the household interviews as these services are not widely operated or available in the locality (see Table 9.75).

Table 9.75 Vulnerable Households' Evaluation of Public Services

Public Services	Good and Very Good		Normal		Bad and Very Bad		No Opinion	
	N	%	N	%	N	%	N	%
Electricity	7	77.78	2	22.22	0	0.00	0	0.00
Roads	6	66.67	1	1.11	2	22.22	0	0.00
Basic Education	6	66.67	2	22.22	1	11.11	0	0.00
Clean Water	5	55.56	3	33.33	1	11.11	0	0.00
Health Care	2	22.22	3	33.33	3	33.33	1	11.11
Internet and Telecommunication Services	2	22.22	0	0.00	1	11.11	6	66.67
Drainage System	1	11.11	0	0.00	2	22.22	6	66.67
Waste Collection Services	0	0.00	0	0.00	2	22.22	7	77.78
Markets	0	0.00	1	1.11	4	44.44	4	44.44

Source: Socio-economic survey conducted by ERM, August 2021

9.6.8.5 Well-Being Perception

During the FGD, a group of seven vulnerable households (including three poor households and four near poor households) in Nang Long-Osor village were asked to show their satisfaction level for specific aspects of their life, on a scale of zero to ten (zero is the lowest and 10 is the highest). Participants showed high satisfaction with their “community support” (9 points), “water quality”, “environment quality”, “low impacts of natural disasters”, and “personal relationships” (8 points). Meanwhile, “current living conditions”, “personal life”, and “health status” are all rated poorly, with the score of 5 or below (see Table 9.76).

Table 9.76 Well-being Evaluation of Vulnerable Households

Well-being Aspects	Ranking by Vulnerable Group	Ranking by Women Group	Ranking by Ethnic Minority Group	Ranking by Agricultural Group
Current living condition	4	5	5	5
Health status	5	8	7	5
Personal life	5	5	6	8

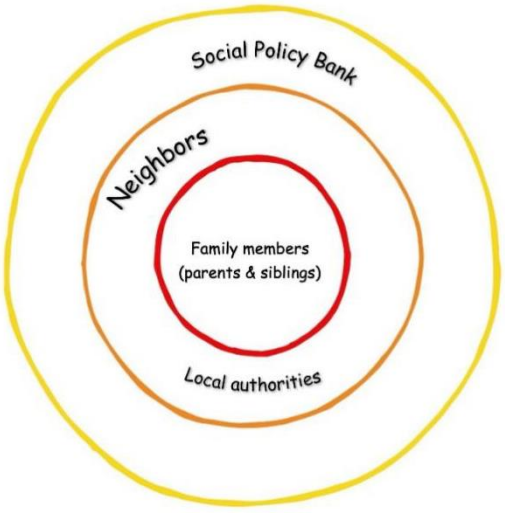
Well-being Aspects	Ranking by Vulnerable Group	Ranking by Women Group	Ranking by Ethnic Minority Group	Ranking by Agricultural Group
Personal relationships	8	8	8	8
Local security	6	8	7	8
Social evils	NA	8	8	9
Community support	9	10	9	9
Traffic safety	6	8	8	8
Water quality	8	8	8	8
Environment quality	8	8	8	8
Impacts of natural disasters	8	8	8	7

Source: Socio-economic survey conducted by ERM, August 2021

The well-being perception of vulnerable group is relatively similar to that of other groups such as women's group, Gia Rai ethnic minority group, and agriculture group on the predetermined aspects, except current living condition, health status, and satisfaction of personal life. Perpetually low agriculture-based income levels are one of the key reasons why vulnerable households remain stuck in poverty and under-invest in their farms. Most of them normally get loans from informal sources (individuals) to pay off their debts from social policy banks. This keep them in vicious poverty cycle. In addition, they encounter lack of off-farm employment opportunities, low investment in children education, low investment in better housing, poor daily nutrition, and limited transportation.

9.6.8.6 Social Support

As shared by the vulnerable household group through the FGD in Nang Long-Osor village, their primary source of support comes from their closest one, which is family members such as parents or siblings. Secondly, their neighbours and local authorities are also identified as the secondary source of support. The local authorities support them with rice, noddle, cooking oil, blankets, and other necessities. Poor households are supported with breeding pig and pig cage. Women's Union and the commune authorities also provide housing and support in repairing house for vulnerable households. In addition, social policy banks are recorded as the final round of support (see Figure 9.43).



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.43 Circle of Social Support Defined by Vulnerable Group

9.6.9 Gender Profile

9.6.9.1 Demographic Profile

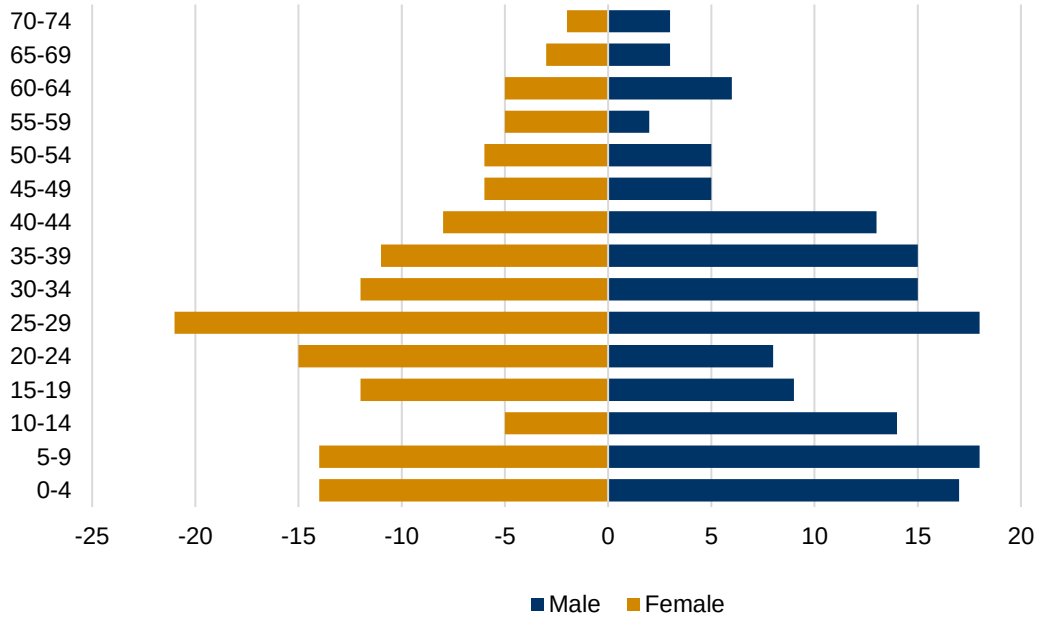
Gender split shows that male and female ratio in the 290 surveyed population is 52:48 with the equivalent figures of 151 males versus 139 females respectively. By ethnicity, the number of males surpassed females in both Kinh and Gia Rai surveyed groups, 52.1% versus 47.9% and 51.8% versus 48.2% respectively. In addition, there is one Bahnar male recorded in the household survey (see Table 9.77).

Table 9.77 Surveyed Population by Gender and Ethnicity

Ethnicity	Male (N=151)		Female (N=139)		All Surveyed Population (N=290)	
	N	%	N	%	N	%
Kinh	49	52.13	45	47.87	94	32.41
Gia Rai	101	51.79	94	48.21	195	67.24
Bahnar	1	100.00	0	0.00	1	0.34
Total	**151**	**52.07**	**139**	**47.93**	**290**	**100.00**

Source: Socio-economic survey conducted by ERM, August 2021

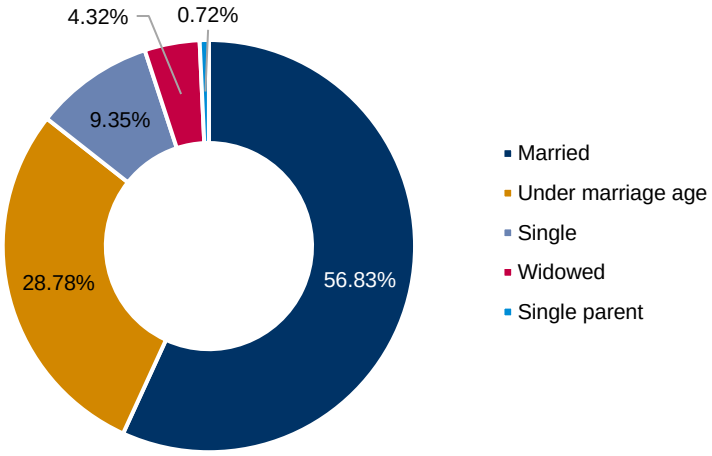
The below age pyramid shows that the number of males are predominant in the group of under 15 years old (59.8% versus 40.2% respectively) and over 60 years old (54.5% versus 45.5% respectively). Gender split in the 15 to 60 years bracket also indicates a gap of around 3% between the number of males and females (48.4% versus 51.6% respectively) (see Figure 9.44).



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.44 Population Pyramid by Age and Gender

In terms of marital status of the surveyed females, more than half of the female population (56.7% or 79 people) are married. Meanwhile, less than one third of the surveyed females (28.8% or 40 females) are under marriage age and 9.4% or 13 females are single. In addition, six females (4.3%) identify their marital status as widowed and only one female (0.7%) is reported to be a single parent (see Figure 9.45).



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.45 Surveyed Female Population by Marital Status

9.6.9.2 Education

In terms of literacy, the level of illiteracy of female population[216] is threefold as high as male population, including 18 females and six males, 75% versus 25% respectively reflecting the imbalance between genders in education accessibility. The age span of the male illiterate group is mostly in eldely group (from 62 to 72 years old) while the illiterate female population is in the broader age bracket (from 30 to 70 years old). Among the literate population, the number of males surpasses their female counterparts, with the corresponding figures of 55.1% versus 44.9% (125 males and 102 females respectively) (see Table 9.78).

Table 9.78 Education Status by Gender

Education Status	Male (N=131)		Female (N=120)		Surveyed Population (N=251)	
	N	%	N	%	N	%
Illiteracy	6	25.00	18	75.00	24	9.56
Literacy	125	55.07	102	44.93	227	90.44

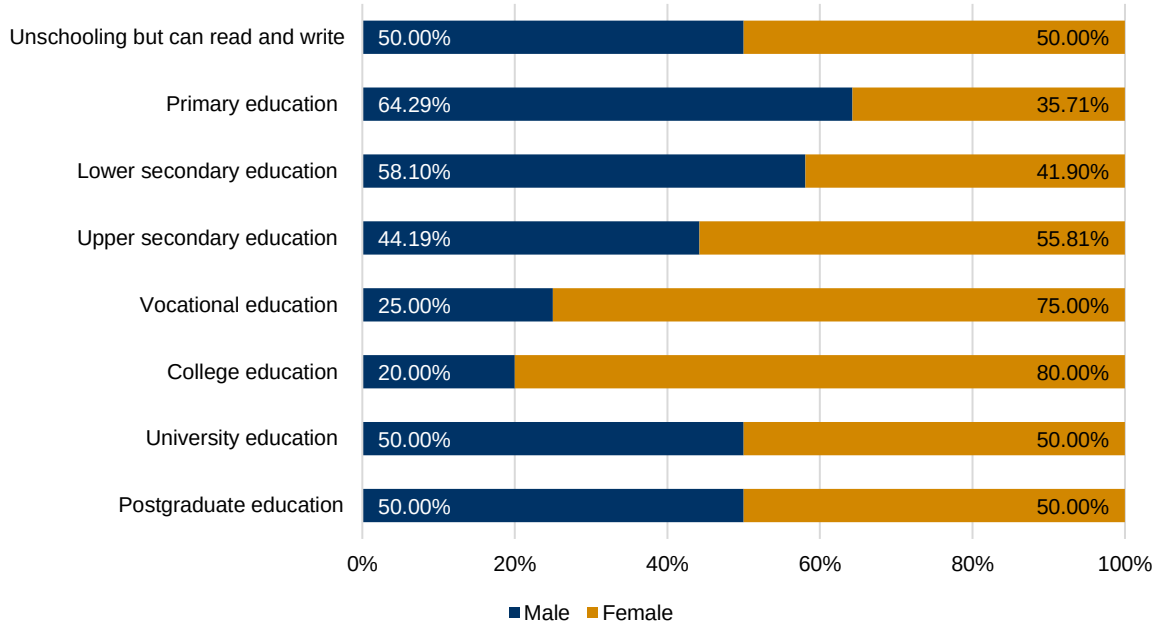
Source: Socio-economic survey conducted by ERM, August 2021

Regarding gender distribution in education, gender gaps vary in different levels albeit at different rate. In general education, male takes up a considerable proportion in primary and lower secondary levels 64.3% and 58.1% respectively. Meanwhile, a higher level of female attending upper secondary level compared to their male counterparts, 55.8% versus 44.2% respectively.

At higher education levels such as vocational and college, the proportion of female substantially surpasses male with the corresponding figures of 75% female versus 25% male and 80% female versus

[216] For education, the analysis was based on data from 251 people, in which data from 39 people (including 36 children under schooling age and three people whose educational levels are not clearly identified by the interviewees) were not included.

20% male. In addition, a balance gender rate is recorded in tertiary education and postgraduate education. This pattern is also found in the literate population without formal schooling (see Figure 9.46).



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.46 Surveyed Population by Educational Attainment and Gender

9.6.9.3 Health

When disaggregating the information by gender, among the 90 surveyed people reported to be encountered with health issues, a higher number of females are prone to health problems than males (51.1% for female and 48.9% for male).

Regarding the number of health issues encountered, the number of females having one health problem outweigh male's statistics, 54.4% or 37 females while the number of males having from two health problems are higher than that of females (13 males versus nine females respectively). (see Table 9.79).

Table 9.79 Surveyed Population with Health Issues

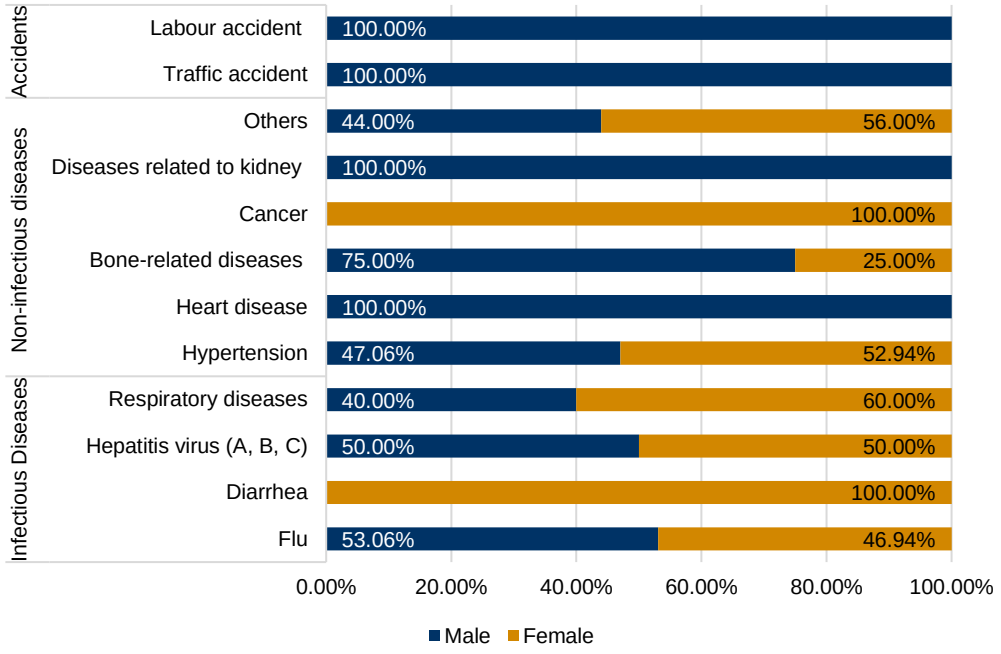
Health Issues	Male (N=44)		Female (N=46)	
	N	%	N	%
People with one health issue	31	45.59	37	54.41
People with two health issues	10	58.82	7	41.18
People with three health issues	1	50.00	1	50.00
People with four health issues	2	66.67	1	33.33

Source: Socio-economic survey conducted by ERM, August 2021

In terms of common infectious diseases, females are having a higher rate in getting the diseases. Specifically, a higher proportion of female encountered diarrhea (100%), respiratory diseases (60%), except hepatitis virus (A,B,C) (50%) and flu (46.9%) (see Figure 9.47).

Regarding non-infectious diseases, males are recorded with higher risks of getting diseases related to kidney (100%), heart disease (100%), and bone related diseases (75%) while women, are prone to diseases such as cancer (100%), and other diseases (56%) such as headache, abdominal pain, stroke, and Sciatica.

For labour and traffic accidents, only male has got into accidents with one case of traffic accident and one case of labour accident.



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.47 Types of Common Diseases among the Surveyed Population by Gender

9.6.9.4 Women's Roles

Women's roles in reproduction activities, production activities, and community affairs were identified by local Gia Rai women participating in the FGD (see Table 9.80).

Table 9.80 Women's Roles Perceived by Gia Rai Women

Activities	Description
Reproduction activities	Gia Rai women take charge of domestic work such as cooking, doing household chores house, and taking care of children. Water fetching and firewood collection are primarily carried out by women. Normally, women use motorbike to fetch water or firewood in the dry season but in the rainy season, they travel on foot. The distance from their house to area for water fetching is about 200m. They take water twice a day in early morning and in the afternoon. As firewood is the main source for cooking, they collect firewood and store it before the rainy season (before March) so that they can have enough during the period April - October. Firewood is collected from production areas. In addition, women collect natural food sources such as bamboo shoots (May to September) or vegetable in local farms for household meals or for sale.
Production activities	They are engaged in economic activities including agricultural production and day labour. Husband and wife work as day labourers with a wage of VND 180,000 for female and VND 200,000-250,000 per male. They work at least 3-4 days per month or maximum 10 days

Activities	Description
	per month. Men normally take heavy work while women take light work such as weeding, coffee picking, branch cutting, and rubber tapping. In terms of household finance, husbands normally contribute more income compared to women.
Community activities	Women are participating in community festivals. Some important festivals of Gia Rai community include grave removal festival, rain worshipping, and water ceremony. Women and men dance and sing together on these festivals and involve in preparing the ceremonies. Women also play volleyball in their free time.
Decision making	The Gia Rai community is characterised by matriarchal family. Women are respected but men take important roles in the community such as community affairs, worshipping ceremonies, and meetings. In the changing process, the men's position in family has been improved. There is no difference between female and male in the family as both are engaged in making decisions related to household affairs.

Source: FGDs conducted by ERM, August 2021

The perception of women's roles under Gia Rai women's lens is also reflected when they describe their typical day. A day in Gia Rai women's life is quite busy with household chores and agricultural production activities. Women complete household and caregiving chores after they've finished their labour in agricultural production.

> We get up at 5 am and start preparing breakfast for the whole family and also lunch for us when working in farms. After that, we fetch water, clean up the house yard, feed our children, and pack food for working. Around at 7 am, we take children to schools and then go to farms. We spend most of the day to work in farms with our husbands. At 4pm, we are going to be back to home and fetch water on the way back. When at home, we prepare a dinner, wash their children, and tidy up the house. We oversee our children's studies and take them to bed at 9 pm. After 9:00 pm is time for ourselves. We can spend a little time at the end of a day for updating social information through television or social media when our children already sleep well. Our next day follows almost exactly the same pattern (FGD, women's group, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 29 August 2021).

9.6.9.5 Changes and Challenges in Women's Living Conditions

There are some positive changes in women's living conditions observed. Women normally choose to give birth at hospitals or health stations to ensure a low-risk pregnancy instead of practicing home birth. In addition, women's reproductive health care is paid much attention. Women receive gynaecological examination and practice their fertility control through reproductive healthcare programs of the commune health station. In addition, access to transportation vehicles (i.e. motorbike) supports women to reduce their time and efforts in household chores such as firewood collection and water fetching. Women's living conditions is increasingly improved as women are engaged in income generation activities such as day labour and agricultural production. Women can access loan programs delivered by social policy banks for production investment. In addition, women are increasingly participating in community activities such as traditional festivals. However, finding a job is difficult to women due to limited educational background and burden from household tasks (FGD, women's group and ethnic minority group, Gia Rai ethnicity, Nang Long-Osor village, Ia Pech commune, 29 August 2021). The survey findings showed that the rate of Gia Rai women attending upper secondary education and above among the surveyed Gia Rai female population is much lower than that of Kinh women (17.7% versus 46.7% respectively). This may limit employment opportunities to Gia Rai women.

9.6.9.6 Livelihood Engagement

This section analyses employment of 178 people who are currently engaged in land-based, enterprise-based, and wage-based livelihoods. This includes 90 males (50.6%) and 88 females (49.4%). Regarding male and female engagement level in household's livelihoods, male occupies a larger part in some types of employments such as public servant (70%) and day labourer (75%). The proportion of male and female engaging in cultivation, small business, and company employment is nearly balanced. As for husbandry, two females are recorded while no male engages in this type of livelihood (see Table 9.81).

When comparing the average monthly income between surveyed female-headed household (one household) and surveyed male-headed households, male-headed households' average monthly income vastly surpass the female-headed household. Specifically, the average income of male headed households is nearly three times higher than female, VND 13.9 million versus five million and the average monthly income per capita is around fivefold, VND 1.67 million for female-headed household versus 9.2 million for male-headed households.

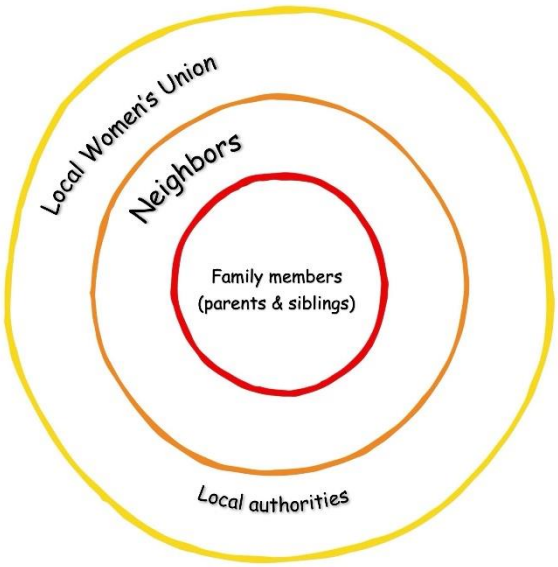
Table 9.81 Livelihood Engagement by Gender

Livelihoods		Male Working Population (N=90)		Female Working Population (N=88)	
		N	%	N	%
Land-based livelihoods	Cultivation	72	49.66	73	50.34
	Husbandry	0	0.00	2	100.00
Enterprise-based livelihoods	Small business	4	50.00	4	50.00
Wage-based livelihoods	Public servant	7	70.00	3	30.00
	Company worker	4	44.44	5	55.56
	Day labourer	3	75.00	1	25.00
All Surveyed Population		**90**	**50.56**	**88**	**49.44**

Source: Socio-economic survey conducted by ERM, August 2021

9.6.9.7 Social Support

During the FGD with a women group of Gia Rai ethnicity in Nang Long-Osor village, all participating women were requested to rate the support level from different groups using a three-order circle of support in terms of importance for their needs. Their primary source of support comes from their closest one, which is family members such as parents or siblings. Secondly, their neighbours are also identified as the secondary source of support. In addition, Women's Union and local authorities are recorded as the final round of support (see Figure 9.48).



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.48 Circle of Social Support Defined by Women Group

9.6.10 Needs Assessment for Livelihood Restoration

9.6.10.1 Profile of Affected Households by Land Acquisition

- Classification of Affected Households

According to the available data to ERM at the time of writing the ESIA report, there were approximately 160 households whose land had been acquired for the Project (both long-term and short-term land acquisition). The exact number of households affected by land acquisition could not be determined from the land acquisition documents provided to ERM, especially on the enclosed confirmation of compensation value for land and assets on land for each slot of land issued by Ia Grai DPC, the land use right owners of several land slots were not identified. Due to the limitations provided earlier in this social baseline section, there were only 23 households impacted by land acquisition for the Project that participated in these remote interviews on the phone.

Of the 63 surveyed households, there are 23 households including 13 Gia Rai and 10 Kinh households affected by the land acquisition for the Project. Out of the 23 surveyed households, three households are identified as vulnerable (two near poor households and one female-headed households with physically disabled members).

Of these 23 affected households, 10 households (seven Gia Rai and three Kinh households) have residential land (including gardening land) acquired, and 13 households (six Gia Rai and seven Kinh households) have agricultural production land acquired (see Table 9.82).

Table 9.82 Classification of Affected Households by Type of Land

Affected Households by Type of Land Acquired	Gia Rai Group (N=13)		Kinh Group (N=10)		Affected Households (N=23)	
	N	%	N	%	N	%
Households having residential land acquired	7	53.84	3	30.00	10	43.48
Households having agricultural production land acquired	6	46.16	7	70.00	13	56.52

Source: Socio-economic survey conducted by ERM, August 2021

- Compensation Payment

According to the information shared by the developer, all 23 affected households have been fully compensated. Only three households (13%) confirmed that they still keep compensation records while the remaining 20 households (87%) did not keep any documents. It was reported that the compensation ranges from VND 900,000 to VND 180,000,000 for agricultural production land and from VND 9,000,000 to VND 30,000,000 for residential land, depending on the acquired land area. Apart from land compensation, some affected households are eligible for tree compensation. The “tree compensation” refers to the compensation for any trees, plants or crops associated with the land at the time of land acquisition. The compensation rate was mainly based on the mutual agreement through the direct negotiation between the Project and the affected households.

Details of the Project land acquisition process, compensation, support and resettlement for affected households are discussed in Chapter 12 – Social Impact Assessment.

Nearly two thirds of the 23 affected households (60.9% or 14 households included indigenous peoples, 10 Gia Rai and four Kinh households), were dissatisfied with the compensation amount as they could not really found any alternative land to be acquired through the compensation amount (see Table 9.83). Meanwhile, only one Kinh household (4.4%) was satisfied with the price.

Table 9.83 Local Perception of the Compensation Price

Local Perception of the Compensation Price	Gia Rai Group (N=13)		Kinh Group (N=10)		Affected Households (N=23)	
	N	%	N	%	N	%
Good price	0	0.00	1	10.00	1	4.35
The price is too low to get any alternative land plots	10	76.92	4	40.00	14	60.87
No opinion	3	23.08	5	50.00	8	34.78

Source: Socio-economic survey conducted by ERM, August 2021

- Compensation Use Plan

Reportedly, nearly half of the affected households (11 households or 47.8%) use their compensation on daily expenses (see Table 9.84). A smaller number of the affected households planned to use their land compensation on maintaining or renovating their house (13%), investing in their current occupation (8.7%), and/or spending on medical treatment or healthcare (8.7%). Other plans included using compensation on education investment, debt payment, new asset purchases, financial support to family members, bank saving, and livestock purchase.

Table 9.84 Compensation Use Plan

Compensation Use Plan	Gia Rai Group (N=13)		Kinh Group (N=10)		Affected Households (N=23)	
	N	%	N	%	N	%
Daily expenses	8	61.54	3	30.00	11	47.83
Maintaining or renovating house	1	7.69	2	20.00	3	13.04
Investment in current work	0	0.00	2	20.00	2	8.70
Medical treatment or health care	0	0.00	2	20.00	2	8.70
Education investment	1	7.69	0	0.00	1	4.35
Paying household debts	1	7.69	0	0.00	1	4.35
Buying new assets	0	0.00	1	10.00	1	4.35
Financial support for family members	1	7.69	0	0.00	1	4.35
Bank savings	1	7.69	0	0.00	1	4.35
Buying cattle	1	7.69	0	0.00	1	4.35

Source: Socio-economic survey conducted by ERM, August 2021

- Engagement in the Land Acquisition Process

Over two-thirds of the 23 affected households confirmed that they have participated in the land acquisition processes (69.6% or 16 households, including 10 Gia Rai and six Kinh households) while the remaining households (30.4%) were not involved at all in any of the stages of land acquisition process (see Table 9.85).

Among 16 households involved in land acquisition process, most of them (14 households or 87.5%) participated in the compensation negotiation process. Receiving notice of the land acquisition and supervising the detailed land measurement survey and asset inventory are among important stages which 56.25% affected households were involved.

In addition, the affected households also participated in other stages of the land acquisition process such as getting compensation and support plan from the local authorities (four households or 25%), receiving a decision related to land acquisition (two households or 12.5%), handing over the acquired land through land use right transfer (one household or 6.3%), and handing over the acquired land to the government (one households or 6.3%).

Table 9.85 Household Engagement in Different Steps of the Land Acquisition Process

Different Steps of the Land Acquisition Process	Gia Rai Group (N=10)		Kinh Group (N=6)		Affected Households (N=16)	
	N	%	N	%	N	%
Participated in compensation negotiation process	8	80.00	6	100.00	14	87.50
Received notice of land acquisition	7	70.00	2	33.33	9	56.25
Supervised land measurement and assets acquired	7	70.00	2	33.33	9	56.25
Received a compensation and support plan from the local authorities	0	0.00	4	66.67	4	25.00

Different Steps of the Land Acquisition Process	Gia Rai Group (N=10)		Kinh Group (N=6)		Affected Households (N=16)	
	N	%	N	%	N	%
Received a decision on land acquisition	2	20.00	0	0.00	2	12.50
Handed over the acquired land through the form of land use right transfer	0	0.00	1	16.67	1	6.25
Handed over the acquired land to the government	1	10.00	0	0.00	1	6.25

Source: Socio-economic survey conducted by ERM, August 2021

- Information Dissemination on Land Acquisition

Regarding the sufficiency of provided information related to land acquisition, one third of the affected households perceived the amount of information given to be sufficient and very sufficient (34.8% or eight households); however, the similar figure (30.4%) stated the opposite. Four households (17.4%) considered the sufficiency of provided information as neutral while the remaining four households (17.4%) reported that they are not certain about the adequacy level of received information related to land acquisition (see Table 9.86).

Table 9.86 Adequacy of Provided Land Acquisition Information

Adequacy Level of Provided Information	Gia Rai Group (N=13)		Kinh Group (N=10)		Affected Households (N=23)	
	N	%	N	%	N	%
Very sufficient	0	0.00	1	10.00	1	4.35
Sufficient	4	30.77	2	20.00	6	26.09
Neutral	3	23.08	1	10.00	4	17.39
Not sufficient	4	30.77	4	40.00	8	34.78
Don't know	2	15.38	2	20.00	4	17.39

Source: Socio-economic survey conducted by ERM, August 2021

Regarding information about the grievance process, most of the 23 surveyed households (22 households or 95.7%) claimed that they are not aware of this process while one Gia Rai household said that they simply submit a petition to the commune authorities in case of having any grievance related to the Project.

9.6.10.2 Local Needs for Livelihood Restoration

- Level of impacts in access to the remaining production land

Of the 23 affected households, 21.7% (five households) encounter challenges in accessing their remaining production land because their land is quite close[217] to the location of wind turbines. These households are afraid of potential dangers posed by the Project traffic activities, and they are also worried about their crop growth. Meanwhile, 73.9% of the respondents confirmed that they do not have any challenge in accessing their remaining production land plots (see Table 9.87).

[217] The households did not specify how close their land was to the location of wind turbines.

Table 9.87 Challenges of Access to the Remaining Production Land

Challenges of Access to the Remaining Production Land	Gia Rai Group (N=13)		Kinh Group (N=10)		Affected Households (N=23)	
	N	%	N	%	N	%
Yes	3	23.08	2	20.00	5	21.74
No	9	69.23	8	80.00	17	73.91
Don't know	1	7.69	0	0.00	1	4.35

Source: Socio-economic survey conducted by ERM, August 2021

- Level of impacts on livelihoods

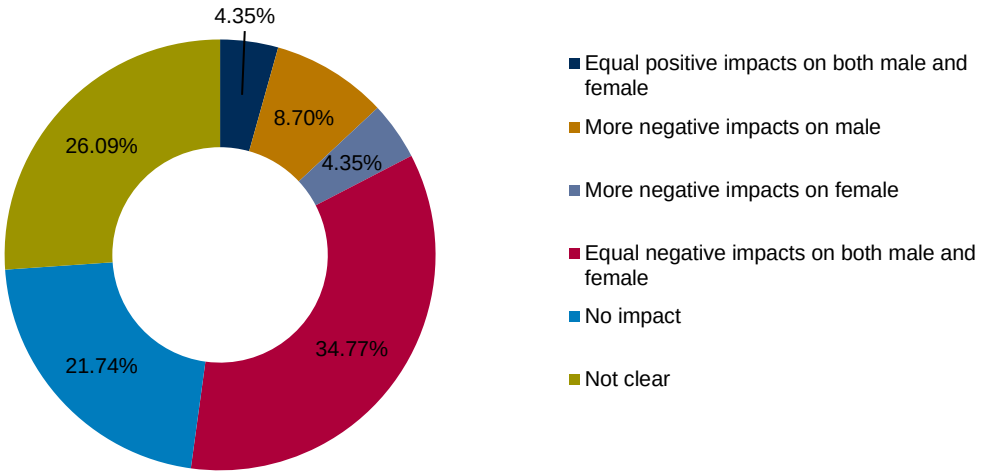
In term of land acquisition impacts on livelihoods, most of the affected households claimed to have minimal impacts (nine households or 39.1%) or no impact (ten households or 43.5%) as their acquired land area is not significant or they can not envision potential impacts as the Project has not been in operation yet. Four Gia Rai households (17.4%) asserted that the land acquisition laid a significant impact on their livelihood (see Table 9.88). These four households' acquired land was of agriculture land.

Table 9.88 Evaluation of Land Acquisition Impacts on Livelihood

Impacts on Livelihoods	Gia Rai Group (N=13)		Kinh Group (N=10)		Affected Households (N=23)	
	N	%	N	%	N	%
Significant	4	30.77	0	0.00	4	17.39
Minimal	3	23.08	6	60.00	9	39.13
No impact	6	46.15	4	40.00	10	43.48

Source: Socio-economic survey conducted by ERM, August 2021

Strikingly, when analysing the land acquisition impacts on livelihood by gender, 34.7% of the 23 surveyed households stated that the Project may bring equally negative impacts for both male and female while only 4.4% considered that there are equally positive impacts for both male and female related to the land acquisition. The common reason provided by the respondants was that be it a man or a woman, they worked on the same land and lived in the same house, so whatever the impacts might be, they would affect men and women similarly. Approximately 8.7% affirmed that male faces more negative impacts compared to female while 4.4% stated the opposite. Nearly a quarter of the affected households (21.7%) do not see any potential impacts and other 26.1% are not clear about gendered impacts caused by the land acquisition (see Figure 9.49).



Source: Socio-economic survey conducted by ERM, August 2021

Figure 9.49 Land Acquisition Impacts on Household Livelihood by Gender

- Land Acquisition Impacts on Current Living Conditions

Due to the small acquired land area, most respondents reported that their living standards remain unchanged, accounting 87% or 20 households (see Table 9.89). Meanwhile, two households perceiving significant impacts of land acquisition on their livelihoods claimed that their living standards become worse (8.7%).

Table 9.89 Evaluation of Current Living Standards after Land Acquisition

Living Standard Evaluation	Gia Rai Group(N=13)		Kinh Group (N=10)		Affected Households (N=23)	
	N	%	N	%	N	%
No change	11	84.62	9	90.00	20	86.95
Worse	2	15.38	0	0.00	2	8.70
Don't know	0	0.00	1	10.00	1	4.35

Source: Socio-economic survey conducted by ERM, August 2021

- Local Needs for Livelihood Restoration

Among the 23 affected households, a considerable figure of households (eight households or 34.8%) expressed their needs for livelihoods restoration programs, including irrigation supply for farming activities, compensation schemes for affected crops during the Project construction and operation, and improved access roads to production areas. These supporting programs need to be associated with mitigation strategies to negative environment impacts such as dust and air pollution.

10. ENVIRONMENTAL IMPACT ASSESSMENT

10.1 Noise Impact Assessment

10.1.1 Scope of Assessment

The scope of the noise impact assessment includes all activities identified to result in noise during both construction and operation of the Project, identified in Table 10.1. Potential resulting impacts and consequences as well as identified receptors are described in Table 10.1.

Table 10.1 Scope of Noise Impact Assessment

Phases	Potential Activities	Potential Impacts	Potential Consequences	Receptor
Construction	Equipment and material transport and supply	Short-term increase in noise levels	■ Potential consequences to human health can vary, depending on other factors such as noise levels, human health conditions and age. ■ Construction workers can suffer from hearing problems and mental illness caused by high noise levels if they expose to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection (EHS Guidelines on Occupational Health and Safety 2007)	■ Nearby residents ■ Construction workers
	Land preparation and civil works such as land clearance, demolition, earthworks			
	Construction of substation, transmission line and laydown area			
	Operation of associated facilities such as concrete batching plant			
	Transportation of equipment, workers and materials			
	Foundation construction and Installation work of the WTGs			
Operation	Operation of the WTGs and the substation	Long-term increase in noise levels	Chronic noise exposure can cause in sleep disturbances and mental illness.	Nearby residents

10.1.2 Background Noise Conditions

10.1.2.1 Background Noise and Receptors

Measured noise levels were generally lower than day time IFC threshold (55 dB L_{Aeq}) at all three monitoring points. Measured levels were higher than night-time IFC threshold (45 dB L_{Aeq}) at only NML1, while noise levels monitored at NML2 and NML3 were lower than the night-time IFC threshold.

The high noise levels observed at NML1 were mainly caused by motorbikes, rooster crowing, insects, and barking sounds during the monitoring period. This indicates that noise levels in the Project area are influenced by non-wind affected sources. Measurement data from the "Baseline Noise Report of Gia Lai Wind Power Project, Ia Grai District, Gia Lai Province" (see Appendix B) suggests non-wind driven noise sources were present intermittently for large portions of the 48-hour measurement period.

According to satellite imagery analysis, there are 2,601 potential sensitive receptors observed within a 2 km noise buffer area, referred to as the noise Area of Influence (AoI), as shown in Figure 10.1. Among 2,601 receptors, there are five selected Noise Sensitive Receptors (NSRs) representing each receptor group identified based on the environmental setting at each location. The representative NSRs in the Project area which was featured in Figure 10.1.

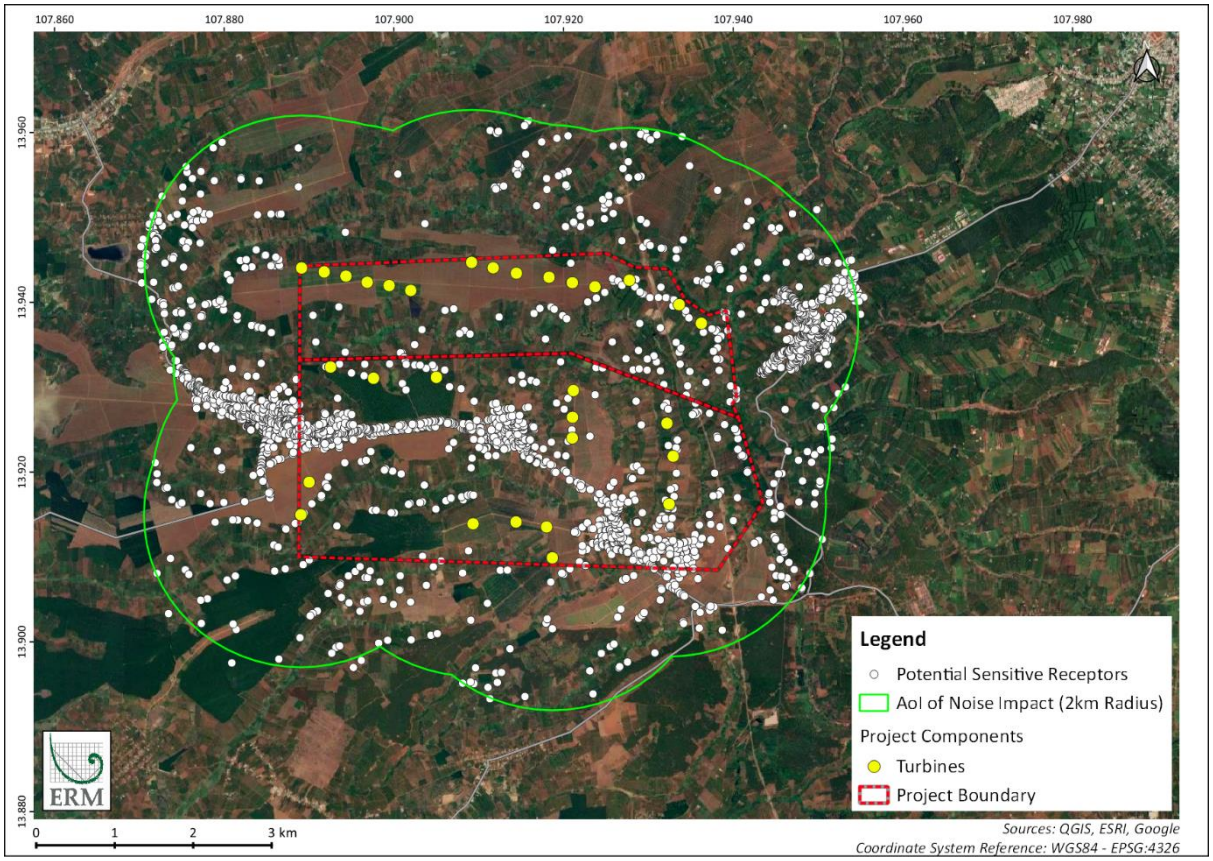


Figure 10.1 Potential Sensitive Receptors within 2 km Noise AoI

Figure 10.2 Noise Sensitive Receptors in the Project Area

10.1.2.2 Background Noise Plot and Regression Analysis

Background noise is typically expected to increase as wind speed increases, as a result of wind-induced noise generated around objects or vegetation. The background noise levels (L_{A90}) measured during the daytime were plotted against the wind speed at a hub height of 110 metres to obtain a background noise versus wind speed characteristic.

Regression analysis of the background noise data and the hub height wind speed data were carried out to determine a line of 'best fit' from the baseline noise measurements, from which the noise impact assessment criteria were established as a function of wind speed. The line of best fit for the data set was determined using a linear trend line, as it provided the most realistic correlation between wind speed and background noise level.

The results of the regression analysis is shown in Figure 10.3 to Figure 10.5, for NMLs 2 to NML3. The day and night-time (45 dBA) plots show the line of 'best fit' curve for NML1 to NML3.

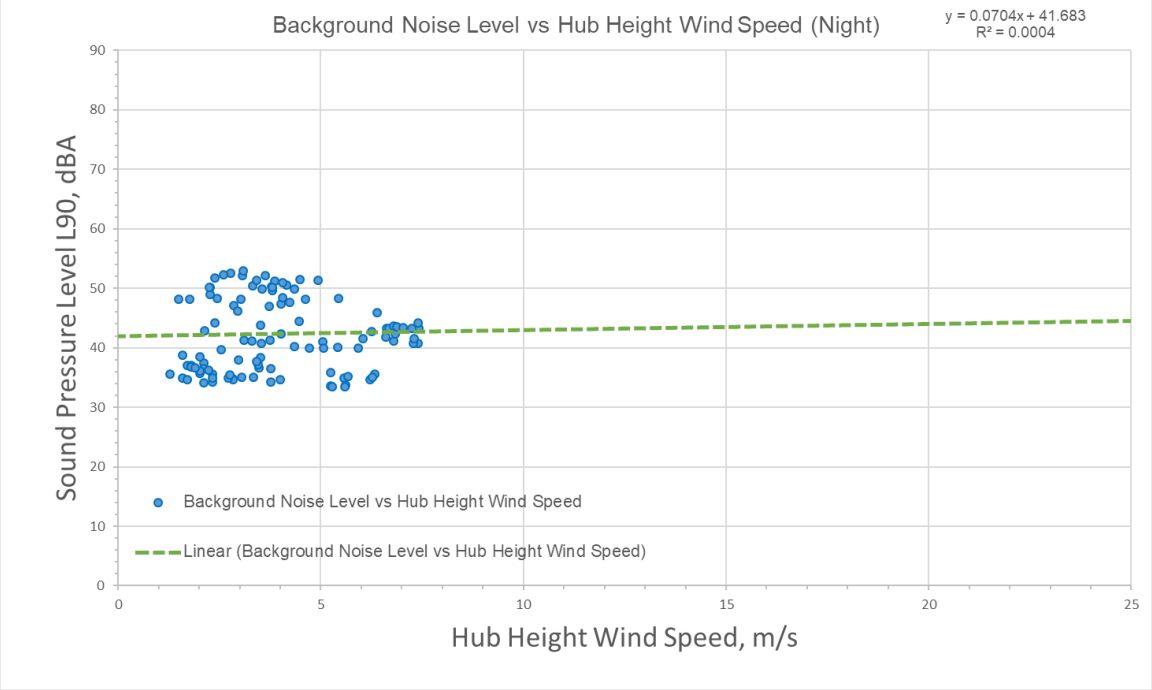


Figure 10.3 NML1 Background Noise Curve

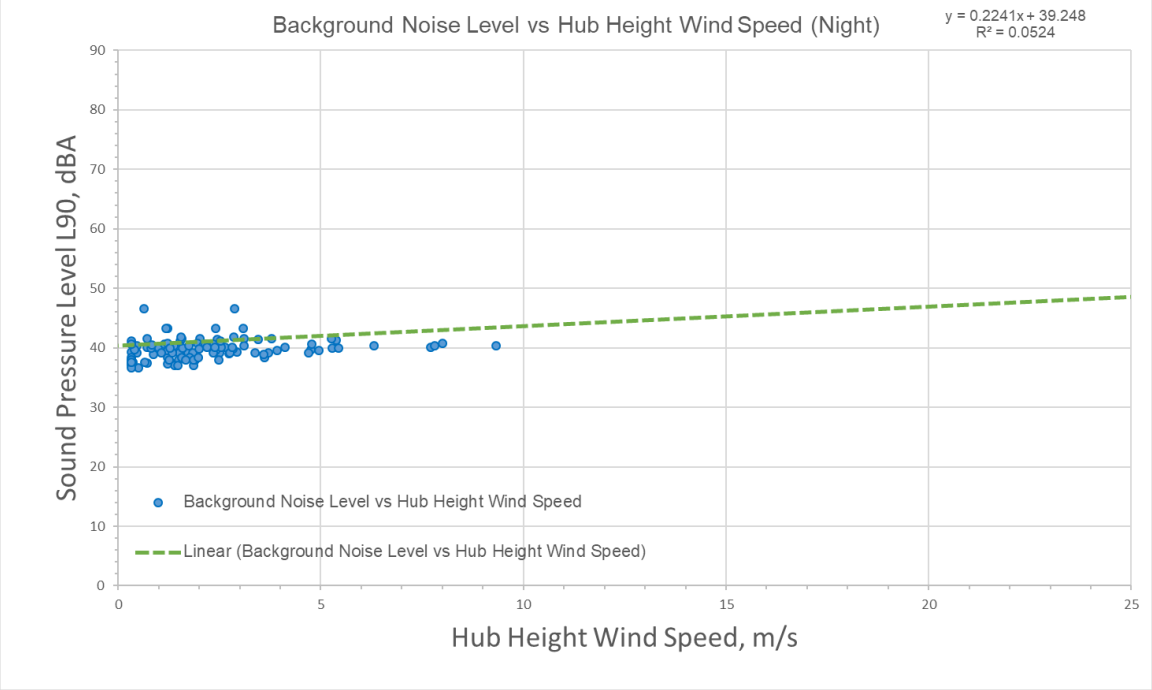


Figure 10.4 NML2 Background Noise Curve

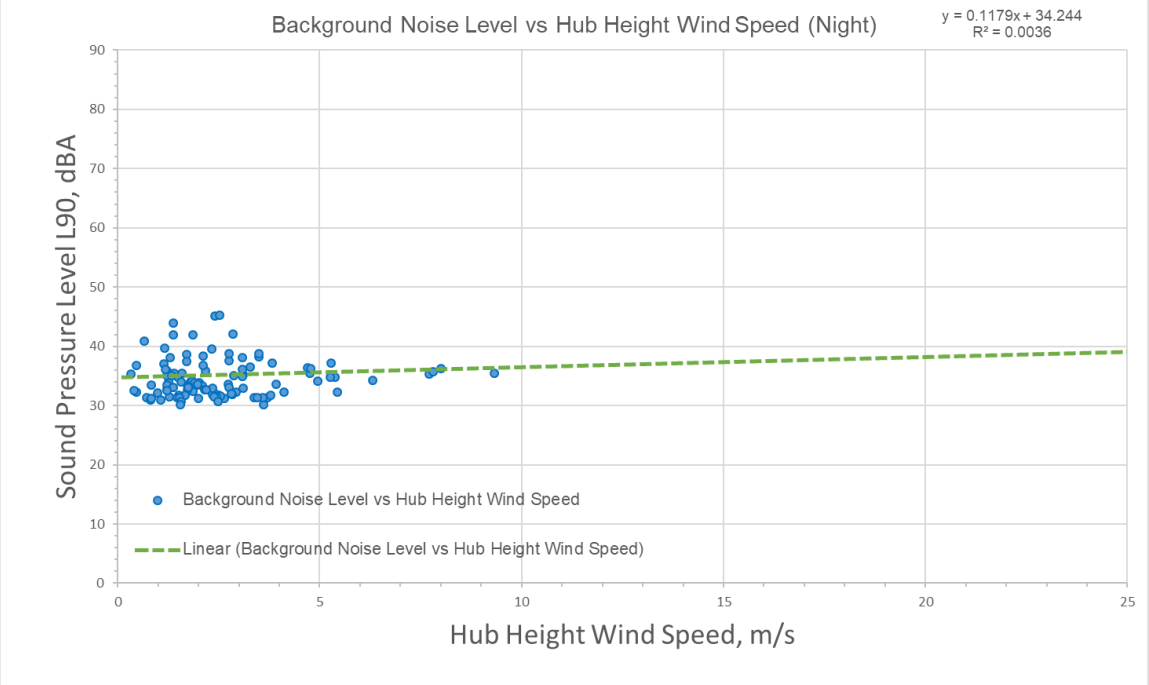


Figure 10.5 NML3 Background Noise Curve

10.1.3 Impact Assessment

10.1.3.1 Impacts during Construction Phase

10.1.3.1.1 Potential Impacts

During the Project's construction phase, a range of works and activities will be required at various locations within the Project 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, and
- Use of specialised (e.g. concrete batching plants) or unforeseen wind farm construction equipment, or activities that are to be undertaken.

10.1.3.1.2 Existing Control

The mitigation measures identified in the EIAs include:

- Regularly check and maintain construction equipment
- Avoid using many machines which generate high noise level at the same time and at the same specific location
- Strictly comply with technical requirements in the process of installing equipment and machines
- Do not use outdated equipment with a high noise potential
- Turn off the vehicle engine in case it is not in use

- Avoid operating during peak hours for construction vehicles and machines to minimize the impact on local people's lives
- Implementation of a noise management plan to promote community engagement, and record noise complaints

10.1.3.1.3 Significance of Impacts

A quantitative noise modelling assessment has not been conducted; however, those activities associated with the Project that are expected to generate noise levels that would potentially generate direct and negative impacts are typical of many construction works associated with major developments. Project related noise emissions during construction will not be experienced by the community on a constant or long-term basis, either through the project's construction phase. Increased noise levels due to construction activities would only be experienced for limited periods of time when works are occurring at selected locations, typically closest to the receiver; they would often not be experienced continuously during either the day time, or during evening or night-time periods. Any impacts associated with these works would be temporary and will not result in a permanent impact on the community and the surrounding environment. The impact magnitude is accordingly assessed as **Small** for the noise emissions generated during the construction phase. As works progress to the other side of the site, noise impact levels will gradually decrease to acceptable levels.

The noise level is accelerated by a large number of construction activities, in particular the wind turbine foundation construction which will engage heavy equipment and significantly affect nearby residential areas. Based on satellite imagery analysis and data collected during the baseline survey, there are potentially 2,601 sensitive receptors within the 2 km AoI defined by the IFC EHS Guidelines. The nearest identified sensitive receptor is only approximately 19 m away from WTG E22. Sensitive receptors are not only permanent residential buildings but also temporary houses and/or places for local people to stay and rest during cultivation periods. Hence, the receptor sensitivity is considered as **High** during the construction phase.

Some noise from construction sites is inevitable, such that good construction management practices usually focus on minimising noise impacts, rather than only meeting noise thresholds. Good-practice construction noise management and noise mitigation techniques may be required for construction of the Project to reduce noise levels as far as practicable. These would need to be considered and then implemented, where necessary. Complaints from the local community would be recorded and addressed to ensure suitable working periods are identified to minimise impact, or to provide respite periods.

Based on the aforementioned findings, the suitable recommendations which can be considered and potentially implemented on-site are provided in Section 10.1.3.1.4. Construction noise levels would 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.

Table 10.2 Noise Impact during Construction Phase

Impact Description	**Noise impacts during Construction Phase**			
Impact Nature	**Negative**	Positive	Neutral	
Impact Type	**Direct**	Indirect	Induced	
Impact Duration	Temporary	**Short-term**	Long-term	Permanent
Impact Extent	**Local**	Regional	International	

Impact Description	Noise impacts during Construction Phase			
Impact Frequency	Intermittent over the construction period (18 months)			
Impact Magnitude	Negligible	**Small**	Medium	Large
Receptor Sensitivity	Low	Medium	**High**	
Impact Significance	Negligible	Minor	**Moderate**	Major

10.1.3.1.4 Additional Mitigation Measures

Based on the findings of the qualitative construction noise assessment presented in the section above noise mitigation will be adopted as follows:

- Community engagement during the construction phase:
  - Engage with the community at the earliest possible time to get their consent on noisy activities and negotiate the best time to conduct this type of work (i.e. when residents are not home).
  - Arrange respite periods during noisy activities (5 – 10 minute break every working hour); and
  - Alleviate community concern based on planned construction noise being short-term and occurring during day time only.
- During construction of the 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 practicable to implement should be considered, for example:
  - avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient;
  - ensure all machinery used on site is in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machinery should be repaired or removed from 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.
- High noise generating construction works and activities should be limited to the daytime period (7:00 to 22:00), and work should be avoided on Sundays or public holidays if possible.
- Construction road traffic and heavy vehicle movements have the potential to generate high “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 day time period. 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, drivers should be instructed 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 for the Project. The Project personnel should however remain aware of the potential for nuisance, or an

unacceptable impact on amenity, to occur due to construction noise, and continue to plan for and manage construction works accordingly.

10.1.3.1.5 Residual Impacts

With the proposed mitigation measures, the residual impacts are expected to be Minor.

10.1.3.1.6 Monitoring and Audit

It is suggested that monitoring of noise during the construction phase will be conducted quarterly at the same locations used for baseline monitoring. The monitored parameters include LAeq in accordance to QCVN 26: 2010/BTNMT – National Technical Regulation on Noise.

10.1.3.2 Impacts during Operation Phase

10.1.3.2.1 Impact Assessment Criteria

Wind farm noise assessment criteria for receptors were based on the background noise plot against wind speed with the omission of non-wind sources, and on the limits defined in the ETSU-R-97 "*The Assessment & Rating of Noise from Wind Farms*" document referenced in the IFC EHS Guidelines for Wind Energy (2015). Using this approach, the noise limit was set at 5 dBA above background level (L_{A90}). Since wind turbine noise specification data are provided in terms of L_{Aeq}, the predicted L_{Aeq} noise levels from the wind turbines cannot be compared directly to the L_{A90} criteria. A further 2 dB has been added to convert the L_{A90} criteria to enable direct comparison to the predicted L_{Aeq} noise levels. This factor is based on the approximate difference between the two parameters for a typical wind farm based on the UK Institute of Acoustics (IOA) document "A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise" (2013).

IFC EHS Guidelines also specify noise thresholds of 55 dB $L_{Aeq,1\ hour}$ during the day (07.00 to 22.00) and 45 dB $L_{Aeq,1\ hour}$ at night (22.00 to 07.00). For the purpose of this assessment, the more stringent noise criterion (45dBA) has been adopted. Based on this methodology, the plots showing the impact assessment criteria relationship with hub height wind speed for each noise survey location are presented from Figure 10.6 to Figure 10.9.

10.1.3.2.2 Noise Prediction Method

To support the impact assessment, a noise model was used to predict wind farm noise levels at sensitive receptors, based on ISO 9613-2:1996 as implemented in the Predictor computer noise model. The model predicts noise level through spherical spreading and includes the effect of air absorption (as per ISO 9613-1:1996), ground attenuation and shielding. Additional advice provided by the IOA 2013 which is referenced in the IFC wind farm guidance (IFC Guidance Notes 2012) has also been adopted.

Predicted L_{Aeq} noise levels were calculated based upon sound power levels determined in accordance with the recognised standard IEC-61400-11:2012 "*Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques*", where available, for wind speed ranging between 3 m/s and 20 m/s.

Key features, inputs and assumptions that have informed noise modelling and assessment are outlined in Table 10.3.

Table 10.3 Assessment Features, Inputs and Assumptions

ID	Feature	Description
1	General Acoustics	All sound pressure levels presented in this report (e.g. 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 (e.g. noise levels assigned to specific sources) are decibels referenced to 10^{-12} W, with A-weighting applied.
2a	Noise Modelling	Predictor 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 and unknown at distances above 1000 metres.
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 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.
2c		A ground absorption factor of 0.5 was adopted across the entire modelled region, which represents an absorption factor for partly soft ground.
3	Noise Source Data	■ Sound Power Level (L_W, dBA) data (overall L_W values) incorporated into the project-specific noise model for the Wind Turbine Generator System WD3.3-164-50 Hz model was provided for use in this assessment by the manufacturer. The Wind Turbine Generator System 3.3-164-50 Hz data identified the L_W, dBA value of: - each wind turbine model (standard blades) at wind speeds between cut-in and cut-out e.g. 2.5 to 20 metres per second (m/s); and - only one operational mode (3.3-164 at 111.9 dB) ■ The key document referenced to quantify main source emissions for the Wind Turbine Generator System was provided by the Project Owner. ■ Spectral data (dBA per frequency band in 1/1 octaves).

ID	Feature	Description
		■ Hub height of 110 metres has been adopted for all Generator System 3.3-164-50 Hz wind turbines. ■ Sound power level data was assumed in this report, adopting a worst-case approach for the candidate turbines.

10.1.3.2.3 Noise Emission Sources

The noise specifications adopted for the purpose of this assessment are presented in Table 10.4. These specifications are for wind speeds between 3 m/s and 20 m/s. Below 3 m/s significant differences in levels and impacts are not anticipated and above 20 m/s noise level results are expected to be equal to that modelled for the 20 m/s wind speed scenario.

The reference spectrum (noise level in dBA for each 1/1 octave band between 31.5 Hz and 8000 Hz) was provided by the Project's Owner, as presented in Table 10.4. This spectrum is from Predictor V2021.1 wind turbines database. The sound power levels are presented for the highest overall sound power value used in the assessment (111.9 dBA) which applies at 10 m/s wind speed and above. The sound power spectrum has been adjusted at lower wind speeds to represent the lower sound power values generated.

Table 10.4 Windey 3.3-164-50 Hz Represented Reference Spectrum

Make, Model, Mode, Wind Speed	Spectral Data – dBA in 1/1 Octave Bands: 31.5 to 8kHz									Overall Lw (dBA)
	31	63	125	250	500	1000	2000	4000	8000	
Windey 3.3-164-50 Hz, 10m/s	75.9	85.7	92.7	100.1	107.6	108.8	105.1	99	92.7	111.9

10.1.3.2.4 Representative Noise Sensitive Receptors for Modelling

A total of five NSRs were chosen as representative locations for each group of receptors within areas most likely to be affected. These are described in Table 10.5 below.

Table 10.5 Representative Noise Sensitive Receptors

Receptor ID	UTM[1] WGS84 North Zone 48 (metres)		Distance to the closest WTG (m)	Comments
	Latitude	Longitude		
NSR1	812590.23	1542133.82	21 (E29)	Representative of closest residential properties in Plei A Pech and Plei A Tau Villages, Ia Pech Commune, Gia Lai Province. Associated noise monitoring location is NML4
NSR2	815614.30	1541212.45	71 (E22)	Representative of closest residential properties in Plei O Gia and Plei O Son Villages, Ia Pech Commune, Ia Grai District. Associated noise monitoring location is NML3.
NSR3	813238.01	1539353.47	1,333 (E31)	Representative of sparse residential situated in the south of the Project, Ia Pech Commune, Ia Grai District. Associated noise monitoring location is NML2.
NSR4	818187.88	1540571.76	1,283 (E18)	Representative of closest residential properties in Plei O Son Village, Ia Pech

Receptor ID	UTM[1] WGS84 North Zone 48 (metres)		Distance to the closest WTG (m)	Comments
	Latitude	Longitude		
				Commune, Ia Grai District. Associated noise monitoring location is NML2.
NSR5	817093.92	1542940.38	113 (E14)	Representative of closest residential properties in Village 1, Dien Phu Commune, Pleiku City. Associated noise monitoring location is NML3.

Note [1]: Universal Transverse Mercator coordinate system

10.1.3.2.5 Predicted Wind Farm Operational Noise Levels

The resultant worst-case operational noise levels from the Project for each NSR are presented in Table 10.6. Noise contour maps for the Project operating in the acoustically worst-case mode are provided in Figure 10.6.

Table 10.6 Predicted Operational Noise Levels at NSRs (LAeq)

Wind Speed at Hub Height (m/s)	Predicted Noise Level at NSR 1	Predicted Noise Level at NSR 2	Predicted Noise Level at NSR 3	Predicted Noise Level at NSR 4	Predicted Noise Level at NSR 5
3	51	52	33	31	51
4	51	52	33	31	51
5	53	53	35	33	53
6	54	54	36	33	54
7	58	58	40	38	58
8	61	62	43	41	61
9	63	64	45	43	63
10	63	64	45	43	63
11	63	64	45	43	63
12	63	64	45	43	63
13	63	64	45	43	63
14	63	64	45	43	63
15	63	64	45	43	63
16	63	64	45	43	63
17	63	64	45	43	63
18	63	64	45	43	63
19	63	64	45	43	63
20	63	64	45	43	63

Figure 10.6 Worst-case and Operational Noise Contours

10.1.3.2.6 Discussion of Predicted Wind Farm Noise

Wind farm operational noise predictions have been undertaken at each of the representative NSRs. Figure 10.7 to Figure 10.8 show the predicted noise levels without mitigation and a comparison with the day and night-time impacts assessment criteria at eleven NSRs. These results are discussed further below.

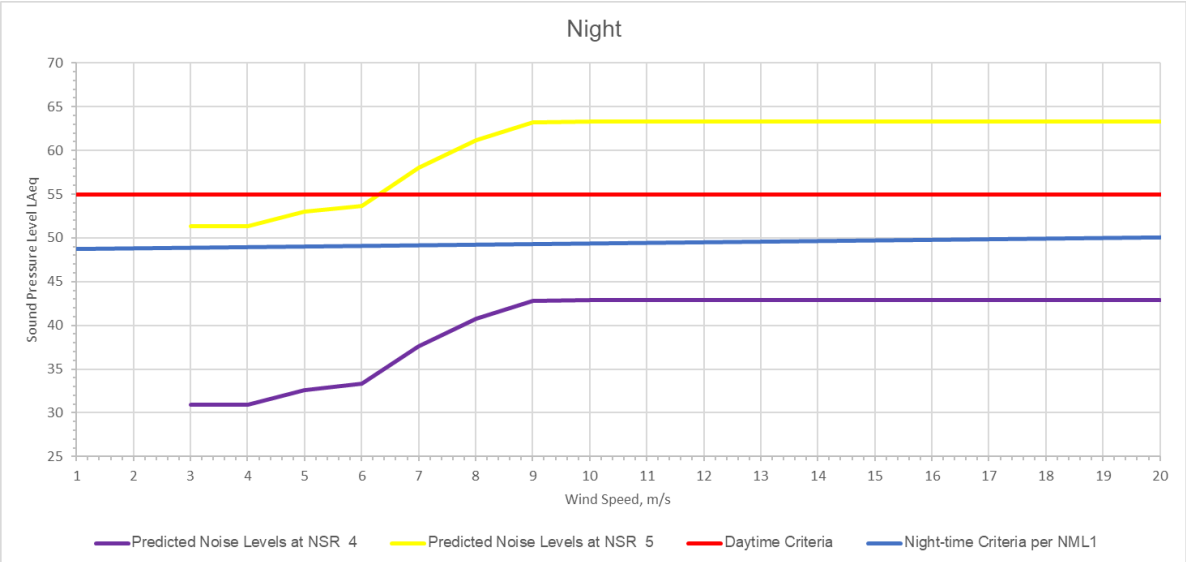


Figure 10.7 Predicted Wind Farm Noise Levels and Noise Assessment Criteria against (Hub Height) Wind Speed Wind Speed at NSR4 and NSR5 with NML1

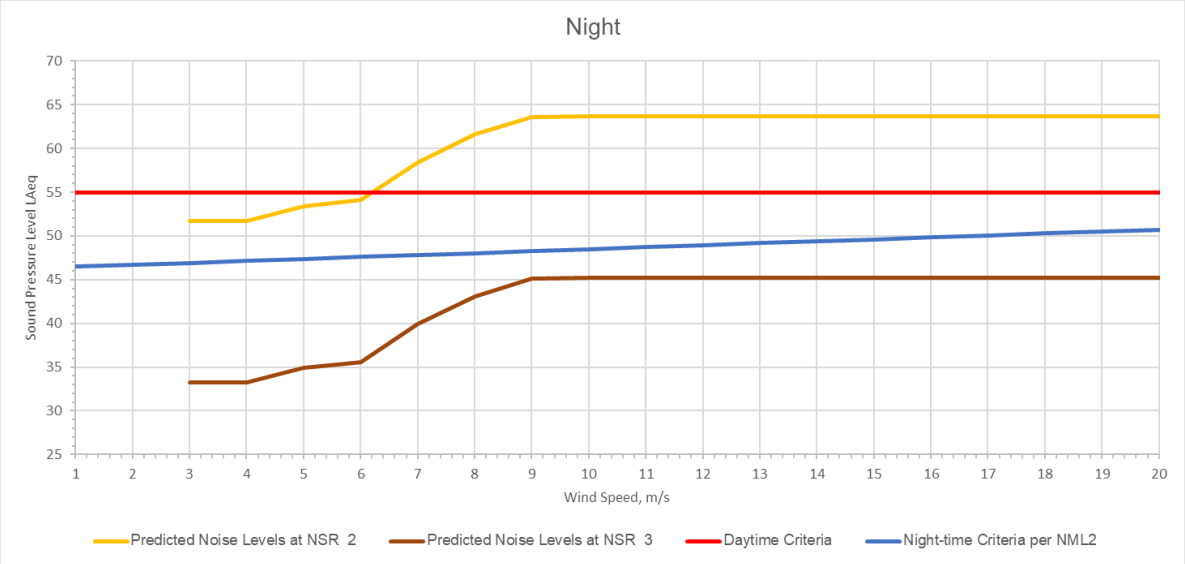


Figure 10.8 Predicted Wind Farm Noise Levels and Noise Assessment Criteria against (Hub Height) Wind Speed at NSR2 and NSR3 with NML2

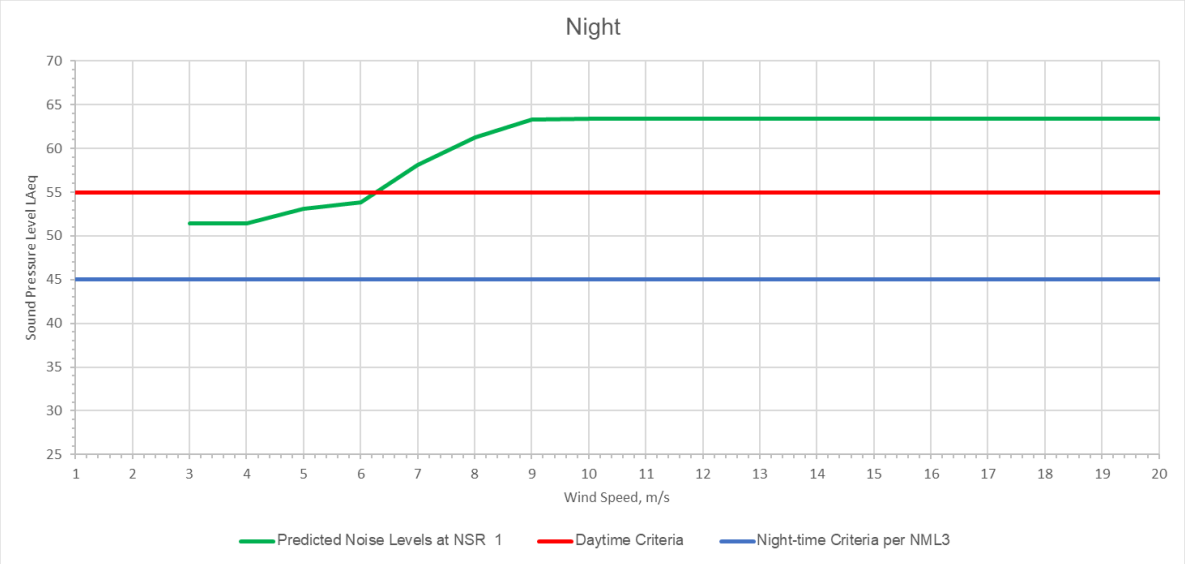


Figure 10.9 Predicted Wind Farm Noise Levels and Noise Assessment Criteria against (Hub Height) Wind Speed at NSR1 with NML3

According to presented results, NSR1, 2, and 5 were predicted to be impacted during the day. However, based on the wind data for the Project area presented in Section 7.2.6.2, it is noted that the wind distribution at 100 m ranges from 3 m/s to 9 m/s (see Table 7.9 and Figure 7.8). Thus, predicted noise level at NSR1, 2 and 5 are likely to result in disturbance at wind speeds ranging from 6 m/s to 9 m/s with the maximum exceedance predicted to be 8 dBA (E14, 15, 21, 22, 29, and 28).

At night, NSR1, 2, and 5 were predicted to be exposed to noise levels in exceedance of the noise criteria, resulting in a maximum exceedance of 18 dBA (E14, 15, 21, 22, 29, and 28). NSR3 and NSR4 were predicted to experience noise levels below exceedance thresholds for both NML2 and NML1.

10.1.3.2.7 Significance of Impacts

The assessment has indicated that noise impacts from the Project's WTGs operation are expected to be significant at NSR1, 2, and 5 because predicted noise levels are above criteria when operating at the acoustically worst-case scenario. The impact magnitude is therefore considered **Large**. The sensitivity of receptors in the area is considered **High**. Therefore, the negative impact is ranked as being of **Major** significance, as shown in Table 10.7.

Table 10.7 Noise Impact Significance during Operation Phase

Impact Description	**Disturbance and potential health impact**				
Impact Nature	**Negative**	Positive	Neutral		
	Disturbance and potential health impacts are considered **Negative**.				
Impact Type	**Direct**	Indirect	Induced		
	Exposure to noise causes **direct** disturbance and potential health impacts.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	The impact duration is **Long-Term** during the Project lifetime**.**				
Impact Extent	**Local**	Regional	Global		
	Impacts are within the Project area.				
Frequency	Operational noise levels may occur intermittently or continuously depending on wind conditions and WTG operations in the operation phase				
Impact Magnitude	Positive	Negligible	Small	Medium	**Large**
	The impact magnitude is **Large**.				
Receptor Sensitivity	Low	Medium	**High**		
	The vulnerability of receptor is **High** as explained above.				
Impact Significance	Negligible	Minor	Moderate	**Major**	
	The significance is **Major.**				

10.1.3.2.8 Additional Mitigation Measures

Noise impacts from WTG emissions were predicted at three of the five NSRs assessed (NSR1, 2, and 5), during night time and at all operational wind speeds. Modelling indicates noise levels may need to be reduced by up to 18 dB at NSR1.

- The installation of noise reduction devices (e.g. trailing edge noise reduction of wind turbine blades) is recommended for WTG E13 to E22 and WTG E27 to E31 due to noise exceedance predicted at three NSRs. The noise reduction devices should be endorsed by the turbine manufacturer to ensure the compatibility between the devices and the WTGs.
- Routine maintenance of wind turbines should also be conducted during the operation phase, with specific attention to equipment degradation that may cause further noise impacts. Any equipment that is abnormally noisy should be evaluated and repaired as necessary to return emissions to typical operating performance.
- A community grievance mechanism should be applied. It is recommended that if any repeated/validated noise complaints are received then compliance monitoring should be undertaken at the most affected receptors to confirm predicted noise levels. Where noise

monitoring is required, monitoring requirements should be scoped and then conducted by a suitably experienced person. The purpose of the monitoring is to understand in-situ noise levels and to provide a comparison to predicted levels such that additional controls may be identified and implemented if feasible, reasonable and practicable to do so. If this is required:

- All project / site noise levels should be measured in the absence of any influential source not associated with the project.
- If the measured site noise levels are below the predicted values and comply with the applicable thresholds, limits or criteria identified for each noise aspect, no further noise control is required.
- If the measured site noise levels are above the predicted noise levels or the applicable thresholds, limits or criteria identified for each noise aspect, further noise control should be considered.

- Closely collaborating with local authorities to ensure local people are well aware of the predicted noise exceedance areas and notify the potential impacts to local residents in case of new houses are proposed within those areas.
- Relocation of potential sensitive receptors, particularly identified households living in the 300m radius safety zone of eight WTGs including E1 (3), E12 to E23 (75), E27 to E31 (25) who are predicted to be significantly affected by noise emissions shall be highly recommended as a last resort. In this case, the relocation plan shall be developed and managed by the Project Owner.
- Other receptors within the radius of 300 m safety zone of the remaining WTGs shall also be closely engaged to monitor noise impacts from wind turbine operation via different communication channels (village heads, Project's grievance mechanism, and local authorities).

10.1.3.2.9 Residual Impacts

The residual impact is still considered as Major due to the high density of residential areas within the Project area. The Project Owner shall be responsible for applying the mitigation measures and re-assessing the implementation to ensure that noise levels at the potential affected receptors meet the permissible thresholds as stated in national and international standards.

10.1.3.2.10 Monitoring and Audit

A noise monitoring program should be conducted every 3 months at the Project's location and another location in proximity to residential areas during the operation phase. The monitored parameters include LAeq in accordance to QCVN 26: 2010/BTNMT – National Technical Regulation on Noise. Additionally, noise-related complaints should be monitored through the Project's grievance mechanism.

10.2 Visual Impact Assessment

This section presents the assessment of the Project's potential impacts on specific views and 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.

This section provides the methodology, baseline conditions within the Project site and surroundings in relation to landscape and visual amenity and the assessment of the anticipated impacts throughout the Project construction and operational phases. Management measures (including mitigation measures and additional requirements) and monitoring efforts have also been identified to avoid impacts or reduce them to acceptable levels.

10.2.1 Scope of Assessment

The scope of this assessment is limited to the proposed Project wind turbine design and observers in Section 10.6, including a qualitative visual aesthetics assessment and associated reporting to document the methodology, findings and any agreed mitigation measures for the proposed wind farm site or design. The scope of the assessment includes:

- Reviewing existing project information and operational activities to understand site conditions on 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.

10.2.2 Considerations and Assumptions

Visual impacts relate to changes that arise in the composition of available views due to changes to the landscape, to people's response to any changes, and the overall impacts with respect to visual amenity.

Based on Shuttle Radar Topography Mission (SRTM) data, it is noted that the Project wind turbines will be located in a raised area where the elevation can be up to 600 masl[218]. It is also noted that the region where the receptors and the wind turbines are located is characterised by rough terrain (Section 7.2.8).

10.2.3 Assessment Methodology

Visual impacts relate to changes that arise in the composition of available views due to 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 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 specific 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 sensitive to change, and the combined effects on several residents within an area may also be considered.

10.2.4 Visual Baseline

The assessment has been developed according to the following tasks:

- Study area definition
- Viewshed analysis
- Viewpoints and sensitive receptors identification

10.2.4.1 Study Area Definition and Viewshed

The landscape study area is defined as the area within which the Project could be discernible by the human eye and could interfere with the main sensitives identified in the local context.

The Zone of Theoretical Visibility (ZTV) has been determined to identify the landscape study area through computer analysis of topographical mapping to establish the theoretical distance from which the wind turbines could be visible in each direction.

This ZTV was determined through a viewshed analysis using the software QGIS 3.20. The viewshed analysis is based only on topography (i.e. digital elevation model) and represents the areas where the

[218] masl: meters above sea level

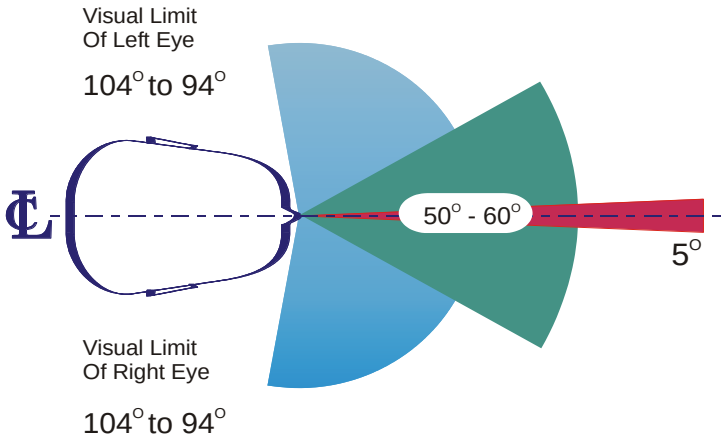
wind farm could be potentially visible. SRTM 30 m Digital Elevation has been utilised for this specific assessment.

Defining an appropriate viewshed is the starting point to understand the visual impacts of the Project. The area of the viewshed will vary depending on the nature and scale of the proposed facility. The larger (and higher) the facility is, the bigger the viewshed will be, as it may be visible for a greater distance. The viewshed is, therefore, the area that is most likely to be visually impacted.

The following information[219] explains how a viewshed is defined and identified depending on the horizontal and vertical field of views.

A. Horizontal Field of View

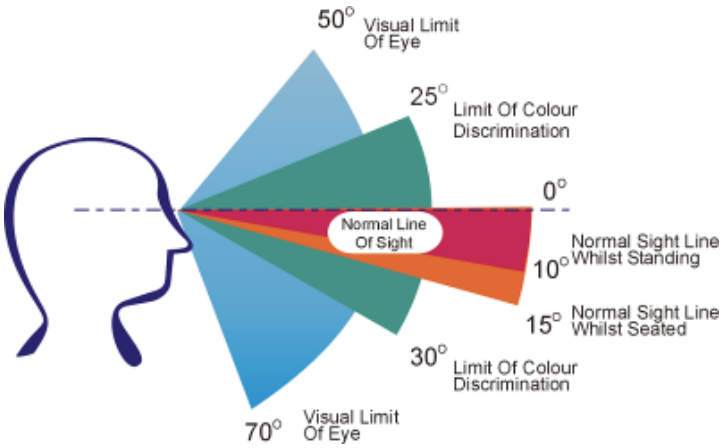
For most people, the horizontal central field of vision covers an angle between 50° to 60°. Within this angle, both eyes observe an object simultaneously but from a slightly different angle. This angle creates a central field of greater magnitude than that possible by each eye separately. This major horizontal field of vision is termed the 'binocular field' (green zone). Within this field, images are sharp, depth perception occurs, and colour discrimination is possible. Research suggests that the visual impact of a project component will vary according to the proportion of the binocular field it occupies. Project components that occupy 5% or 2.5° or less of the horizontal central binocular field of vision are usually perceived as insignificant objects. In contrast, components that occupy 30° are considered to be visually dominating.



B. Vertical Field of View

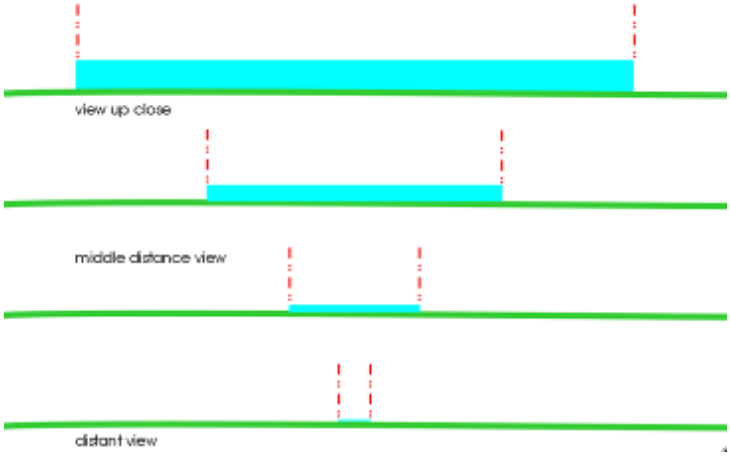
The vertical central field of vision has a similar set of parameters. The vertical binocular field usually is 25° above the vertical and 30° below the sheer. When project components exceed the eye's 50° upper visual limit, they are considered to dominate the vertical central field of vision. When project components occupy 0.5°, they are not regarded as dominant, nor are they usually perceived as a significant change to the existing baseline condition when they are located within an anthropogenically modified landscape.

[219] Source: Human Dimension & Interior Space – A Source Book of Design Reference Standards, Julius Panero and Martin Zelnik, The Architectural Press Ltd. London, 1979



C. Horizontal versus Vertical Visibility over Distance

As a person moves further away from a project component, the visibility of the vertical dimension tends to reduce more significantly than the visibility of the horizontal size. This effect is illustrated below.



10.2.4.2 Visual Baseline

Visual interferences may occur when new elements are introduced into a landscape, or existing elements are altered or removed, changing how stakeholders access, perceive, or experience landscape resources.

Based on the Project characteristics, the main interferences could occur from:

- Installation and operation of turbines
- Movement of large construction vehicles

The proposed wind turbines are the primary visual element of the proposed development and may visually impact the surrounding. As the viewer moves further away from these structures, the visual impact decreases until it is no longer visible. However, before the point of non-visibility is reached, the wind turbines have reduced in scale such that they no longer have a significant visual impact.

The wind farm comprises 30 individual WD164-3300 WTGs manufactured by Zhejiang Windey with hub height of 110 m and a rotor diameter of 164 m.

Those WTGs are located in line and scattered within the Project's area, over roughly 2000 ha. The closest distance between turbines is less than 300 m. In assessing the wind turbine's visual impact, it is assumed that the most significant horizontal component is the entire rotor diameter, which would be a maximum of 164 m. Whilst the highest vertical part of the WTG is considered to be the tip height –

the highest point of a WTG when the position of the turbine's blade is perpendicular to the ground. The assessment has also evaluated the combined effect of multiple rotors throughout the landscape.

As shown in Table 10.8, calculations suggest that the impact of rotors of WTGs would reduce to insignificance at about 3.7 km, as it would form less than 5% or 2.5° of the horizontal field of view.

Table 10.8 Horizontal Field of View

Horizontal Field of View	Impact	Distance from observer to rotors
<2.5° of view	The development will take up less than 5% of the central field of view. The product, unless particularly conspicuous against the background, will not intrude significantly into the scenery. The extent of the vertical angle will also affect the visual impact.	3,758.01 m
2.5° – 30° of view	The development may usually have a moderate impact that may be not noticeable at the most significant distance of this range.	3,758.01 m to 306.03 m
>30° of view	Developments that fill more than 50% of the central field of vision will always be noticed, and only sympathetic treatments will mitigate visual effects.	306.03 m

A similar analysis based upon the vertical field of view for human vision (Table 10.9) shows the relationship between impact and the development's proportion within the vertical line of sight.

Table 10.9 Vertical Field of View

Vertical Line of Sight	Impact	Distance from observer to the WTG's tip height
< 0.5° of vertical angle	A thin line in the landscape	22,001.44 m
0.5° – 2.5° of vertical angle	The degree of visual intrusion will depend on the development's ability to blend in with the surroundings	22,001.44 m to 4,399.62 m
> 2.5° of vertical angle	Usually visible; however, the degree of visual intrusion will depend on the width of the object and its placement within the landscape	4,399.62 m

Based on the results, it is reasonable to assume that distances at which the magnitude of the visual impact of the wind turbine will not be significant may be the ones greater than 22 km, where a fully visible WTG would be an insignificant element within the landscape. However the nearest receptors are located within or closer to the Project's boundary, less than one kilometre to the nearest WTGs, and will be significantly impacted by the changing visual amenity.

QGIS 3.20 was used to determine the ZTV for the Project. The current visibility within the ZTV will vary depending on the presence of intervening local topography and features such as vegetation and buildings. The recent viewshed analysis has been based solely on topography and did not consider the potential screening granted by the local vegetation patches, further reducing the actual viewshed. Moreover, it should be highlighted that a typical viewshed assessment does not take local meteorological conditions into account, resulting in changes to real visibility. For example, rainfall and other atmospheric conditions will alter the visibility of the wind farm. The diminution of visual clarity bought about by atmospheric conditions also increases with distance, and cloudy days can result in the natural attenuation of the visibility of the Project.

Similar to cloud coverage, rainy days can reduce the visibility as the water droplets obscure vision. Visibility varies greatly depending on the heaviness of the precipitation, but even light rain obscures distant objects greatly. Figure 10.10 shows the ZTV mapping from any points inside the buffer area.

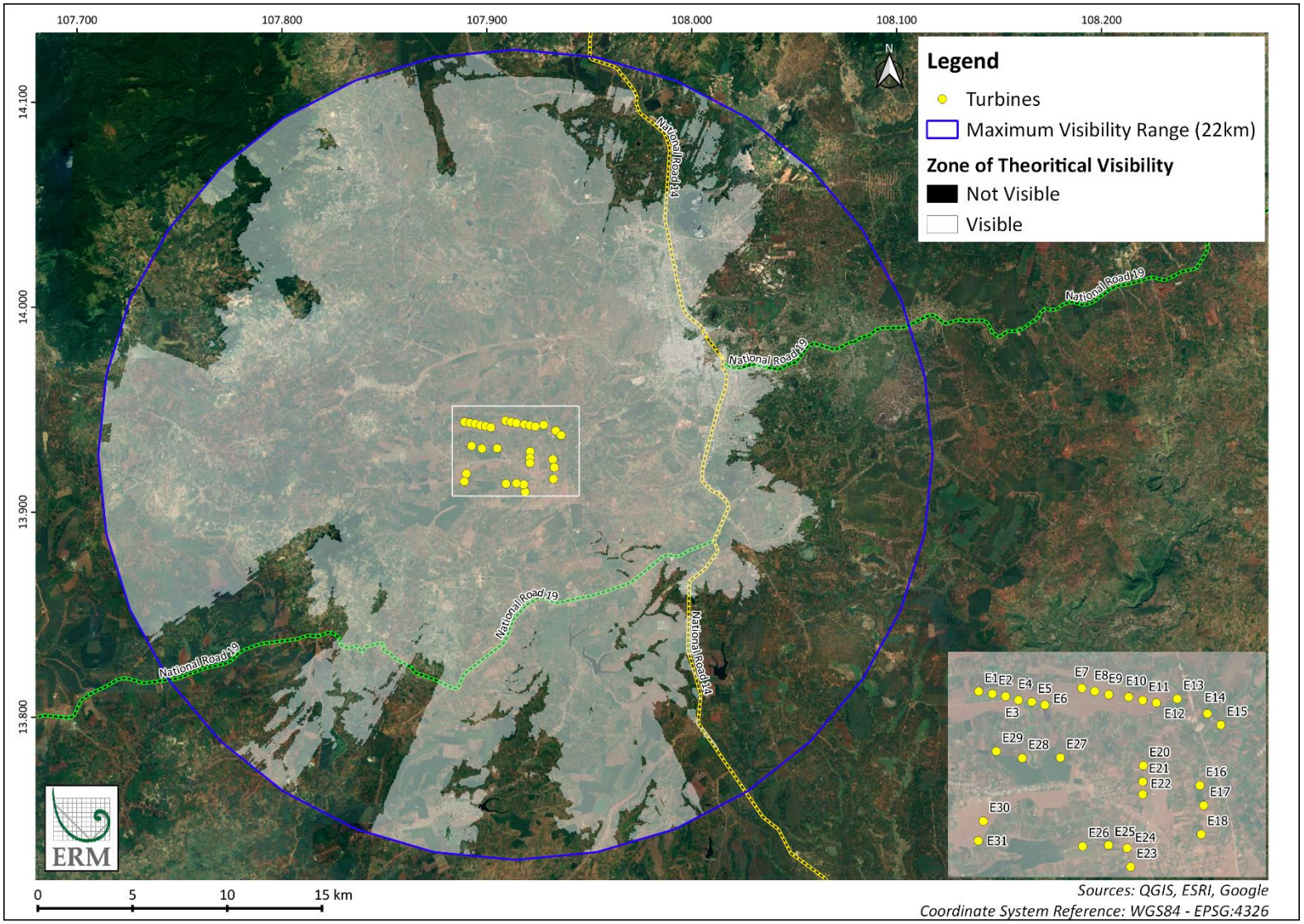

107.700
107.800
107.900
108.000
108.100
108.200
14.100
14.000
13.900
13.800
N
Legend
Turbines
Maximum Visibility Range (22km)
Zone of Theoritical Visibility
Not Visible
Visible
National Road 14
National Road 19
National Road 19
National Road 19
National Road 19
National Road 14
E1 E2 E4 E5 E6 E3
E7 E8 E9 E10 E11 E13 E14 E12 E15
E29 E28 E27
E20 E21 E22 E16 E17
E30 E31
E26 E25 E24 E23 E18
ERM
0
5
10
15 km
Sources: QGIS, ESRI, Google
Coordinate System Reference: WGS84 - EPSG:4326

Figure 10.10 Viewshed (22 km Buffer)

The results of the viewshed assessment, as presented in Figure 10.11, show that the visibility is a part of the whole area, which is concentrated at the centre of the Project because of the site's morphology and distance to WTGs. Specifically, the terrain is a low-mountainous (600 – 850 masl) area wih some landscapes likely to reduce or block the visibility of WTGs at some observer locations.

It should be emphasised that intervening vegetation is not included in this mapping and is likely to significantly reduce the visibility of wind turbines, in whole or in part, and therefore reduce the impact identified. However, the Project area is analysed and classified as agricultural and bare land, where the vegetation cover is shallow. Thus, the deviation of the assessment from reality is lowered.

Considering the potential visibility from local communities, the Project components, especially the wind turbines, will either wholly or partly be visible from the residential areas in the vicinity. A total of 14 locations within the Project area have been selected as visual sensitive receptors (VSRs) to evaluate the significance of impact in different directions. The selection boundary is within the vertical viewshed of the wind turbine’s tip (radius 22 km) because this is the highest part to be seen. The buffer zone covers all the visual perceptions of people that could be affected by the presence of the Project. A viewshed analysis has been carried out to reflect the view of receptors toward the turbines within the field of view (Section 10.2.5.1.4).

The following criteria were used to assess the sensitivity of the VSRs to screen the potential sensitive receptors:

- Value and quality of existing views
- Type and estimated number of receiver population
- Duration of frequency of view
- Degree of visibility

Figure 10.11 shows the locations of the VSRs, which are houses selected for analysis.

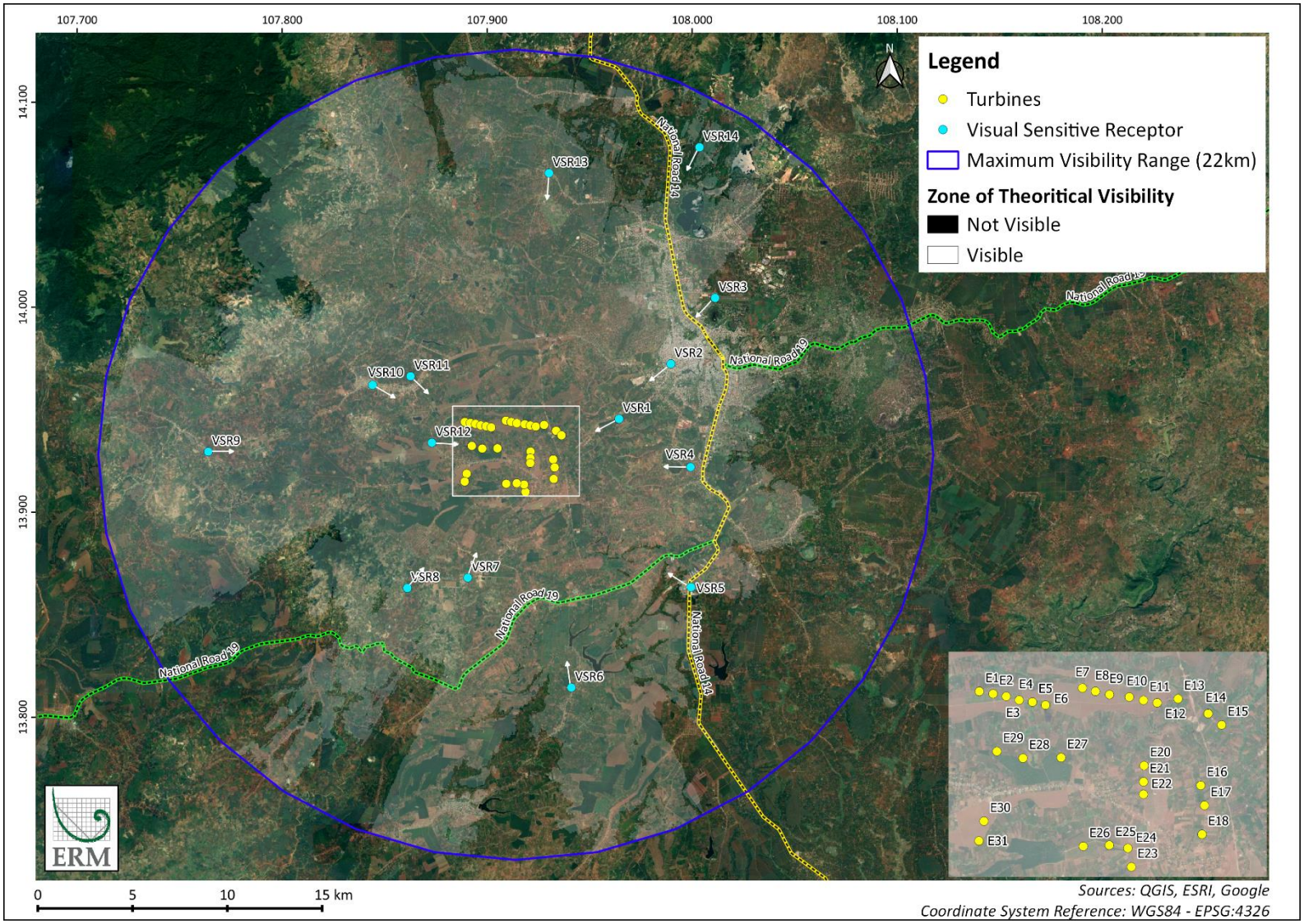

107.700
107.800
107.900
108.000
108.100
108.200
14.100
14.000
13.900
13.800
N
Legend
Turbines
Visual Sensitive Receptor
Maximum Visibility Range (22km)
Zone of Theoritical Visibility
Not Visible
Visible
VSR1
VSR2
VSR3
VSR4
VSR5
VSR6
VSR7
VSR8
VSR9
VSR10
VSR11
VSR12
VSR13
VSR14
National Road 14
National Road 19
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
E11
E12
E13
E14
E15
E16
E17
E18
E20
E21
E22
E23
E24
E25
E26
E27
E28
E29
E30
E31
ERM
0
5
10
15 km
Sources: QGIS, ESRI, Google
Coordinate System Reference: WGS84 - EPSG:4326

Figure 10.11 Visual Sensitive Receptors Location

10.2.5 Impact Assessment

The assessment of impacts on visual amenity was performed following accepted methodologies derived from best practice guidelines. Impact significance for visual comfort is generally derived based on the following main factors:

- The quality/importance of the visual amenity as a resource/function that is potentially affected
- The sensitivity of the visual amenity towards Project activities
- The magnitude of change to the receiving visual amenity as a result of the Project

The visual impact assessment describes changes in the character of the available views to people resulting from the Project and their visual amenity. It is necessary to consider the sensitivity of the visual receptors against the magnitude of visual effects to determine the significance of visual effects.

10.2.5.1 Methodology

10.2.5.1.1 Sensitivity of Receptors

Visual receptors are people and must be assessed in terms of their sensitivity, combining judgements on their susceptibility to the specific change proposed and the value attached to a view or their visual amenity. Susceptibility refers to the degree to which a particular visual receptor can accommodate change arising from the Project, without detrimental effects on the visual amenity, and will vary with the:

- Occupation or activity of people experiencing the view
- Location and context of the view
- The extent to which their attention or interest may be focused on the view and their visual amenity

Judgements about the sensitivity of visual receptors should be recorded on a scale (e.g., low, medium and high) with clearly stated criteria. Table 10.10 indicates the relative sensitivities of several visual receptors.

Table 10.10 Sensitivity of Visual Receptors

Visual Receptors	Sensitivity
A small number of visitors with interest to the surroundings. Viewers with a passing interest are not explicitly focused on the landscape, e.g. workers, commuters. The quality of the existing view, as likely to be perceived by the viewer, is assessed as being low	Low
Small numbers of residents and moderate numbers of visitors with interest in their environment. More significant numbers of recreational road users. The quality of the existing view, as likely to be perceived by the viewer, is assessed as being medium	Medium
More significant numbers of viewers and/or those with proprietary interest and prolonged viewing opportunities include residents and users of attractive and well-used recreational facilities. The quality of the existing view, as likely to be perceived by the viewer, is assessed as being high	High

10.2.5.1.2 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:

- The scale of change relating to the loss or additions of features in the scenery, including the proportion of the view occupied by the proposed development
- Degree of contrast or integration of any new part or changes in the composition of the view

- Duration of the effect, whether temporary or permanent, intermittent or continuous
- The angle of view to the main activity of the receptor
- Distance of the viewpoint from the Project
- The extent of the area over which the changes would be visible
- Variation in the degree of visibility of the Project (it is helpful to categorise those variations)
- The extent of the view that the Project would occupy: total, partial or glimpse
- The distance of the viewpoint from the Project and whether the viewer would focus on the Project due to proximity of the Project would form one element in a particular view
- The proportion of the Project or particular features that would be visible: full, most, a small amount, none
- Whether the view is transient or one of a sequence of opinions 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., when lower moisture levels increase visibility during dry season). The typical criteria and thresholds in determining the magnitude of effect on visual receptors are set out in Table 10.11.

Table 10.11 Magnitude of Visual Effect

Typical criteria and thresholds	Visual Magnitude of effect
A change that is barely or rarely perceptible, at very long distance, or visible for a short duration, perhaps at an oblique angle, or blends in with the existing view. The change may be short term.	Negligible
A subtle change in the view, at long distances, or visible for a short distance, perhaps at an oblique angle, or blends in with the existing view. The change may be short term.	Small
A noticeable change in the view at an intermediate distance affects a substantial part of the view and a more wide-ranging, less concentrated change across an expansive area. The difference may be medium to long term and may not be reversible.	Medium
An evident change in the view at a close distance, affecting a substantial part of the view, is continuously visible for a long duration or obstructing essential elements of the view. The change may be medium to long term and would not be reversible.	Large

10.2.5.1.3 Significance of Visual Effect

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 influential viewpoints or amenity routes are likely to be more significant than changes affecting less important paths and roads
- Changes affecting large numbers of people are generally more significant than those involving a relatively small group of users

The significance matrix below illustrates the relationship between the sensitivity of a visual receptor and the magnitude of the visual effect. The significance of an optical 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 impact constitutes a significant effect will vary on a project by project basis.

Table 10.12 Significance of 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

10.2.5.1.4 Identification of Visual Impact

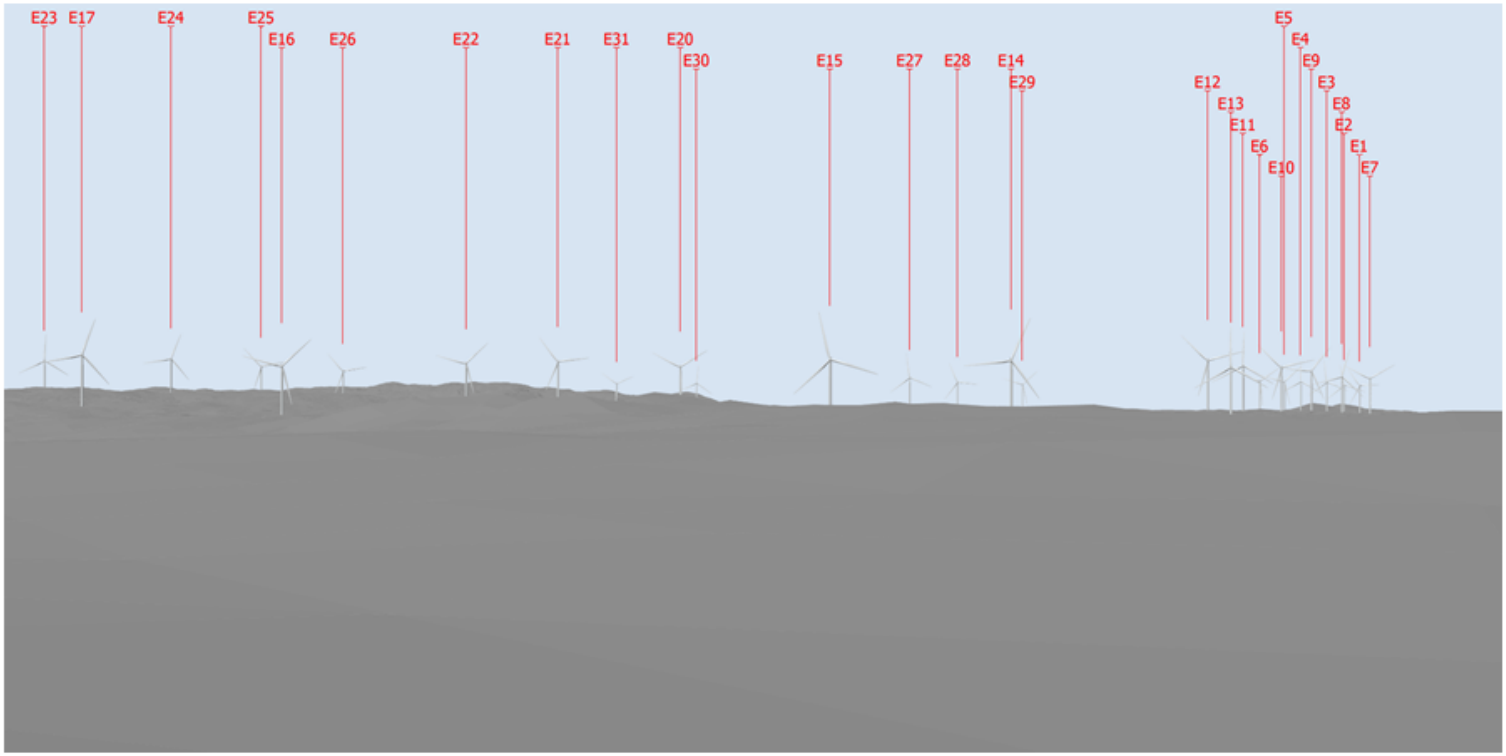
The visual impact is a product of the magnitude of change to the existing baseline conditions, the landscape context and the sensitivities of VSRs.

The viewshed analysis (Figure 10.10) shows that the proposed wind turbines can be visible in the nearby areas, not continue due to the variability of the landscape for the area surrounding the Project.

Figure 10.11 shows the location of the VSRs selected for the analysis, and Table 10.13 shows the summary of the Project's visual impacts at the selected VSRs.

In the subsequent pages, the viewpoints for each VSR previously identified are presented.

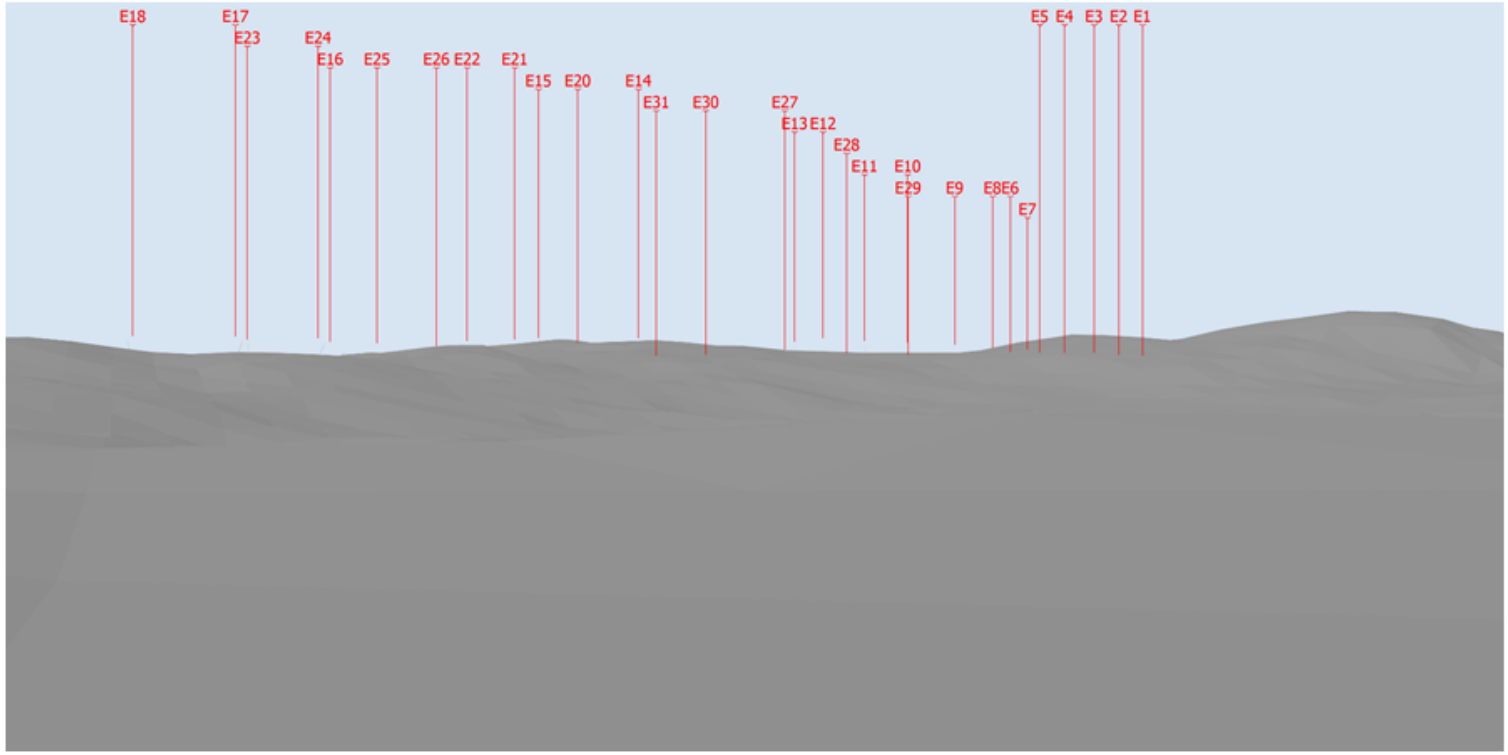
VIEWPOINT VSR01



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.945516	107.964332	769	WSW	50	29	29	29	3,140	8,820

Visual Sensitivity	Magnitude of Change
The present view was taken from the yard of a university located in a small residential area of Pleiku City, Gia Lai Province. Due to the average number of residents and couple schools in the area, the visual sensitivity is considered to be MEDIUM.	Given the topography of the land and the distance, from this point of view, all wind turbines are noticeable at the point of view. In particular, the local residents can observe almost full tower wind turbines. Thus, it is considered that the magnitude of change is LARGE.

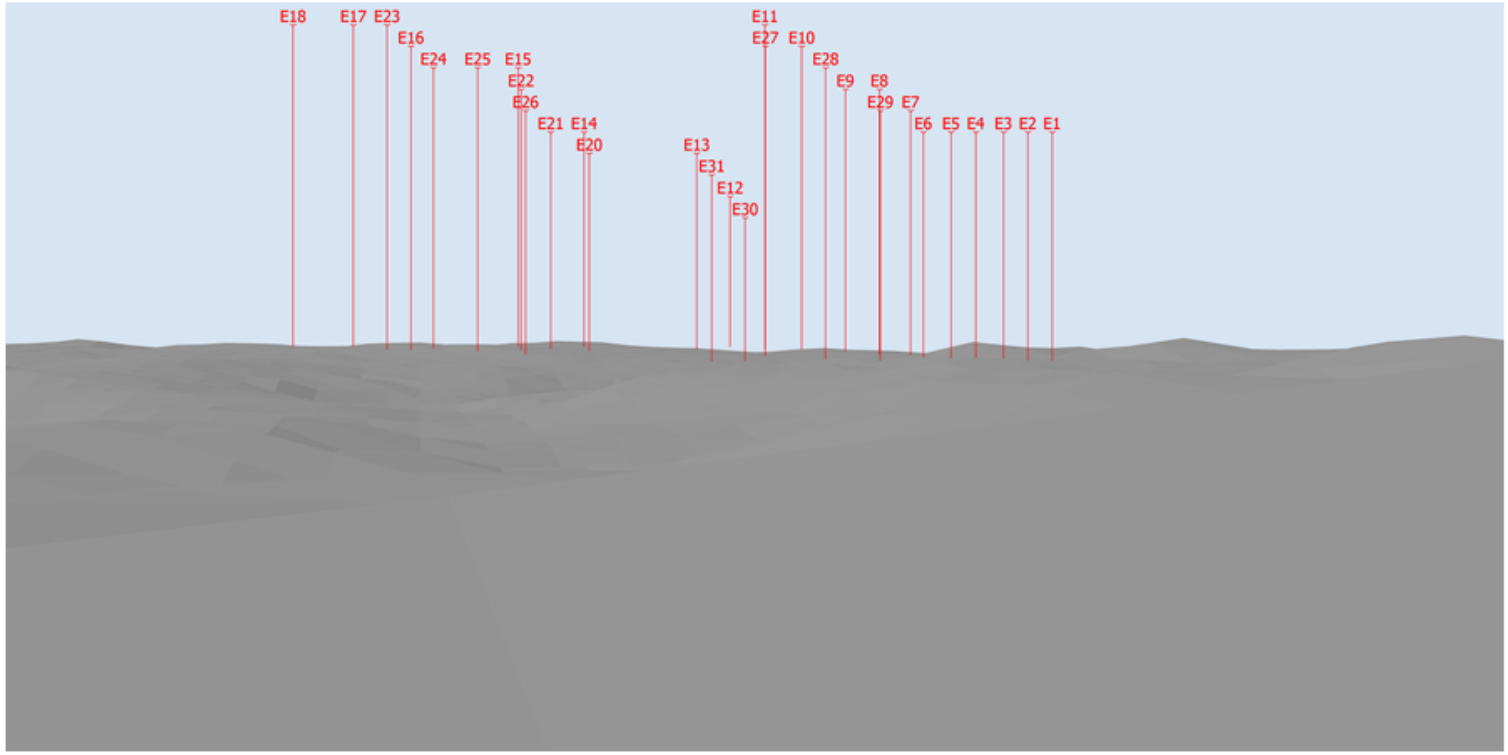
VIEWPOINT VSR02



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.972221	107.989430	807.9	WSW	50	30	14	0	6,924	12,582

Visual Sensitivity	Magnitude of Change
The present view was taken from the busy centre area of Pleiku City, Gia Lai Province. Given the high density of people gathering at the city centre, the visual sensitivity is considered to be HIGH.	Due to the topography of the land and the distance, from this point of view, only half the amount of wind turbines are exposed at the tip. Thus, it is considered that the magnitude of change is NEGLIGIBLE.

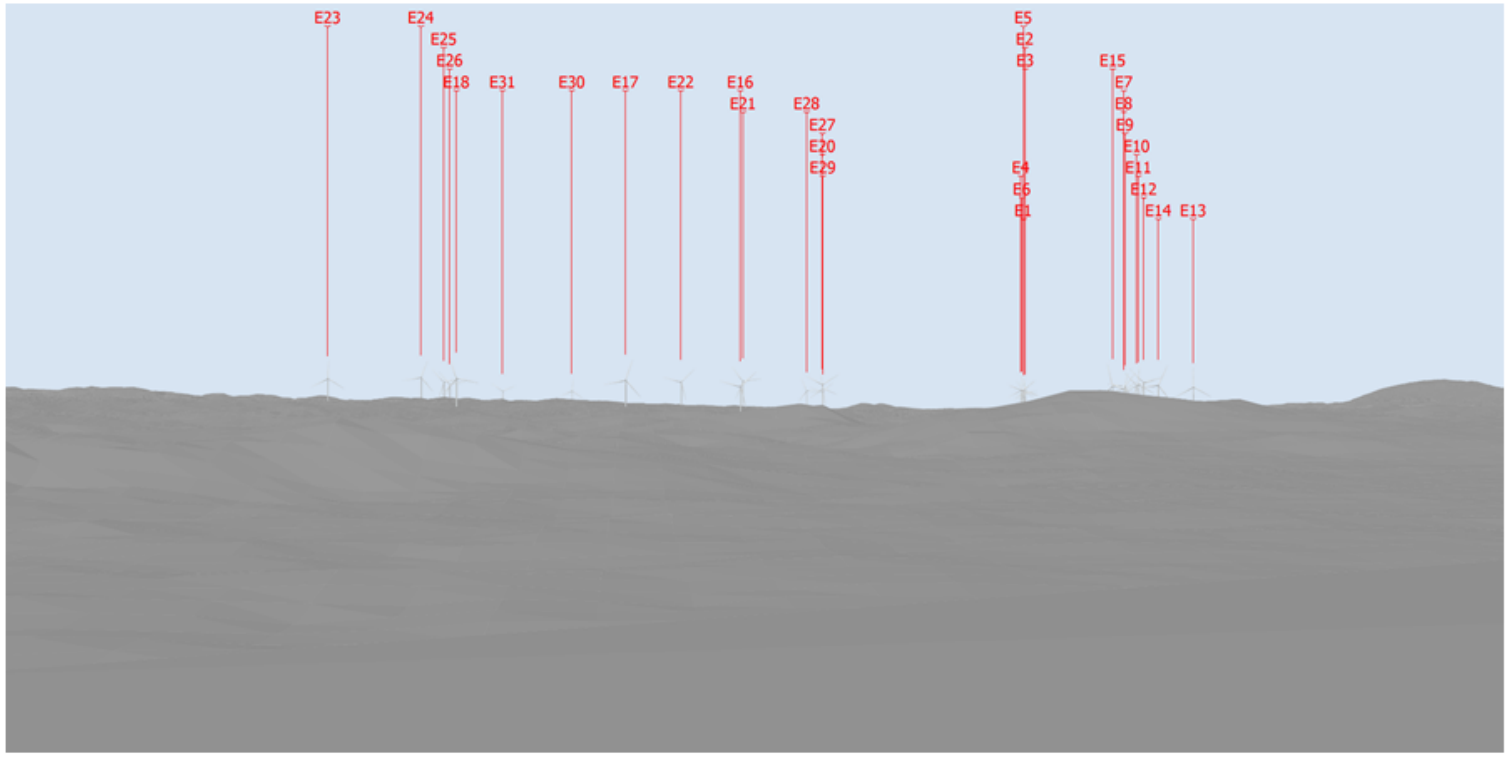
VIEWPOINT VSR03



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
14.004697	108.010540	744	WSW	50	30	2	0	10,971	16,497

Visual Sensitivity	Magnitude of Change
The view was taken from the runway of Pleiku airport located in Pleiku City, Gia Lai Province. With the potential frequency of 49 outbound flights every week, the visual sensitivity is considered to be HIGH.	Due to the topography of the land and the distance, only E10 and E12 turbines are barely visible at the tip of the structure. Thus, it is considered that the magnitude of change is NEGLIGIBLE.

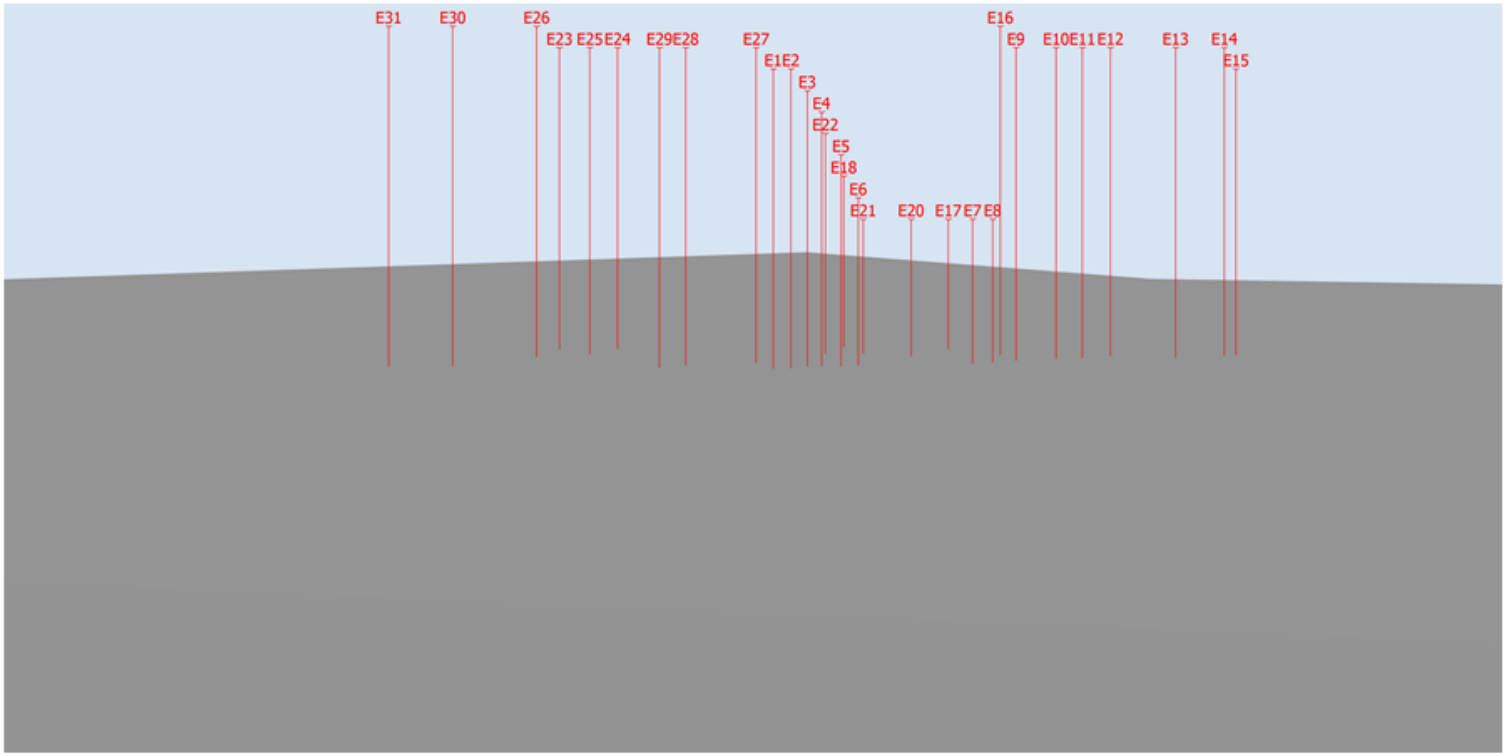
VIEWPOINT VSR04



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.922042	107.999166	826.1	W	50	30	30	30	7,015	12,143

Visual Sensitivity	Magnitude of Change
The view was taken from the residential area of Ia Kenh Commune, Pleiku City, Gia Lai Province and closed to National Road No. 14. Additionally, approximately one kilometre from the viewpoint was a tourist attraction (Đồi thông Diên Phú). Therefore, the visual sensitivity is considered to be MEDIUM.	From this present view, all of the wind turbines are exposed at least more than two-third of the tower structure and established a noticeable change. It is considered that the magnitude in changing the visual amenity is MEDIUM.

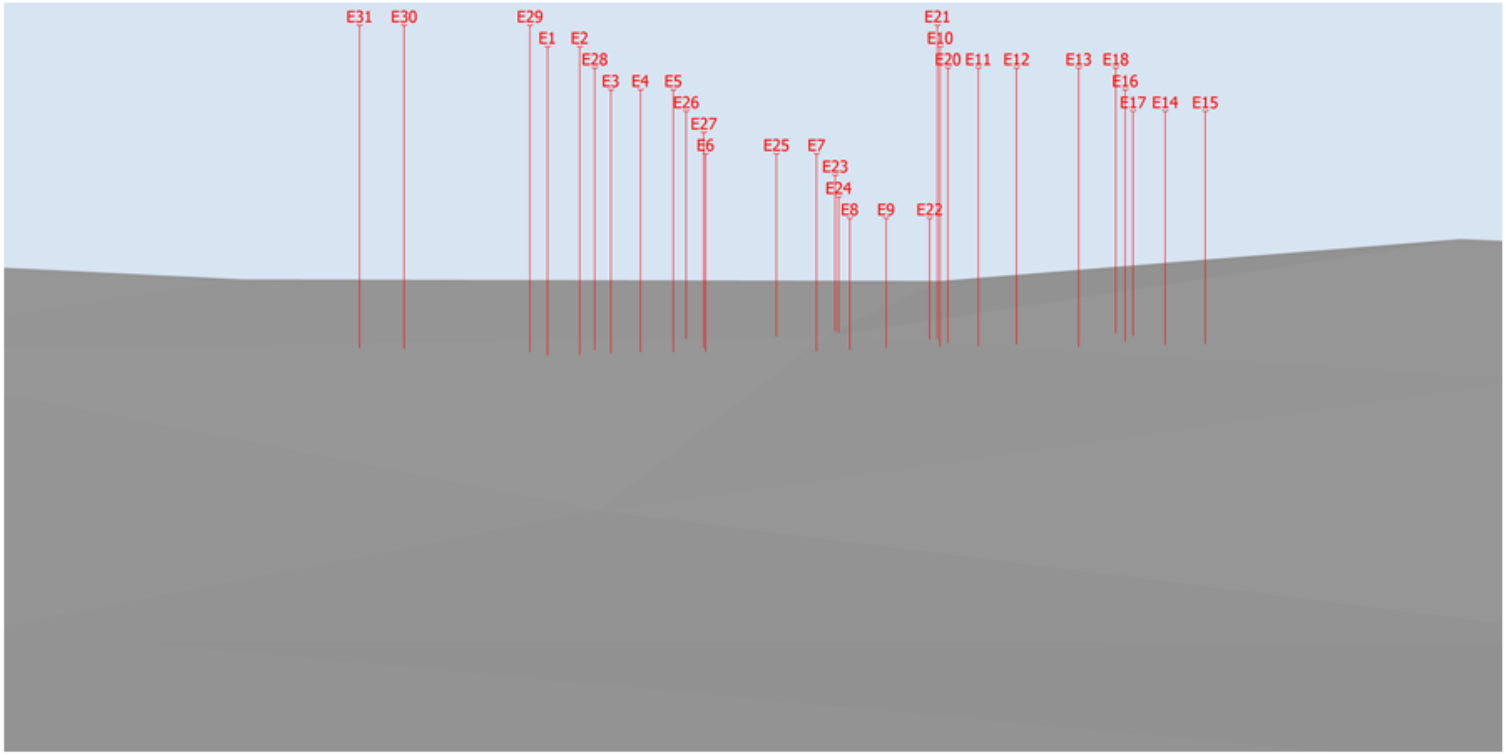
VIEWPOINT VSR05



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.863481	107.999420	772.8	NW	50	30	0	0	9,321	14,918

Visual Sensitivity	Magnitude of Change
The view was taken from the Hoang Anh Gia Lai's soccer practice field located in Ia Bang Commune, Dak Doa District, Gia Lai Province. However, given the area is filled with industrial warehouses/plants with low density of residential structures, the sensitivity is considered to be LOW.	Due to the topography of the land and the distance, no wind turbines are observed at this viewpoint. Thus, the magnitude of change is considered NEGLIGIBLE.

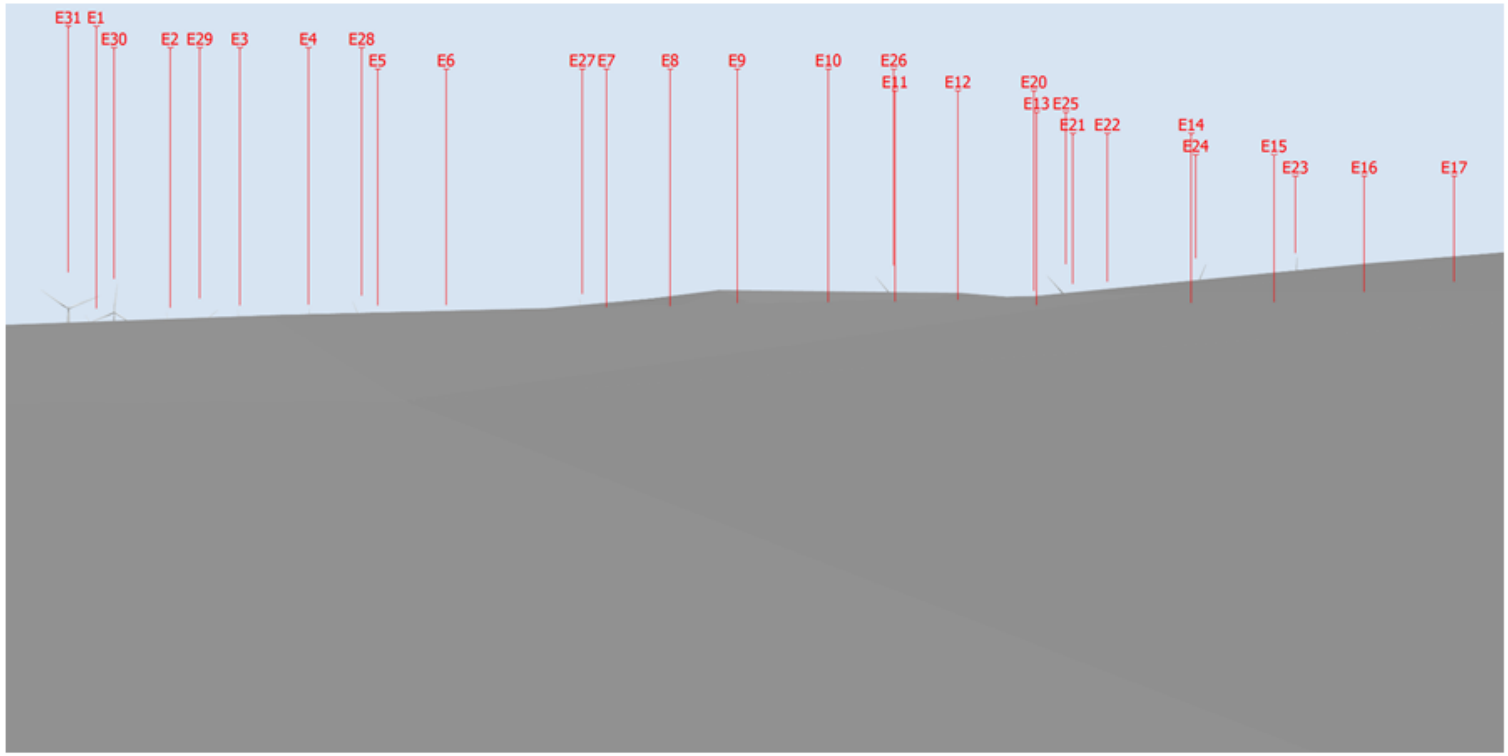
VIEWPOINT VSR06



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.814490	107.941022	668.6	NNW	50	30	0	0	10,891	15,475

Visual Sensitivity	Magnitude of Change
The present view was taken within the churchyard of Hoang Yen's parish church located in a low density residential area of Hoang An Commune, Chu Prong District, Gia Lai Province. Henceforth, the visual sensitivity is considered to be LOW.	Due to the topography of the land and the distance, no wind turbines are observed at this viewpoint. Thus, the magnitude of change is considered NEGLIGIBLE.

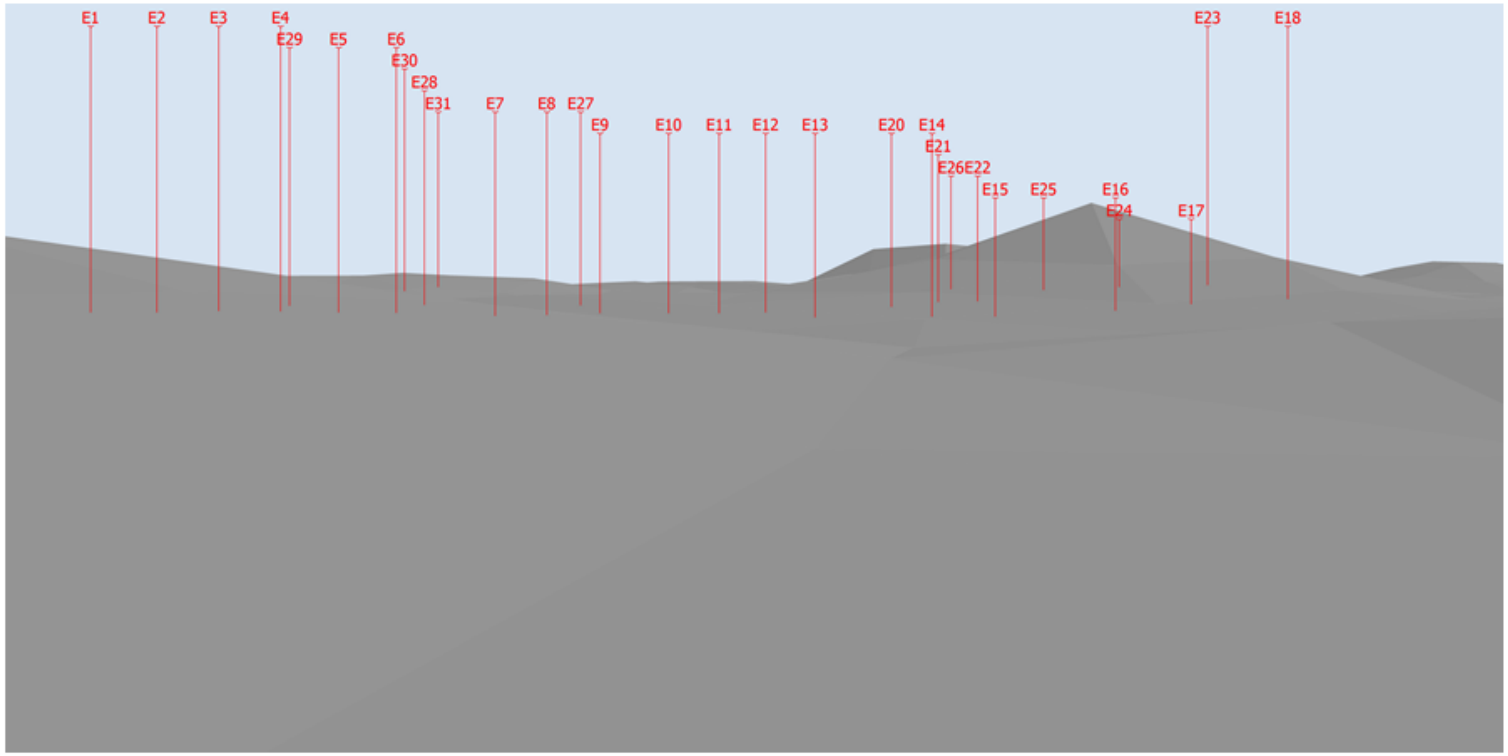
VIEWPOINT VSR07



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.868071	107.890521	615.1	NNE	50	29	18	2	5,222	9,236

Visual Sensitivity	Magnitude of Change
The present view was taken from a tourist attraction (Đồi chè – Hoa Muồng) where also the place to host the Hoa Muong festival every year at the beginning of October. However, the viewpoint located within the agricultural area with limited residential buildings in Bau Can Commune, Chu Prong District, Gia Lai Province. Therefore, the visual sensitivity is considered to be MEDIUM	Due to the topography of the land and the distance, only a small portion of the blade of a few number of wind turbines is visible and established a slightly noticeable change in the view. Hence, the magnitude is SMALL.

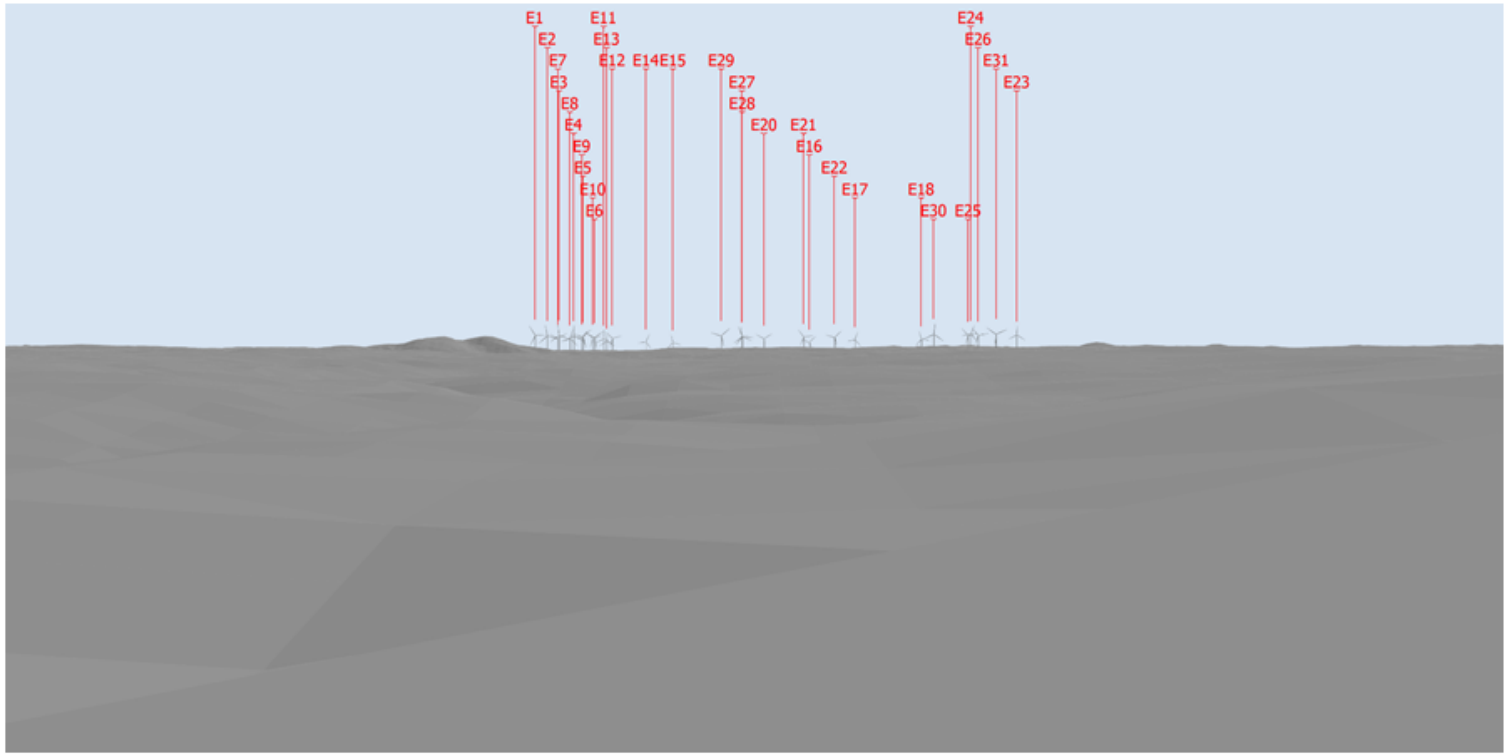
VIEWPOINT VSR08



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.864750	107.860334	569.9	NE	50	30	0	0	6,392	11,528

Visual Sensitivity	Magnitude of Change
The present view was taken from the entrance point to the Doi 3 waterfall – a tourist attraction located in Bau Can Commune, Chu Prong District, Gia Lai Province. The area was filled and surrounded with agricultural and forest lands and couple of residential building. Therefore, the visual sensitivity is considered to be MEDIUM.	Due to the topography of the land and the distance, from this point of view, no wind turbines are observed at this viewpoint. Thus, the magnitude of change is considered NEGLIGIBLE.

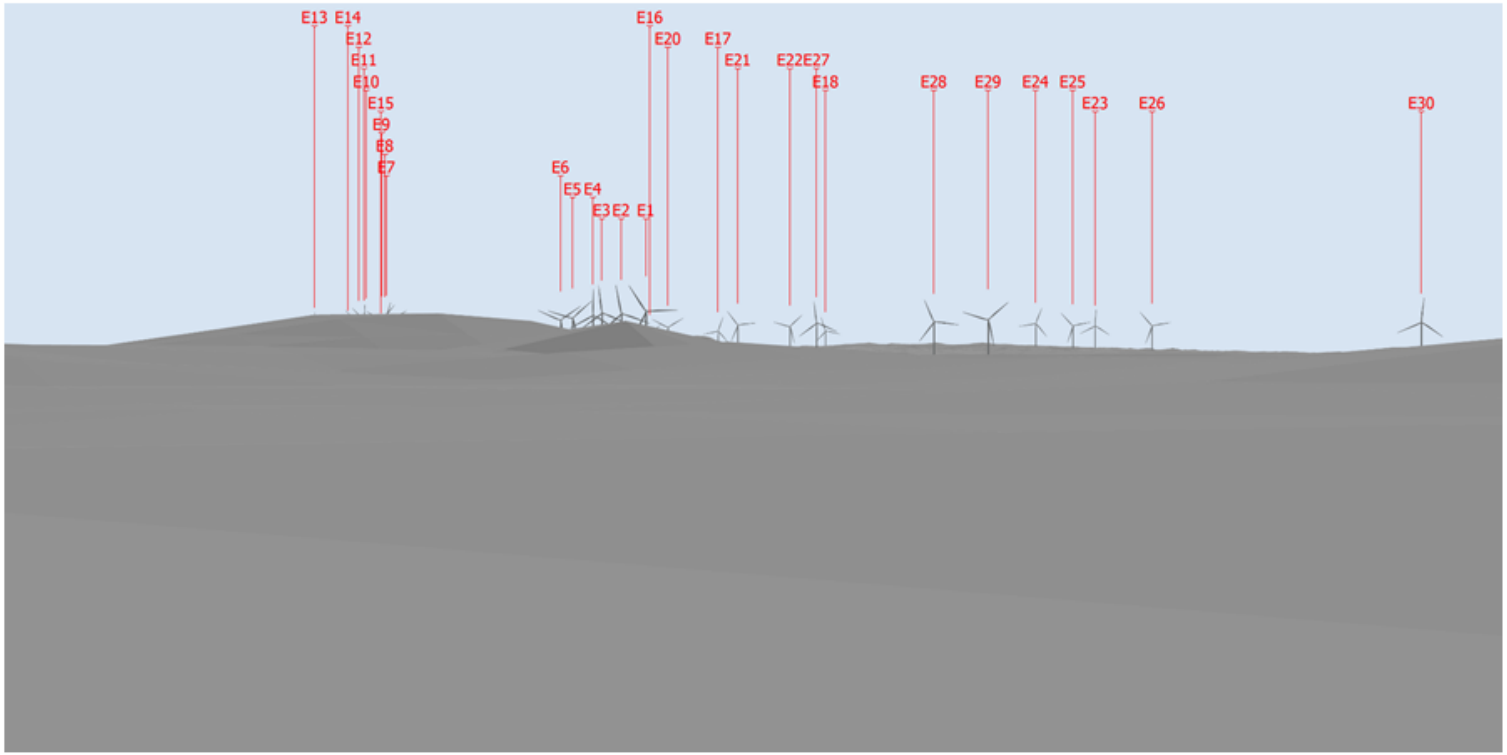
VIEWPOINT VSR09



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.929521	107.763950	437.2	E	50	30	30	30	13,611	18,637

Visual Sensitivity	Magnitude of Change
The view is taken from the Tran Hung Dao's secondary school in a moderately dense residential area in Ia Grang Commune, Ia Grai District, Gia Lai Province. Therefore, the visual sensitivity is considered to be MEDIUM.	Despite the distance to the wind project area and the congregated turbine layout, from the present view, most of WTGs are visible and made a reasonably noticeable change. Thus, it is considered that the magnitude of change is SMALL.

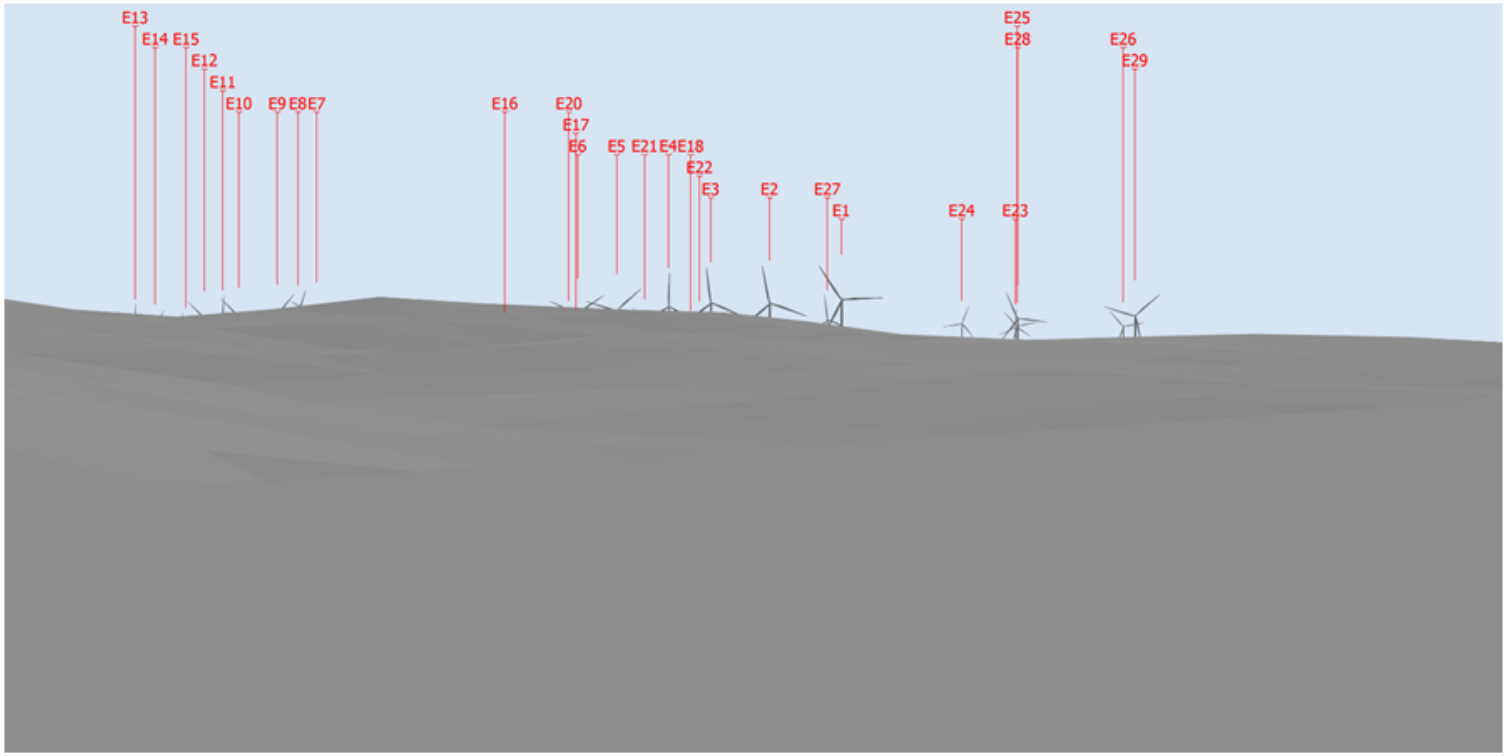
VIEWPOINT VSR10



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.961889	107.846602	586.8	ESE	50	30	29	20	5,002	10,575

Visual Sensitivity	Magnitude of Change
The view is taken from Ia Kha township, Ia Grai District, Gia Lai Province where both township-level and district-level authorities are situated. The area is also filled with residents and public services. Hence, the visual sensitivity is considered to be HIGH.	Despite the congregated turbine layout, from the present view, most of WTGs are visible and made a noticeable change. Thus, it is considered that the magnitude of change is MEDIUM.

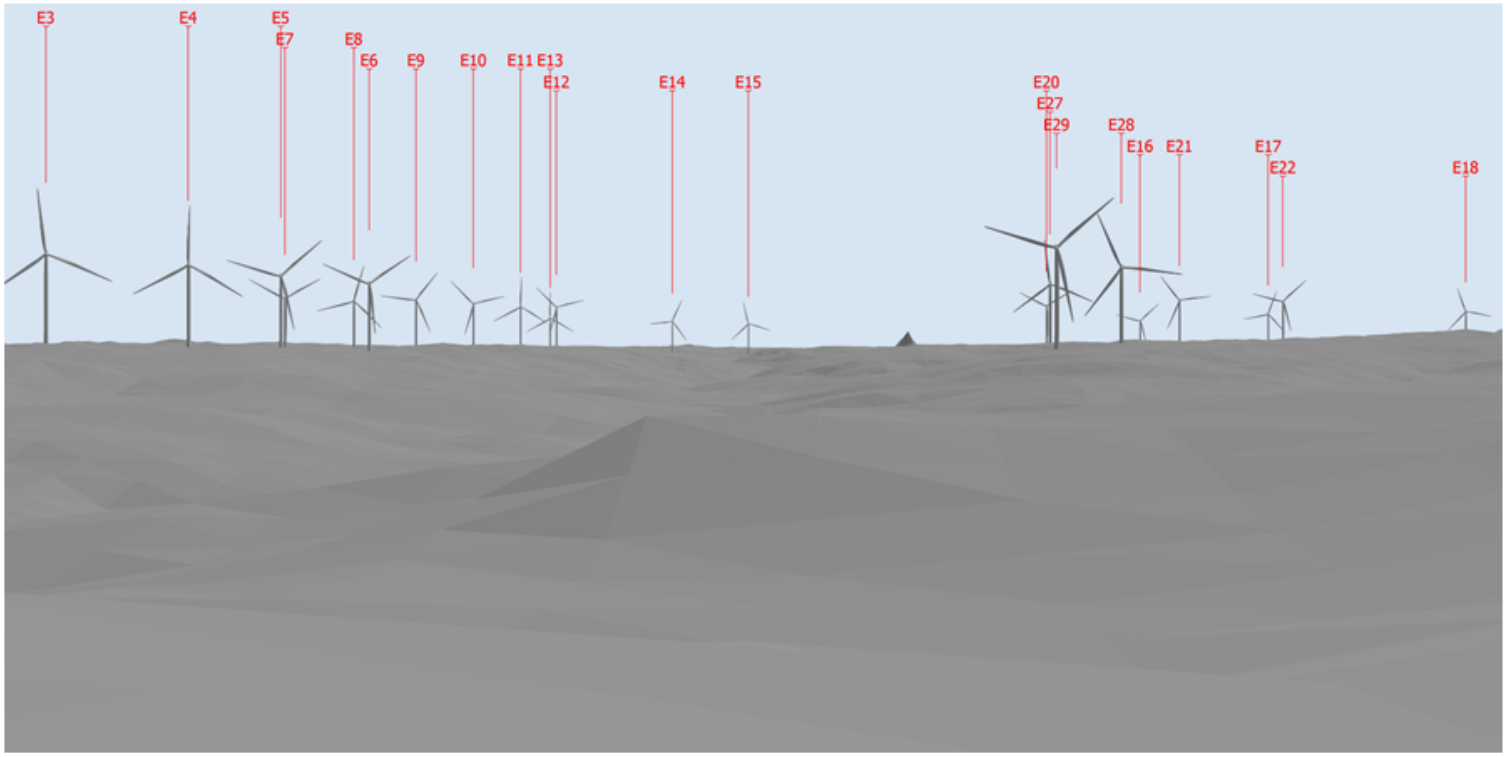
VIEWPOINT VSR11



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.966343	107.862620	595.8	SE	50	28	25	11	3,787	9,382

Visual Sensitivity	Magnitude of Change
The view is taken from local community resides in Chu Plang village, Pong Drang commune. Due to the small number of residents, the visual sensitivity is considered to be LOW.	Due to the topographic condition, a congregated turbine layout is able to be observed from this point of view and made a noticeable change to the scene. Thus, it is considered that the magnitude of change is MEDIUM.

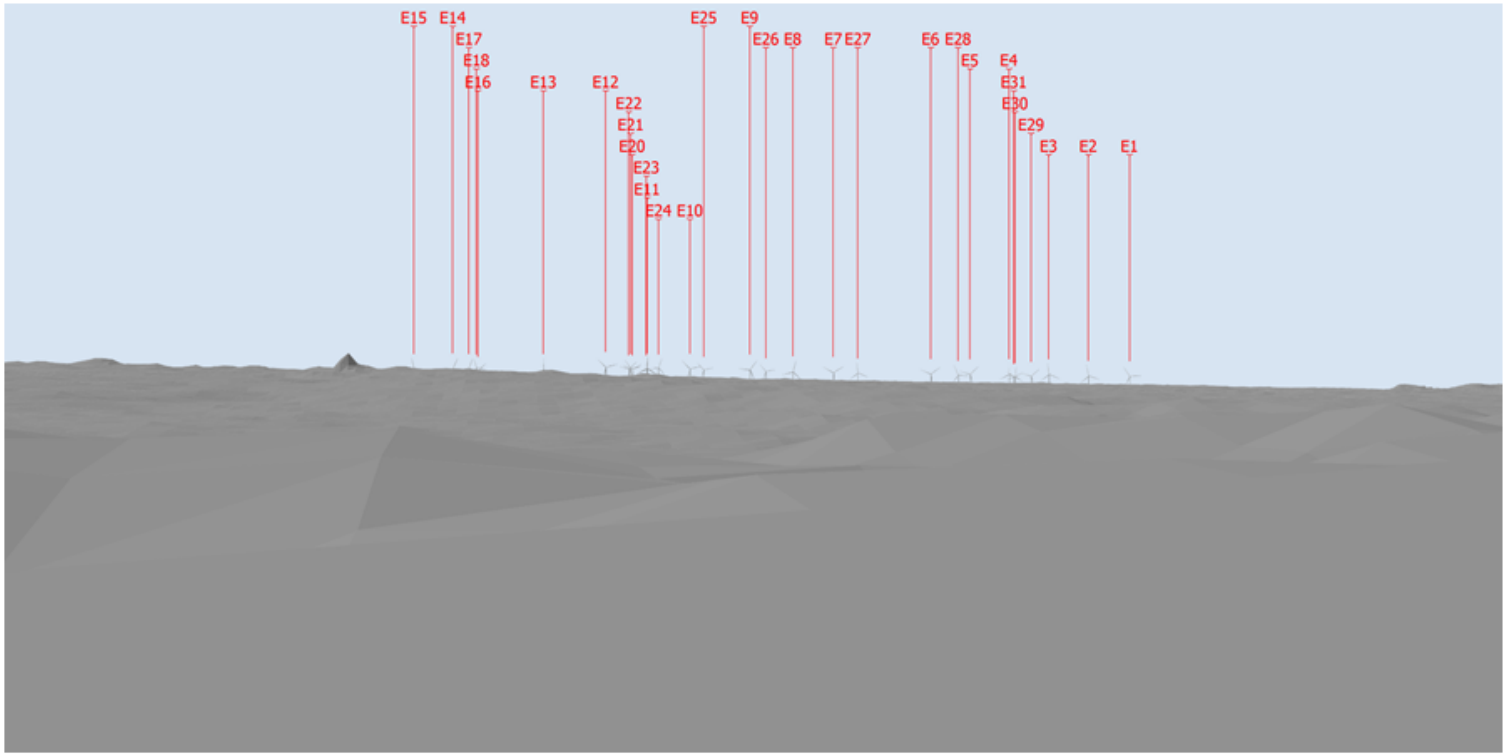
VIEWPOINT VSR12



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
13.934398	107.873211	616.7	E	50	22	22	22	2,098	6,818

Visual Sensitivity	Magnitude of Change
The view was taken from access road to Ia Pech Commune, Ia Grai District, Gia Lai Province which travel through the Project's area. Given there is a relatively high residents along the road and the Project is located within the agricultural area of Ia Pech Commune, the visual sensitivity is considered to be HIGH.	The topographic condition of the area is considerably even which let the higher exposure of wind turbines' structures. Taken into account of the proximity of the Project and surrounding receptors together with topography, the Project makes an noticeable change in the view. Henceforth, the magnitude of changing in visual amenity is considered to be LARGE.

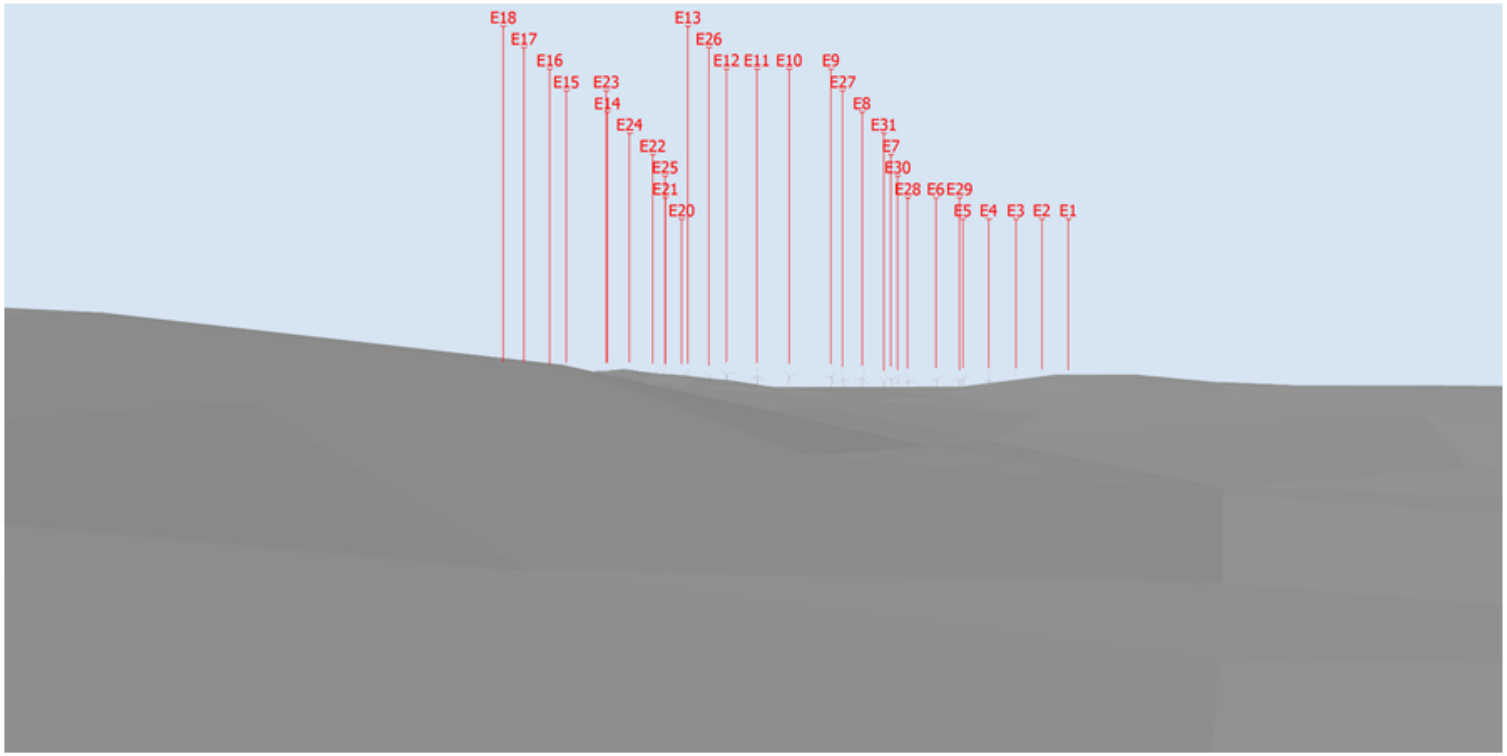
VIEWPOINT VSR13



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
14.065389	107.930159	723.3	S	50	30	30	29	13,627	17,356

Visual Sensitivity	Magnitude of Change
The view is taken from the local community resides in Ia Sao Commune, Ia Grai District Gia Lai Province. Given the small residential area with scattered residential buildings, the visual sensitivity is considered to be LOW.	Despite the distance to the wind project area and the congregated turbine layout, from the present view, most of WTGs are visible and made a reasonably noticeable change. Thus, it is considered that the magnitude of change is SMALL.

VIEWPOINT VSR14



Viewpoint Location Information									
Latitude	Longitude	Height above sea level (m)	Centre of Panorama – View Direction	Field of View (FoV) (°)	WTG within FoV	Visible WTG at tip height	Visible WTG at hub height	Nearest WTG (m)	Furthest WTG (m)
14.078006	108.003560	761.6	SW	50	30	24	0	17,149	21,968

Visual Sensitivity	Magnitude of Change
The present view was taken from a tea leaf field which is also a tourist attraction (Đồng chè Biển Hồ). A relatively high density residential area is about 1.5 kilometre to the right belonged to Nghia Hung Commune, Pleiku City, Gia Lai Province. Thus, the visual sensitivity is considered to be MEDIUM.	Due to the topography of the land and the very long distance, from the present view, most of WTGs are barely visible and cannot potentially made a significant change in the view. Thus, it is considered that the magnitude of change to visual amenity is NEGLIGIBLE.

Table 10.13 Summary of Visual Impacts from Viewshed Analysis

VSR	Distance to nearest wind turbine	Project visibility	Sensitivity of Receptor	Magnitude of Visual Effect	Significance of Visual Effect – Combined Impact
VSR01	3.1 km	Visible	Medium	Large	Major
VSR02	6.9 km	Not Visible	High	Negligible	Negligible
VSR03	10.9 km	Not Visible	High	Negligible	Negligible
VSR04	7.0 km	Visible	Medium	Medium	Moderate
VSR05	9.3 km	Not Visible	Low	Negligible	Negligible
VSR06	10.9 km	Not Visible	Low	Negligible	Negligible
VSR07	5.2 km	Visible	Medium	Small	Minor
VSR08	6.4 km	Not Visible	Medium	Negligible	Negligible
VSR09	13.6 km	Visible	Medium	Small	Minor
VSR10	5.0 km	Visible	High	Medium	Major
VSR11	3.8 km	Visible	Low	Medium	Minor
VSR12	2.1 km	Visible	High	Large	Major
VSR13	13.6 km	Visible	Low	Small	Negligible
VSR14	11.5 km	Visible	Low	Negligible	Negligible

14 VSRs were selected as representative of communes around the Project area. Within the viewshed. VSR3 was chosen to represent receptors outside the visibility area based on the viewshed analysis, to verify the visibility within the 22 km area to the Project.

It should be noted that views of the Project could be filtered through vegetation not included in the present analysis. As shown in Table 10.13, receptors near the Project are likely to be affected by the turbines. The area located far from the Project is not expected to be affected due to the distance and obstacles (e.g. terrain, vegetation, buildings). Three out of 14 selected VSRs were assessed as being impacted to a Major extent. The other VSRs will mainly be negligibly affected with a couple of Moderate to Minor degrees. Therefore, the overall significance of visual impact from the erection of the wind turbines is considered Moderate to Minor.

10.2.5.2 Additional Mitigation Measures

The following identifies mitigation measures to be applied by the Project Owner and EPC contractor:

- Use of materials that will minimise light reflection should be used for all Project components
- Prominent logos and colours at a long wavelength of the visible spectrum should be avoided to be painted for the WTGs
- 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 essential requirement, and
- Existing vegetation should be retained to the greatest extent possible. Foliage should be maintained along roads, substations, and other Project infrastructure

10.2.5.3 Residual Impact

Following the implementation of these mitigation measures, residual impact's significance is considered Minor to Negligible depending mainly on the distance of the receptors to wind turbines.

10.2.5.4 Monitoring Audit

No specific monitoring measures are identified at this stage. However, the Project Developer is recommended to monitor any raised concerns or feedbacks from local communities regarding changing local visual amenities via the Project's community grievance mechanism.

10.3 Solid Waste Impact Assessment

10.3.1 Scope of Assessment

Solid wastes are likely to be generated at all stages of the project development, including non-hazardous domestic / construction / industrial wastes as well as a range of hazardous wastes. The amount of each type of waste differs between different stages. Main activities contributing to the total volume of waste in the construction and operation phases and the corresponding types of waste to be anticipated include:

- **Construction phase**: site clearance (vegetation / topsoil and demolished materials), construction activities (metals, wasted materials, broken equipment, covers, containers), office operation (ink, paper, batteries, plastic, etc.) and living activities of construction workers (food, plastics)
- **Operation phase**: operation of the administrative office and control room (paper, batteries, fluorescent tubes, domestic waste, etc.) and maintenance activities at the WTGs' location, substation and transmission line (spent oil, rags, used equipment, etc.).

This section assesses potential impacts associated with disposal and handling of the above wastes throughout the project's lifetime. Existing handling methods embedded in the technical design as well as construction arrangement are considered prior to evaluation of overall significance of the potential impacts. Mitigation measures and management procedures are defined to make sure residual impacts are at environmentally or socially acceptable levels.

10.3.2 Relevant Guidelines and Criteria

10.3.2.1 Vietnamese Regulations

Vietnamese legislative requirements applicable to the Project are:

- Law No 55/2014/QH13 dated 23 June 2014 on Environmental Protection
- Decree No. 38/2015/ND-CP dated 24 April 2015 on management of waste and discarded materials
- Decree No. 40/2019/ND-CP dated 13 May 2019 on amendments to Decrees on guidelines for the Law on Environment Protection
- Circular No. 08/2017/TT-BXD dated 16 May 16 2017 on construction solid waste management, and
- Circular No. 36/2015/TT-BTNMT dated 30 June 2015 on hazardous waste management.

10.3.2.2 International Guidelines

International guidance applicable to the Project are:

- AIIB Environmental and Social Framework – ESS 1: Environmental and Social Assessment and Management

- IFC Performance Standard 3: Resource Efficiency and Pollution Prevention
- IFC Performance Standard 4: Community Health, Safety, and Security
- IFC General EHS Guidelines 1.6 Waste Management, and
- IFC Environmental, Health, and Safety Guidelines for Waste Management Facilities.

10.3.3 Assessment of Impacts

10.3.3.1 Construction Phase

10.3.3.1.1 Potential Impact

Construction of the project components (turbine foundations, administration building, substation, and transmission line) requires clearance of 597,900 m^2 land consisting of mainly perrenial tree cropping land (rubber, coffee, etc.) which accounts for 99.9% of the Project area, as well as the demolition of one house. Clearance and demolition activities generate a large amount of solid waste comprising mainly organic wastes (roots, branches, leaves, etc.) and housing debris. In addition, the construction activities generate a significant amount of construction waste such as empty cement bags, soil waste from earthworks and groundworks excavations, sand, stones and other waste materials from construction activities.

At the time of this assessment, land clearance, underground works and construction of the turbine foundations, internal roads and main part of the administration building and substation had been completed. The remaining construction activities comprise the installation of the wind turbines, T-line, completion of the administration building and installation of the electrical components of the Project. Accordingly, the Project expects to generate approximately 32 kg/day of construction waste including mainly covers, equipment scraps, office waste, etc. Besides, the Project will also generate approximately 50 kg domestic waste per day as a result of activities, based on the presence of around 100 workers on site; comprising mainly plastic bags, food leftovers, used packaging etc.

During this period, hazardous waste, such as spent oil, oily sludge and contaminated rags, will also be generated from the maintenance of construction machinery and equipment. Based on the waste records of similar-scale wind projects, it is estimated that approximately 4 kg hazardous waste will be generated on a daily basis during the remainder of the construction phase.

Based on current Project information, all construction waste have been collected and stored on site. Upon the completion of the construction phase, the EPC contractor will contract a specialized entity (following instruction of the local authority) to collect and dispose off the wastes appropriately.

These wastes, if not properly managed, can cause impacts to human health and environment, including airborne and water-borne diseases, air pollution (from fugitive dust), soil, groundwater and surface water contamination, impacts to flora and fauna, and affect economic development, tourism, and local infrastructure.

10.3.3.1.2 Significance of Impact

The improper disposal of construction, domestic and hazardous wastes during the construction phase will indirectly and negatively affect the local environmental quality and human health. Given the construction phase has been nearly done, the concerned impact will only last over a short-term period of about 3 months of the remaining construction phase wherein the impact frequency is expected to be intermittent. Moreover, only a small area nearby the project's components will be affected, thus, the overall impact magnitude is considered **Small**. Local residents, who are key receptors of the impact from mishandling of solid waste, are considered having **Medium** vulnerability. Overall, the significance of impact is considered **Minor** as summarized in Table 10.14 below.

Table 10.14 Solid Waste Impact Significance – Construction Phase

Impact Description	Impact level			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Impact Duration	**Short-term**	Medium-term	Long-term	Permanent
Impact Extent	**Local**	Regional	Global	
Impact Frequency	One-off	Rarely	**Sometimes**	Often
Impact Magnitude	Negligible	**Small**	Medium	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	Negligible	**Minor**	Moderate	Major

10.3.3.1.3 Mitigation Measures

The following measures are proposed to mitigate and properly manage the impact due to solid wastes to be generated during the remaining construction period:

Construction waste

- Ensuring coverage of the waste gather area to avoid washout of large particles during rainfall
- Inspecting regularly the waste stockpiling area to make sure appropriate containment measures are in place and no pathways exist for the generation of airborne or waterborne pathogens.
- Establishing internal regulations to guide all Project's employees on good conduct in terms of hygiene and environmental protection.

Domestic waste

- Arranging waste bins around the project site in strategic positions where there is a high number of construction workers gathering such as administration building, substation, and temporary office area
- Avoiding storing organic waste in open areas, especially those close to adjacent communities or roads
- Using iron bins with lids to avoid access of wildlife that can cause trash spill
- Waste storage will be protected from physical elements (e.g. direct sunlight, wind, rain, storms, etc.) and kept away from natural drainage canals.
- Restricting storing organic wastes over long period of time, collecting domestic waste daily and transporting to specialized treatment facilities.
- Workers will be trained on waste management practices (e.g. handling, storing and disposal) as a part of environmental awareness program

Hazardous waste

- Establishing a list of hazardous waste relevant to the Project including oily wastes, batteries, fluorescense lamps, etc., as per Vietnames National Regulation QCVN 07:2009/BTNMT
- Establishing a management plan to manage the generation and handling of hazardous waste
- Educating construction workers on appropriate collection and storing of hazardous waste
- Dedicated hazardous waste storage will be arranged next to construction waste storage areas, and will be built in accordance with legal requirements (the storage must be roofed, the floor must be

impervious, secondary containment must be provided etc.). Within the storage area, hazardous waste bins will be arranged and labelled to accommodate each type of waste.

- Access to hazardous waste storage areas will be limited to employees who have received appropriate training.
- Contracting a specialized entity to collect and dispose hazardous waste appropriately.

10.3.3.1.4 Residual Impact

With the implementation of the above mitigation measures, the residual impact is expected to be **Negligible.**

10.3.3.1.5 Monitoring and Auditing

- A daily site inspection regime will be implemented to verify compliance with mitigation measures.
- Records of the amount of waste generated by the project will be documented and maintained on site along with storage practices, management and final destination for future inspection.
- Planned and unplanned audits to onsite waste storage areas and around the project site will be implemented to ensure compliance with legal requirements.

10.3.3.2 Operation Phase

10.3.3.2.1 Potential Impact

Domestic waste

During the operation phase of the wind farm, about 10 staff will be present on an ongoing basis. It is estimated that each person will generate around 1 kg of domestic waste per day, thus totally about 10kg of waste will be generated from the Project on a daily basis. The waste will mainly comprise of:

- Organic waste such as discarded vegetables, leftovers
- Food and drink packaging
- Discarded plastic and glass products, and
- Metals, such as empty food cans.

Hazardous waste

The main sources of hazardous waste in operation phase are:

- Spent oil from maintenance and repair of the wind turbines and transformers
- Oil-contaminated cloth, and
- Discarded ink cartridges, broken fluorescent lamps, used batteries from office activities.

Based on experience from similar projects, the wind turbines and transformers will be maintained once every four to five years. Expected amount of waste oil to be generated during each maintenance event is 350 litres, while the amount of oil-contaminated waste is estimated to be 2 kg.

Office activities are expected to generate about 3 kg of hazardous waste monthly.

10.3.3.2.2 Significance of Impacts

During operation phase, solid waste will be generated with only a small amount and low frequency (regular for domestic waste and intermittent for hazardous waste from maintenance activities). Consequently, despite negative nature of the expecting impact on local environmental quality and

human health, the impact extent will likely be local and impact magnitude will be **Negligible**. Local residents, who are key receptors of the impact from mishandling of solid waste, are considered having **Medium** vulnerability. Overall, the significance of impact is considered **Negligible** as summarized in Table 10.15 below.

Table 10.15 Solid Waste Impact Significance – Operation Phase

Impact Description	Impact level			
Impact Nature	Positive		**Negative**	
Impact Type	**Direct**		Indirect	
Impact Duration	Short-term	Medium-term	**Long-term**	Permanent
Impact Extent	**Local**	Regional	Global	
Impact Frequency	One-off	Rarely	**Sometimes**	Often
Impact Magnitude	**Negligible**	Small	Medium	Large
Sensitivity/Vulnerability	Low	**Medium**	High	
Significance	**Negligible**	Minor	Moderate	Major

10.3.3.2.3 Additional Measures

Although the overall significance of the impact is considered negligible, the following measures are proposed as per the international good practice to retain the impact at negligible level and avoid further accummulation of the impact:

- Domestic waste will be collected, classified and disposed every day by a local waste treatment company.
- Separate bins for each type of waste will be arranged accordingly.
- Hazardous waste will be collected in closed and labelled bins/containers in a roofed area before being transported for disposal by an authorised waste treatment company in accordance with legal requirements.
- Before the scheduled maintenance, the waste treatment company will be informed in advance to ensure that they are able to handle a large volume of waste oil and other hazardous waste.
- Project staff will be trained on waste management and storage practices (e.g. handling, storing and disposal) as a part of environmental awareness program.
- A Waste Management Plan will be established to keep track of the waste sources and amounts generated during the operation phase as well as collection and disposal records, and
- An appropriately trained member of staff will be assigned responsibility to perform regular inspection of the project area for appropriate waste management and handling.

10.3.3.2.4 Residual Impacts

With the implementation of the above mitigation measures, the residual impacts is expected to be retained at **Negligible.**

10.3.3.2.5 Monitoring and Auditing

- Records of the amount of waste generated by the project will be documented maintained on site along with the storage practices, management and final destination for future inspection.

- Planned and unplanned audits to onsite waste storage areas and around the project site will be implemented to ensure compliance with legal requirements, especially before and after scheduled maintenance of the wind farm.

10.4 Greenhouse Gas Impact Assessment

10.4.1 Scope of Assessment

This section assesses the impact of greenhouse gas emissions in both the construction and operation phases of the Gia Lai wind farm project. The Project's construction will result in emissions associated with fuel combustion, transportation activities, and emissions of biogenic carbon released from the vegetation removal and site clearance (including site clearance for the access road). The most significant source of GHG emissions is associated with land use change which occur at the time of the disturbance at the beginning of the construction phase.

The operation of the wind farm will not produce direct GHG emissions during its entire lifetime (Ramchandra Bhandari, 2020), therefore, in terms of GHG emissions, it will have positive impacts.

GHG emissions are divided into three categories, or Scopes, as follows:

- **Scope 1 emissions**: direct GHG emissions that occur from sources that are owned or controlled by the reporting entity.
- **Scope 2 emissions**: indirect emissions that occur from the generation of purchased energy products (principally electricity, steam/heat and reduction materials used for smelting) by the entity, and
- **Scope 3 emissions**: Those emissions that are a consequence of the activities of an entity, but which arise from sources not owned or controlled by the Company. Examples of Scope 3 activities include extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services.

Scope 1 and Scope 2 emissions for the Project's construction phase were estimated and based on conservative assumptions (e.g. maximum fuel consumption). As such, they represent the maximum expected emissions for the activities identified in this assessment. IFC PS3 requires projects which emit more than 25,000 t CO_2 per year to quantify direct emissions within the physical boundary and indirect emissions associated with the off-site production of energy used by the Project.

Scope 3 emissions associated with the production and transport of the WTG parts from overseas suppliers to Cam Ranh Port is not considered in the current assessment. Emissions associated with the production and transport of WTGs could be significant, but represent a source of indirect emissions that are not under the Project's operational control (Scope 3), and at present details on the source and transport of WTGs have yet been confirmed. Considering the information available at the time of this assessment as well as guidance from the IFC PS3 to quantify Scope 1 and Scope 2 emissions, this assessment therefore does not consider Scope 3 GHG emissions from the Project's development.

Furthermore, this assessment considers GHG emissions throughout the entire construction phase despite the fact that the construction has nearly been completed at the time of this assessment. The reason for such approach is that GHG emissions affect the climate and weather patterns over a long-term period on global scale rather than produce immediate impact on the adjacent environment such as for other physical environmental and social aspects.

10.4.2 Methodology

10.4.2.1 Carbon Footprint Methodology

The latest 2019 Refinement to 2006 IPCC Guidelines for National GHG Inventories[220], which are considered the most current guidelines, are used to estimate GHG emissions for the Project. It is noted that the 2006 IPCC Guidelines[221] provide a technically sound methodological basis for evaluating national GHG inventories, and therefore fundamental revision of this methodology is unnecessary. However, to maintain the scientific validity of the 2006 IPCC Guidelines, certain refinements are required over time to take into account scientific and other technical advances that have been developed since 2006 (IPCC, 2018).

Vietnam is an Annex I Party of the UNFCCC[222] whose reporting guidelines on annual inventories for Annex I Parties (Decision No. 24/CP.19) requires the use of the 2006 IPCC Guidelines for National GHG Inventories. As such, the 2006 IPCC Guidelines are considered appropriate for estimating GHG emissions for the Project.

These guidelines consist of a three-tier approach for estimating emissions from fossil fuel combustion, as shown in Table 10.16 below.

Table 10.16 Methodology Tiers for Estimation of GHG Emissions by Fossil Fuels

Scope	Description	Treatment in this assessment
Tier 1 Approach	Calculates emissions by multiplying estimated fuel consumed with a default emission factor. For CO_2, emission factors mainly depend upon the carbon content of the fuel and therefore emissions can be estimated fairly accurately using this method. Emission factors for Methane (CH_4) and Nitrous Oxide (N_2O) depend on the combustion technology and operating conditions and vary significantly. As such, large uncertainties are anticipated from this method.	Approach used for CO_2, CH_4, and N_2O.
Tier 2 Approach	The approach is the same as Tier 1 but country-specific emission factors are used in place of the Tier 1 defaults.	Not used in this assessment as no country-specific published data are available.
Tier 3 Approach	Technology-specific emission factors.	Approach used for CH_4, and N_2O for stationary combustion.

CH_4 and N_2O emissions are converted to CO_2 equivalent (CO_2-e) based on the Global Warming Potential (GWP) values of these elements, which represent the total energy that a gas absorbs over a specified period of time (usually 100 years), compared to CO_2. The current assessment makes use of

[220] The latest 2019 Refinement to 2006 IPCC Guidelines for National GHG Inventories (2019, [Online] Available at: https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/

[221] The 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006), [Online] Available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/

[222] UNFCCC Parties and Observers (2021), [Online] Available at: https://unfccc.int/parties-observers

the GWP values introduced by the IPCC Fifth Assessment Report in 2014[223] and recommended by the GHG Protocol in 2020 [224] (Table 10.17).

Table 10.17 100-Year Global Warming Potential (GWP) Values

Greenhouse Gas	Global Warming Potential Values
Carbon dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous oxide (N_2O)	265

Source: IPCC Fifth Assessment Report (2014)[223]

10.4.2.2 Impact Assessment Methodology

A traditional impact assessment is conducted by determining how the proposed activities will affect the state of the environment prior to development of a project. In the case of GHG emissions, this process is complicated by the fact that the impact of GHG emissions on the environment cannot be quantified within a defined space and time. The greenhouse effect occurs on a global basis and the geographical source of GHG emissions is irrelevant when considering the future impact on the climate. It is not possible to link emissions from a single source – such as the Project – to particular impacts in the broader study area.

Therefore, this assessment does not consider the physical impacts of climate change resulting from increasing GHG emissions, but instead will assess the impact of the Project's GHG emissions by way of:

- Understanding the scale of the Project's GHG emissions by comparing total emissions to GHG magnitude ratings and scales for projects (developments) that have been developed by various international lender organisations or groupings, including the IFC, the European Bank for Reconstruction and Development (EBRD), and the EP (Table 10.18).
- Assessing the GHG performance of the Project relative to reference benchmarks on the GHG intensity of electricity production, including the GHG intensity of Vietnam's grid electricity and of other wind farm projects; and
- Understanding of the impact of the Project on Vietnam's national GHG emissions inventory, and consideration of the alignment of the Project with the country's climate policy and international GHG reduction commitments.

Table 10.18 Magnitude Scale for Project-wide GHG Emissions Based on Wider Standards

GHG Emissions Thresholds per annum	Magnitude Rating
>1,000,000 tonnes CO_2-e	Very Large
100,000 – 1,000,000 tonnes CO_2-e	Large
25,000 – 100,000 tonnes CO_2-e	Medium
5,000 – 25,000 tonnes CO_2-e	Small

[223] IPCC Fifth Assessment Report (2014), [Online] Available at: https://www.ipcc.ch/assessment-report/ar5/

[224] GHG Protocol (2020), [Online] Available at: https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf

GHG Emissions Thresholds per annum	Magnitude Rating
<5,000 tonnes CO_2-e	Negligible

Note: the magnitude scales are derived from a number of reporting thresholds adopted by the IFC, EBRD, and EP.

10.4.2.3 Assumptions

The following assumptions were made to facilitate the assessment of GHG impacts:

- This study uses information given in the FS report and updated data provided at the time of the assessment by the Project's sponsor.
- This study refers to a variety of policy documents published by the Vietnam government in order to undertake an analysis of Vietnam's energy and climate policy, to describe Vietnam's current national GHG emissions and inventory, and to project the country's GHG emissions towards 2050. In the absence of any information to suggest otherwise, the assessment assumes that existing policies and plans for both the energy sector and with respect to climate change mitigation will be implemented as described in existing policy documents. Any key assumptions made either in the policy documents or in any related analysis have been stated in the assessment.
- The entire biomass is assumed to be removed in the year of conversion. The recommended default assumption for the Tier 1 calculation is that all carbon in biomass is released to the atmosphere through decay processes either on- or off-site.

10.4.3 GHG Inventory

10.4.3.1 Construction Phase

The construction of the Project involves several sources of Scope 1 GHG emissions, including:

- Land conversion from perrenial cropping land into non-forest land
- Mobile combustion

GHG emissions for each of the these sources are calculated in sections 10.4.3.1.1 and 10.4.3.1.2 below.

10.4.3.1.1 Land Conversion – Scope 1

The Project will result in the conversion of approximately 59.79 ha of perennial cropping land (mostly rubber tree belonging to the Chu Pah Rubber Company) to bareland for construction of the project component including access roads. The vegetation clearance will result in a change in carbon stocks from the removal of living biomass.

The change in carbon stocks in living biomass as a result of the land conversion is calculated based on instruction of the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (2003)[225] ("LULUCF guidance"). It is noted that for the particular case of the Project, land conversion was conducted once during the land clearance process and will not recur at later stages of the Project's lifetime. The GHG emission is thus calculated for the entire land conversion activity rather than annual change in carbon stocks of living biomass, as per the guidance's instruction. The applicable equations are modified accordingly (Equation 10.1 and Equation 10.2).

[225] IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (2003) [Online] Available at: https://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_files/GPG_LULUCF_FULL.pdf

Table 10.19 presents key information of the area of converted land and the calculation result of GHG emissions from such activity. Accordingly, the conversion of land cover at the Project's area is expected to result in the emission of approximately 9,865 t CO_2-e.

Equation 10.1 Annual change in carbon stocks in living biomass

$$\Delta C_{LO_{LB}} = A_{Conversion} \times \left(B_{After} - B_{Before}\right) \times CF$$

Equation 10.2 Annual GHG emission (as CO_2-e) from land conversion

$$CO_2\ emission = \Delta C_{LO_{LB}} \times \frac{M_{CO_2}}{M_C}$$

Wherein

$\Delta C_{LO_{LB}}$	=	Annual change in carbon stocks in living biomass in land converted to 'other land'	(t Carbon/yr)
$A_{Conversion}$	=	Area of land converted to 'other land' from some initial land uses	(ha/yr)
B_{After}	=	Amount of living biomass immediately after conversion to 'other land'	(t d.m./ha)
B_{Before}	=	Amount of living biomass immediately before conversion to 'other land'	(t d.m./ha)
CF	=	Carbon fraction of dry matter (default = 0.5)	
M_{CO_2}	=	Molecular weight of CO_2	(g)
M_C	=	Molecular weight of Carbon	(g)

Table 10.19 GHG Emissions from Land Conversion

Item	Unit	Value
Area	ha	59.79
Living biomass *before* land conversion	t dry matter/ha	90[a]
Living biomass *after* land conversion	t dry matter/ha	0[b]
Total GHG emissions	**t CO_2-e/yr**	**9,865**

[a] *Carbon stock in biomass for naturally regenerated forest, moist with long dry season from Table 3A.1.3, Annex 3A.1 of Good Practice Guidance for Land use, Land-use Changes and Forestry (IPCC, 2003).*
[b] *For forest land converted to area of the project components, B_{after} is 0.*

10.4.3.1.2 Mobile Combustion – Scope 1

Construction activities for Project involve operation of several vehicles and equipment and associated fuel consumption. The quantity of heavy equipment involved and expected fuel consumption are given in Table 10.20.

GHG emissions from mobile combustion are estimated using guidance of the Australian Department of the Environment and Energy – National Greenhouse Accounts Factors (2017) [226] as shown in Equation 10.3 below. Emissions of different types of GHG is then converted to CO_2-e using the corresponding

[226] Australian Department of the Environment and Energy – National Greenhouse Accounts Factors (2017) [Online] Available at: https://www.environment.gov.au/system/files/resources/5a169bfb-f417-4b00-9b70-6ba328ea8671/files/national-greenhouse-accounts-factors-july-2017.pdf

GWP values in Table 10.17. The energy content factors and emission factors to be used in the current calculation are given in Table 10.21.

Table 10.20 List of Construction Equipment and Their Fuel Consumption

Equipment - capacity	Quantity [a]	Fuel consumption per 8-hr shift (litre diesel) [b]
Excavator	10	101
Electric welding machine	03	use electricity
Dynamo	01	48
Insert vibrator	05	24
Flat vibrator	05	67
Concrete mixer	04	use electricity
Dump truck	07	65
Desktop cutting machine	02	use electricity
Iron plate bending machine	02	use electricity
Damper dress	05	use electricity
Dress toad	05	11
Loader	03	360
Road roller	01	67

[a] The number of equipment is obtained by summing up the number of equipment working on each of the project components' area including turbine foundation, 110kV substation, 100kV T-line, administration building, access roads, etc.
[b] Fuel consumption per 8-hr shift of each equipment is referenced from similar projects that use similar equipment.

Equation 10.3 GHG Emissions from Mobile Fuel Combustion

$$E_j = \frac{Q_i \times EC_j \times EF_{ijoxec}}{1000}$$

Wherein

E_j	=	Estimated emissions of gas type j (CO_2, CH_4 or N_2O) from fuel type (i)	(t CO_2-e/yr)
Q_i	=	Estimated quantity of fuel type (i)	(t or GJ/yr)
EC_j	=	Energy content factor of fuel (j)	(GJ/t or GJ/kL)
EF_{ijoxec}	=	Emission factor for each fuel type (j)	(kg CO_2-e/GJ or t)

Table 10.21 Default Emissions Factors and Energy Content Factor for Diesel Combustion in Mobile Equipment and Vehicles

Description	Value	Units
Energy content factor for diesel	43 [a]	MJ/kg or GJ/t
	35.9 [b]	GJ/kL
Tier 1 CO_2 emission factor - diesel [c]	74,100	kg CO_2/ TJ
Tier 1 CH_4 emission factor - diesel [c]	4.15	kg CH_4/ TJ

Description	Value	Units
	0.12	kg CO_2-e/ GJ
Tier 1 N_2O emission factor - diesel [c]	28.6	kg N_2O/ TJ
	7.6	kg CO_2-e/ GJ

[a] *(IPCC, 2006) - Table 1.2 (default net calorific values (NCVs) and lower and upper limits of the 95% confidence intervals), page 1.18, Volume 2 (Energy), Chapter 1 (Introduction).*
[b] *Estimated by ERM based on the diesel density (0.84 according to the TCVN 5689:2018, Diesel fuel oils (DO) - Specifications and test methods, Table 1 - Diesel density*
[c] *(IPCC, 2006) - Table 3.3.1 (default emission factors for off-road mobile sources and machinery), page 3.36, Volume 2 (Energy), Chapter 3 (Mobile Combustion).*

According to Decision No. 1134/QD-BXD on the consumption norms of construction equipment by the Vietnamese Ministry of Construction, construction equipment is expected to operate from 200 up to maximum 300 shifts per year. To be conservative, it is assumed that all equipment listed above work in one shift (8 hours), and each equipment operates 300 shifts per year, resulting in the total fuel consumption of 743L/d or 951,000 L/yr of diesel, equivalent to 34 TJ/year.

Table 10.22 presents the amount of GHG emissions from mobile combustion throughout the construction phase (including completed and remaining construction periods). Accordingly, mobile combustion during construction phase is expected to result in emission of approximately 12,104 t CO_2-e in total.

Table 10.22 GHG Emissions from Mobile Combustion in the Construction Phase

Gas	Energy consumption (TJ/year)	Emission factor (kg/TJ)	GHG emission (t/year)	CO_2-e emission (t/year)
CO_2	34	74,100	2,545	2,545
CH_4		4.15	0.14	4
N_2O		28.6	0.98	260
Total				**2,810**

10.4.3.1.3 Electricity Consumption - Scope 2

No information about purchased electricity consumption was given by the Project's sponsor, except that electricity will be supplied from the nearby national grid. According to our experience from a similar project, the construction phase of the wind farm can consume up to 15,000 kWh grid power per month. GHG emissions from electricity consumption is calculated based on the average electricity grid emissions factor of 0.8458 t $CO_{2\text{-}e}$/MWh[227]. The resultant emissions from the Project's construction is expected to be approximately 152 t CO_2-e in total, considering the 12 month construction period.

[227] Department of Climate Change, Ministry of Natural Resources and Environment, 2021, Announcement on the grid emission factor of Vietnam for the year 2019 [Online] Available at: http://www.dcc.gov.vn/van-ban-phap-luat/1066/He-so-phat-thai-luoi-dien-Viet-Nam-2019.html. [Accessed 04 May 2021]

10.4.3.2 Operation Phase

During the operation phase, the Project is expected to produce an annual electricity output of 143 GWh. As wind power generators do not emit greenhouse gases during operation, the Project will contribute to save around 140,000 tCO_{2-e} annually comparing to thermal power generation[228].

10.4.3.3 Summary of Emissions

A summary of the estimated annual GHG emissions for the construction and operation phases are presented in Table 10.23.

Table 10.23 Summary of GHG Emissions in Construction and Operation Phase

Phase	Emission activities	GHG Emissions (t CO2-e)
Construction	Land conversion – Scope 1	9,865
	Mobile combustion – Scope 1	2,810
	Purchased Electricity – Scope 2	152
Operation phase	Power production	-140,000 (saving)

10.4.4 Assessment of Impacts

10.4.4.1 Construction Phase

The AIIB ESF – ESS1 requires the application of "*pollution prevention and control technologies and practices consistent with international good practice*" and implementation of "*technically and financially feasible and cost-effective options that support meeting nationally determined contributions*". Pollution prevention and abatement is said to be required if the project is emitting GHGs. As such the client is required to promote the reduction of GHG emissions from the Project.

According to the above calculation, the Project has been estimated to emit approximately 12,800 t CO_2-e during the 12-month construction phase (Scope 1 and 2) and negative emissions during its operational phase. As a result, its emission profile is ranked Small in magnitude according to the magnitude scale for project-wide GHG emissions based on standards shown in Table 10.18. The Project is therefore considered an insignificant producer of GHG.

IFC requires projects that are expected to produce more than 25,000 t of CO_2-e annually to also quantify direct emissions from its facilities as well as indirect emissions associated with the off-site production of energy used by the project. As such, the Project is not required to quantify its GHG emissions during the Project's life cycle.

With a total estimate of of 12,800 t CO_2-e during the construction phase, the Project is anticipated to contribute only 0.001% of Vietnam's national GHG emissions annually (293.3 Mt CO_2-e excluding LULUCF; MONRE, 2017) and 0% of global anthropogenic emissions (53,526 Mt CO_2-e excluding LULUCF; WB, 2013) over the same period. The overall impact is considered **Negligible**.

10.4.4.2 Operation Phase

As discussed earlier, during the operation phase, the Project is expected to save around 140,000 t CO_2-e annually comparing to thermal power generation. Therefore, the impact nature is considered **Positive**. However, considering that the Project is expected to generate 50 MW, while Vietnam was expected to

[228] Grid emission factor of Vietnam is 0.981 tCO2/ MWh as announced by Department of Climate Change in Notice No. 263/BDKH-TTBVTOD.

have 1,000 MW of wind power generation by the end of 2020[229], the significance of positive impact of the Project in terms of GHG reduction is considered **Small**.

10.5 Electromagnetic Interference Assessment

10.5.1 Scope of Assessment

All transformers and transmission lines, especially high voltage lines, emit a type of low frequency non-ionizing radiation caused by the generation of electric fields, due to electric charges (voltage), and magnetic fields (induced by the flow of electrical current through transmission lines), which collectively is referred to as Electric and Magnetic Fields or Electromagnetic Fields (EMF). Exposure to high levels of EMF can result in negative impacts to receptors along the transmission line and those residing near the substation. The strength and extent of EMF depends on three things:

- How much current is flowing
- The voltage, and
- Configuration of the wires (e.g. size, wiring phase configuration and separation between the wires).

Key aspects that are likely to negatively impact receptors during the operation phase include electromagnetic interference generated by wind turbines transformers, transmission line and substation transformers when the wind turbines are in operation (i.e. once electrical current flows through the conductors).

Table 10.24 Scope of Electromagnetic Interference Assessment

Phases	Potential Activities	Potential Impacts	Potential Consequences	Receptor
Operation	Long-term operational activities of transmission line, substation, and wind turbines as generating electricity from wind energy.	Electromagnetic fields from transmission line, transformers in substations and wind turbines	Health risks	Receptors along the transmission line (in Ia Pech, Ia Der, Ia Hrung Wards, and Ia Kha Town), and near the substation (in Ia Pech Ward)

10.5.2 Relevant Guidelines and Criteria

10.5.2.1 Vietnamese Regulations

- *Electricity Law* dated 03 December 2004 and the Law on amendment and supplement to the Electricity Law dated 20 November 2012
- *Decree No.14/2014/ND-CP*, dated 26 February 2014 stipulating in detail the implementation of electricity law regarding electricity safety, and
- *QCVN 25:2016/BYT* – National Technical Regulation on Industrial Frequency Electromagnetic Fields – Permissible Exposure Level of Industrial Frequency Electromagnetic Fields in the Workplace.

[229] Vietnam aims to install 1,000 MW of wind power by 2020. Voice of Vietnam, 9 April 2019. Available at https://vov.vn/kinh-te/viet-nam-phan-dau-tong-cong-suat-dien-gio-nam-2020-dat-khoang-1000mw-896030.vov. Accessed on 2 March 2021.

10.5.2.2 International Guidelines

IFC Environmental Health and Safety Guidelines for Electric Power Transmission and Distribution (2007) provides guidelines to manage potential environmental and community health and safety impacts from power construction facilities, including electric and magnetic fields.

As mentioned in the above section, electric fields are normally measured in kilovolts per metre (kV/m), while magnetic fields are defined by magnetic flux density, measured in micro-Tesla (μT) or milli-Gauss (mG). The World Bank Group's (WBG) Environmental, Health and Safety (EHS) Guideline[230] for Power Transmission and Distribution (WBG, 2007) refers to the International Commission on Non-Ionizing Radiation Protection (ICNIRP)[231] [232] for health and safety standards relative to exposure to EMF. The World Health Organization (WHO)[233] refers to ICNIRP EMF standards as short-term and high level exposure limits. At present, ICNIRP limits consider the scientific evidence related to possible health effects from long-term, low level exposure to EMF fields insufficient to justify lowering these quantitative exposure limits. The ICNIRP EMF exposure limits are instantaneous and not averaging and it refers to Basic Restrictions and Reference Levels for both magnetic and electric fields under General Public and Occupational exposure conditions (Table 10.25). Basic Restrictions are the fundamental limits on exposure and are based on the internal electric currents or fields that cause established biological effects in humans. They are impractical to measure. Therefore, Reference Levels of exposure to the external fields, which are simpler to measure, are provided as an alternative means of showing compliance with the Basic Restrictions. The Reference Levels have been conservatively formulated to ensure compliance with the Basic Restrictions. In summary, these limits can be considered as chronic exposure standards; no health risks associated with short-term exposure are expected at these levels.

Table 10.25 Basic Restriction and Reference Levels for Exposure to 50Hz EMF at the Edge of Right of Way (ROW)

Exposure Characteristics	Electric field (kilo volts per meter, kV/m)	Magnetic flux intensity		
		Micro-Tesla (μT)	Milli-Gauss (mG)	Ampere/m (A/m)
Occupational	10 kV/m	1,000 (500 prior to 2010)	10,000 (5,000 prior to 2010)	798 (399 prior to 2010)
General Public	5 kV/m	200 (100 prior to 2010)	2,000 (1,000 prior to 2010)	160 (80 prior to 2010)

10.5.3 Assessment Methodology

The calculation of Electro Magnetic Field (EMF) is one of the factors which must be considered during the design process especially for high voltage transmission lines. This is to determine Right of Way (ROW) of the power line such that there will not be danger for the people and surrounding environment.

An excel based software developed by EEP Portal[234] for the calculation of electromagnetic field (EMF) around transmission and distribution overhead lines was used to calculate EMF for the 110 kV

[230] EHS Guidelines for Power Transmission and Distribution, 30 April 2007.

[231] The ICNIRP Guidelines (2010) for limiting exposure to time-varying electric, magnetic and electromagnetic field (up to 300GHz) (http://www.icnirp.de/PubEMF.htm)

[232] These values represent the ICNIRP occupational exposure limits.

[233] WHO 2007, Extremely Low Frequency Fields – Environmental Health Criteria, Monograph No. 238 March 2007.

[234] http://electrical-engineering-portal.com/download-center/electrical-ms-excel-spreadsheets/emf-td-overhead-lines.

transmission line proposed for the Project. The tool can be used to calculate one or two circuit lines in which ground wires can be incorporated for the EMF calculations. In addition, the tool allows combining and creating examples of power lines where two independent power lines can interact with each other. The EMF calculations applied for this tool uses the analytical approach described in EPRI Red Book "Transmission Line Reference Book", third edition, 2005[235]. In addition, accuracy of these EMF calculations could be checked with other commercial software such as MATLAB or CDEGS (Current Distribution, Electromagnetic Fields, Grounding and Soil Structure Analysis).

10.5.4 Impact Assessment

10.5.4.1 EMF from Overhead 110 kV Transmission Line

Input data

As mentioned in Chapter 2, the proposed transmission line is a 110 kV double-circuit line with support tower and angle towers, coded as D122 – 34, D122 – 37, D122 – 42, N122 – 32A, N122 – 32B, N122 – 32D, N122 – 37A, N122 – 37C, N122 – 28D. Naming conventions are provided in Table 10.26.

Table 10.26 The Meaning of Transmission Tower Code

Code	Explanation
D	Support Tower
N	Angle Tower
1	Voltage level: 110kV
2	Double-circuit
2	Two lightning rods
28, 32, 34, 37, 42	Height of Tower
A,B,C,D	Bearing Level

Source: Manufacturer.

The input data used for setting up the transmission tower and circuit lines is given for Tower N122 – 28D and shown in Table 10.27 and Figure 10.12. As stated by the United States Environmental Protection Agency (US EPA)[236], the greater the distance between receptors and the EMF source, the lower the EMF exposure impact will be. In this case, the shortest tower (N122 – 28D) which has the potential to create the most severe EMF impacts to sensitive receptors due to the shortest distance between the two, is selected as a representative of EMF-related impact for the assessment of worst case scenario.

Table 10.27 Transmission Line Parameters of Tower N122 – 28D

			X [m]	Y [m]	Umax [kV]	I [A]	rA [mm]	d [mm]	n	Ph-seq
Line 1	Circuit 1	L1	-3.5	23.5	121	590	10.8	0	1	1
		L2	-3.5	19.5	121	590	10.8	0	1	2

[235] https://www.academia.edu/36962429/EPRI_AC_Transmission_Line_Reference_Book_200_kV_and_Above_Third_Edition

[236] https://www.epa.gov/radtown/electric-and-magnetic-fields-power-lines

			X [m]	Y [m]	Umax [kV]	I [A]	rA [mm]	d [mm]	n	Ph-seq
		L3	-3.5	15.5	121	590	10.8	0	1	3
		g.w.	-3.5	28	0	0	5.4	0	1	0
		g.w.	3.5	28	0	0	5.4	0	1	0
	Circuit 2	L3	3.5	15.5	121	590	10.8	0	1	3
		L2	3.5	19.5	121	590	10.8	0	1	2
		L1	3.5	23.5	121	590	10.8	0	1	1

X [m] – horizontal length from the middle of the line; Y [m] – height in which wires are suspended; Umax [kV] – maximum permissible line voltage; I [A] – maximum permissible line current (in case of bundle it is; determined for all wires); r_A [mm] – wire radius; d_A [mm] – distance between wires in bundle; n – number of wires in bundle; Ph-seq – phase sequence. 1 – L1, 2 – L2, 3 – L3, 0 – Ground Wire

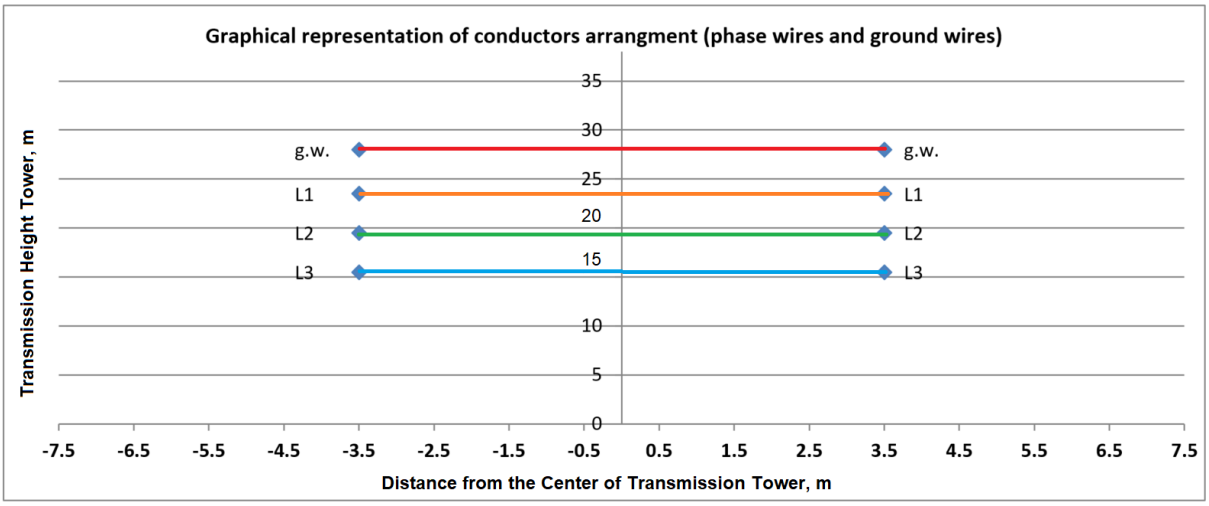


Figure 10.12 Schematic Representation of Transmission Tower with Power Line Arrangement (for Transmission Tower N122 – 28D)

The proposed minimum horizontal free space for the 110 kV double-circuit is 15 m (7.5 m on either side of the transmission tower). The Right of Way (ROW) complies with national requirements in *Decree 14/2014/ND-CP* dated 26 February 2014 stipulating in detail the implementation of electricity law regarding electricity safety. The double circuits wire are to be positioned between 19 – 30 m.

10.5.4.1.1 Potential Impact

EMF can affect human health directly and indirectly. Direct effects result from direct interactions of fields with the body, indirect effects involve interactions with a conduction object where the electric potential of the object is different from that of the body. Exposure to low-frequency electric fields may cause well-defined biological responses, ranging from perception to annoyance, through surface electric-charge effects due to stimulation of central and peripheral nervous tissues and the induction in the retina of phosphines, a perception of faint flickering light in the periphery of the visual field.

10.5.4.1.2 Existing Controls

According to the Feasibility Study Report, the design of transmission tower and transmission line is aligned with applicable regulations, therefore managing the impact to acceptable levels.

10.5.4.1.3 Significance of Impacts

Operation of the Project will result in the formation of EMF along the transmission line and at the substations. Although high-voltage transmission lines do generate higher EMFs, this effect is offset by the fact that the towers are higher, the ROW is wider, and phase cancellation shielding is applied. These measures result in EMF levels being lowered at the edge of the ROW.

Based on the EEP model results, the electric field distribution and magnetic field distribution for the proposed transmission tower calculated at the distance from the transmission line at 1 m above the ground are presented in Figure 10.13 and Figure 10.14, respectively. The maximum electric and magnetic fields are 0.9 kV/m, 3.56 A/m respectively at 1 m above the ground.

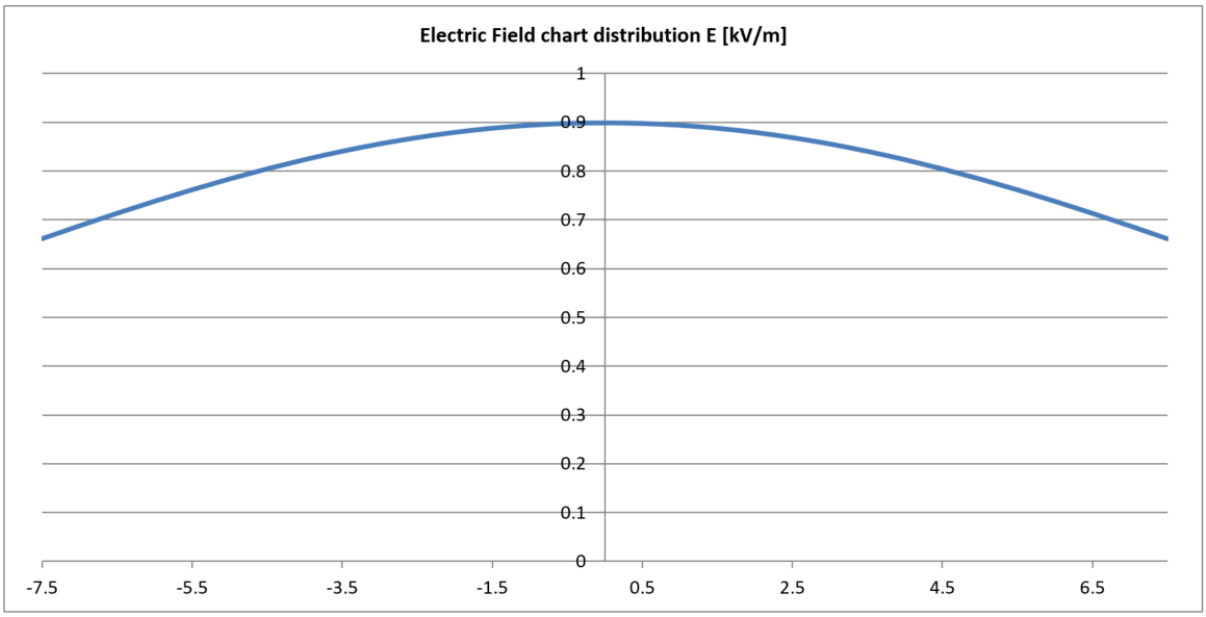


Figure 10.13 Electric Field Distribution for the Proposed Transmission Tower at 1 m above the Ground

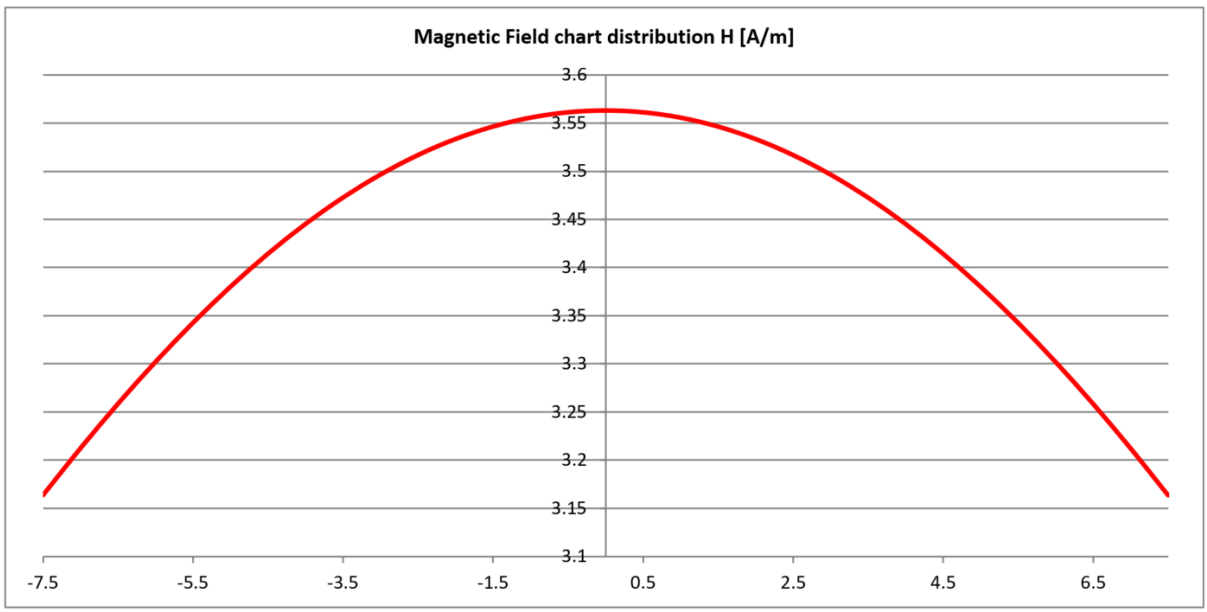


Figure 10.14 Magnetic Field Distribution for the Proposed Transmission Tower at 1m above the Ground

The maximum calculated electric field inside the ROW and magnetic field for Transmission N122 – 28D which is the conservative case does not exceed the recommended ICNIRP occupational exposure limits.

The maximum electric and magnetic fields within the ROW for various transmission towers is shown in Table 10.28. The maximum calculated electric field occurs directly under the conductors and decreases out to the edge of the ROW. The phasing of double circuit that will be used in the proposed transmission line configuration results in cancellation effects for the electric fields, leading to a rapid decrease with distance. As presented in Table 10.28, the calculated maximum electric magnetic fields for various Project's transmission towers are below the allowable public and occupational exposure limits in accordance with ICNRP and *Decree 14/2014/ND-CP*, dated 26 February 2014.

Table 10.28 Maximum Electric and Magnetic Fields for Various Transmission Tower Types at the Edge of the ROW

Tower Type	E_{max} (kV/m)	H_{max}(A/m)
D122 – 34	0.49	1.92
D122 – 37	0.4	1.54
D122 – 42	0.3	1.12
N122 – 32A	0.63	2.47
N122 – 32B	0.63	2.47
N122 – 32D	0.63	2.47
N122 – 37A	0.44	1.68
N122 – 37C	0.44	1.68
N122 – 28D	**0.9**	**3.56**
ICNIRP EMF exposure limits for General public	**5**	**160**
ICNIRP EMF exposure limits for Occupation	**10**	**798**

The EMF calculation results for different tower configuration have shown that at the distance of 7.5 m from the outmost transmission line, the maximum electric field reached 0.9 kV/m and magnetic field gained 3.56 A/m at the hanging height of wire of >28 m while most of human activities occurs at the height below 2m. Additionally, as observed in the satellite image, the 110kV transmission line route has been selected so that its ROW does not overlap the location of any households (the nearest sensitive receptor is approximately 7.5 m from the 110 kV Transmission Line). Hence, the impact magnitude and sensitivity of receptors are assessed as Small and Low, respectively.

The EMF for the proposed 110 kV tower configuration reduces rapidly with distance from the lines. Even though the negative and direct impact may affect sensitive receptors for the duration of operations, the impacts are localized and limited only to within the ROW. As such, the significance of EMF caused by the Project on Human Health is considered to be Negligible (See Table 10.29).

Table 10.29 Assessment of EMF Impact from 110 kV Overhead Transmission Line for the Operation Phase

Impact Nature	Negative	Positive	Neutral

Impact Type	**Direct**		Indirect		Induced
Impact Duration	Temporary	Short-term		**Long-term**	Permanent
Impact Extent	**Local**		Regional		Global
Frequency	The impact frequency is closely related to the operation of the wind farm and substation, and is assumed to be continuous during operation as a worst case.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptor Sensitivity	**Low**		Medium		High
Impact Significance	**Negligible**	Minor		Moderate	Major

10.5.4.1.4 Additional Mitigation Measures

Other additional mitigation measures based on good practice and *Decree No.14/2014/ND-CP* to minimise impacts associated with EMF include:

- Avoid residential buildings, or acquire houses within the ROW, if possible;
- Avoid schools, hospitals, health clinics, and other similar buildings – the Electrolytic Tough Pitch (ETP) alignment avoids these sensitive buildings and maintains at least a 20 m buffer from all schools and health clinics;
- Tower safety features – place warning signs prohibiting climbing on towers and incorporate design elements that prevent climbing of the towers;
- Implement all H&S measures as specified in the regulations including earthling of buildings that are metal clad and directly below the transmission line;
- Conduct regular clearance of the clear zone to ensure the area is safe as required by the regulation;
- Conduct regular checking/ maintenance to ensure the safe condition of the tower and the cable; and
- Emergency contact information – provide signage at each tower with emergency phone numbers.
- Arrange the shielding around the electromagnetic field source at the safety distance as electric fields can be easily shielded by trees, fences, buildings and most other structures. However, magnetic fields are much more difficult to shield than electric fields[237].

10.5.4.1.5 Residual Impacts

The residual impact to occupational and public health from the transmission of power through the proposed 110 kV transmission line is considered to be Negligible.

10.5.4.1.6 Monitoring and Auditing

- The electromagnetic filed should be monitored in the safety corridor of the 110 kV transmission line, at the substation and at the turbine location.
- The EMF monitoring survey should be conducted every 6 months during the operation phases.

[237] https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/safety/understanding-emf-booklet.pdf

- The EMF monitoring results must comply with *Decree No.14/2014/ND-CP*, dated 26 February 2014 on stipulating in detail the implementation of electricity law regarding electricity safety and National Technical Regulation *QCVN 25:2016/BYT* on Industrial Frequency Electromagnetic Fields – Permissible Exposure Level of Industrial Frequency Electromagnetic Fields in the Workplace. Should thresholds be exceeded, further mitigation options should be reviewed and considered.

10.5.4.2 EMF from 22 kV Underground Cable

10.5.4.2.1 Potential Impact

EMF from 22 kV underground transmission line have a similar potential to affect human health as overhead transmission line.

10.5.4.2.2 Existing Controls

There is no existing controls recommended by the Project Owner for this impact.

10.5.4.2.3 Significance of Impact

Based on Feasibility Study, the 22 kV underground cables are low-voltage and are buried directly underground. As stated in Directive 2013/35/EU on Electromagnetic Field[238], EMF emissions will be highly localised in terms of spatial extent as the use of cable insulation is also applied. In addition, although electric fields exist between high voltage conductive cores and earthling amour, EMF is not expected to be emitted by the cable as a result of cable shielding. Hence, the EMF levels expected underground are comparatively small and the predicted magnetic fields are also expected to rapidly decrease both vertically and horizontally. Another study showed that the higher the voltage is, the higher the electric field[239] is. As assessed in the previous section, the EMF-related impact caused by 110 kV transmission line is small, and the EMF-caused impact by 22 kV underground transmission line is much smaller than those predicted for the 110 kV transmission line. Therefore, the magnitude of potential EMF impact from underground cable is expected to be Negligible.

However, the nearest receptor is located at approximately 21m from WTG E29. There is still a potential impact to the nearest receptor within the ROW of wind turbines. Therefore, receptor is considered as Medium.

The EMF-related impact significance of underground transmission line is evaluated as Negligible.

Table 10.30 EMF Impact Assessment from 22 kV Underground Transmission Line for the Operation Phase

Impact Nature	**Negative**		Positive		Neutral
Impact Type	**Direct**		Indirect		Induced
Impact Duration	Temporary	Short-term		**Long-term**	Permanent
Impact Extent	**Local**		Regional		Global
Frequency	The impact frequency is closely related to the operation of the wind farm and substation, and is assumed to be continuous during operation as a worst case.				
Impact Magnitude	Positive	**Negligible**	Small	Medium	Large

238 https://www.gla.ac.uk/media/Media_604615_smxx.pdf

239 https://www.energynetworks.com.au/assets/uploads/emf_handbook_2016_05.pdf

Receptor Sensitivity	Low	**Medium**		High
Impact Significance	**Negligible**	Minor	Moderate	Major

10.5.4.2.4 Additional Mitigation Measures

The following mitigation measures are proposed to manage the impacts of EMF:

- For double circuit lines, it may be possible to arrange the phases to maximise the magnetic field cancellation, and
- Installation of a passive shielding loop can be effective in reducing the magnetic field at a particular point.

10.5.4.2.5 Monitoring and Auditing

- It is proposed that EMF monitoring is carried out by using suitable magnetic and electric field sensors within the first year of operation on a quarterly basis, in accordance with relevant regulations listed in Section 10.5.2. Should thresholds be exceeded, further mitigation options should be review and considered, and
- EMF monitoring will be included as part of the occupational health and safety monitoring program.

10.5.4.3 EMF from 22/110 kV Substation

Substations are part of the electricity supply network that enables the widespread use of electricity for public and industrial use. Inside the substation, there are switches, connections and a transformer. The transformer steps up voltage coming from wind farms and transforms them to the higher voltage of 110kV used by transmission lines. The transformer, is the main unit where EMF will be of similar magnitude as the transmission line; hence it has to be located at a height similar to the transmission line with sufficient buffer applied to minimize occupational and public hazards. EMF from other elements in a substation will be small and standard mitigation methods are available to reduce both electric and magnetic fields generated by them, as described below. EMF levels within the fenced area of a substation depends on the number of transformers used in the substation. However, these EMF levels decrease rapidly with distance from the transformers and other electrical equipment. Most of the time, EMF levels for power transmission line drop to background levels (0.01 – 0.07 kV/m) at a distance of 30 to 60 m[240] from the fenced area.

10.5.4.3.1 Potential Impact

EMF from transformers in substation have a similar potential to affect human health as overhead and underground transmission lines.

10.5.4.3.2 Existing/ In-place Controls

- Equip staffs who come in contact with EMF with PPE and ensure O&M staff can work in different shifts to minimise exposure time to EMF, and
- Provide EMF shielding cover in some places with high level of EMF (especially where the electric field is over 5 kV/m).

[240] https://www.hydroone.com/poweroutagesandsafety_/corporatehealthandsafety_/EMFs/Transmission_Line_EMF_Fields.pdf

10.5.4.3.3 Significance of Impacts

Predicting magnetic field profiles for substations is a complex exercise given the multitude of time varying sources orientated in multiple directions. As a result, the magnetic field profile is highly dependent on the particular circumstances. In order to understand the magnetic field pattern in the proposed substation, modelling performed by Tarmizi et al. (2016) was identified as a suitable proxy for this assessment. Tarmizi et al. modelled magnetic field variability in a substation that had the 400 kV side connected to three loads, a shunt reactance and an autotransformer to step down the voltage to 220 kV. The substation considered by Tarmizi et al. was 280 m long, 140 m wide and the conductors were located at the height of 12m above the ground (on the 400 kV side). Normal operating currents were at frequency of 50Hz for each load. The magnetic field distribution was calculated at the height of 1.7 m where measurements were available for comparison. The computed results for the normal operating currents are presented in Figure 10.15.

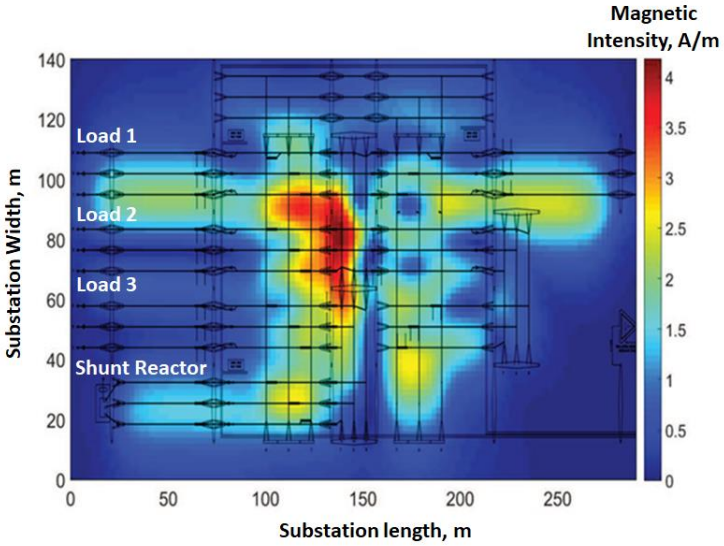


Figure 10.15 Magnetic Field Distribution in the Substation Studied by Tamrizi et al. (2016) for a 400kV Substation (280m long, 140m wide)

Figure 10.15 shows that the predicted highest value of the magnetic field was 4.164A/m located along busbar 1. Under normal operation conditions of the substation, the maximum values of the magnetic field were found to be below public exposure limits proposed by ICNIRP. In addition, modelling showed that the magnetic field decreased rapidly within the perimeter of the substation. However, in a lightning strike scenario, the magnetic field in the substation exceeded the public and the occupational exposure limit set by ICNIRP. The voltages and size of the substation used in the study by Tarmizi et al. were much higher than the proposed substation (voltage of 121 kV; and size up to 80m long by 70m wide) and hence the EMF impact for the Project's substation is expected to be much smaller, and contained within the substation.

Additionally, another study by Grbic et al., (2017)[241] concluded that within two 110kV substations the measured maximum values of electric fields are lower than the low AL (Action Levels) of 10kV/m (i.e. ICNIRP ELF exposure limits for occupational exposure); and the measured maximum values of magnetic flux density are lower than the low AL of 1mT (796 A/m, ICNIRP ELF exposure limits for

[241] Levels of electric and magnetic fields inside 110/X kV substations. Maja Grbic´ ✉, Aleksandar Pavlovic´, Dejan Hrvic´, Branislav Vulevic (24th International Conference & Exhibition on Electricity Distribution (CIRED), 12-15 June 2017). IET Journal.

occupational exposure). ALs are action levels prescribed by Directive 2013/35/EU[242], which states the minimum health and safety requirements regarding the exposure of workers to the risks arising from EMF.

Any negative and direct impacts of EMF from the substation on the occupational health of receptors will however be temporary and localised within the substation. Based on satellite imagery, the nearest sensitive receptor recorded is approximately 100 m far from the substation, outside of the substation's ROW as regulated under *Decree No. 14/2014/ND-CP*. Hence, there is no observed receptors within the ROW of the substation. On this basis impacts of EMF from substation during operation phase are considered Negligible due to Small impact magnitude and Low sensitivity of receptor as shown in Table 10.31.

Table 10.31 Impacts of EMF during Operation Phase from the Substation

Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	**Temporary**	Short-term	Long-term	Permanent	
Impact Extent	**Local**	Regional	Global		
Frequency	The impact frequency is closely related to the operation of the wind farm, and assumed to be continuous during operation as a worst case.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptors Sensitivity	**Low**	Medium	High		
Impact Significance	**Negligible**	Minor	Moderate	Major	

10.5.4.3.4 Additional Mitigation Measures

Some additional mitigation measures could be applied to reduce EMF impacts from substation to human health and to be aligned with *Circular No. 25/2016/TT-BYT* – National Technical Regulation on Industrial Frequency Electromagnetic Fields – Permissible Exposure Level of Industrial Frequency Electromagnetic Fields in the Workplace, as follows:

- Equip staffs who can come close to electromagnetic fields (EMF) with PPE
- Put up warning signs in all high voltage areas
- Organise periodic health check-ups for staff who work in EMF field location
- Provide staff with training on EMF section before performing work
- Consider reallocating sensitive receptors within the ROW (if any) (As observed through the satellite image, there is no sensitive receptors found within the ROW; however, a validation survey should be conducted to identify whether existence of any within the ROW).
- Use ferromagnetic and conductive materials for shielding as a barrier to reduce the field strength at the source; and

[242] Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16(1) of Directive 89/391/ EEC) and repealing Directive 2004/40/EC, Official Journal of the European Union, 29 June 2013 2.

- Limit staff who have health problems such as cardiovascular and congenital diseases from working in areas with EMF.

10.5.4.3.5 Residual Impacts

With appropriate mitigation measures, the occupational and human exposure can be minimized to fall under ICNIRP standards. Therefore the residual impact to occupational and public from the substation is considered to be Negligible.

10.5.4.3.6 Monitoring and Auditing

The regulatory EIA states that the electromagnetic filed should be monitored at the vicinity of the substation. The EMF monitoring survey should be conducted every six months during the operation phase. The EMF monitoring result must comply with *Decree No.14/2014/ND-CP*, dated 26 February 2014 on Stipulating in detail the implementation of electricity law regarding electricity safety and National Technical Regulation *QCVN 25:2016/BYT* on Industrial Frequency Electromagnetic Fields – Permissible Exposure Level of Industrial Frequency Electromagnetic Fields in the Workplace. Should thresholds be exceeded, further mitigation options should be reviewed and considered.

10.5.4.4 EMF from Wind Turbine

10.5.4.4.1 Significance of Impacts

Due to the presence of a step up transformer required to increase the voltage to 22 kV with rated capacity of 1.14 MVA, either in the nacelle of the turbine rotor unit or at some height below it within the wind turbine structure, EMF may be emitted from the WTGs themselves. According to Loren D. Knopper at el.[243], the measured EMF levels within 2 – 3m of the wind turbine were in a range of 0.133 – 0.225 mG equivalent to 0.0105 – 0.0179 A/m even much smaller than the typical household electrical devices[244]. Hence, the EMF emission level are expected to be lower than those of the 110 kV transmission lines.

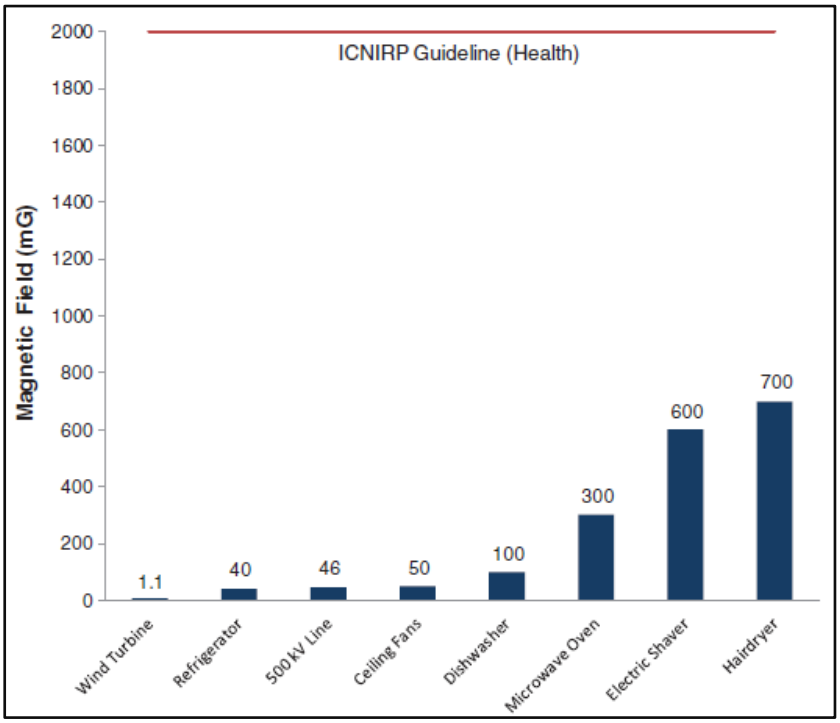
The maximum electric and magnetic fields cannot be assessed quantitatively due to insufficient data of transformer. However, empirical studies of a Canadian 27 MW wind farm by McCallum et al. (2014)[245], collected EMF monitoring data during three operational scenarios to characterize potential EMF exposure: “high wind” (generating power), “low wind” (drawing power from the grid, but not generating power), and “shut off” (neither drawing, nor generating power). Magnetic field levels detected at the base of the turbines under both “high wind” and “low wind” conditions were low (0.9 mG) and rapidly diminished with distance, become indistinguishable from background within 2m of the base. Magnetic field level from this source appeared to have no influence at nearby sensitive receptors located over 1km from the closest turbine. Even though there are some sensitive receptors in the Project area occurring within 1km from the closet wind turbines (the nearest one is approximately 21m away from WTG E29) (see Figure 5.1, any related impacts are anticipated to be Low (Refer to Figure 10.16). The study also concluded that magnetic field levels in the vicinity of wind turbines were lower than those produced by many common household electrical devices (Figure 10.16). Furthermore, when compared

[243] https://www.frontiersin.org/articles/10.3389/fpubh.2014.00063/full#B66

[244] EPA (U.S. Environmental Protection Agency). EMF in Your Environment: Magnetic Field Measurement of Everyday Electrical Devices. Washington, DC: Office of Radiation and Indoor Air, Radiation Studies Division, U.S. Environmental Protection Agency (1992).

[245] McCallum Lindsay, Aslund M.L.W, Knopper L D, Ferguson G M and Ollson C A. 2014. Measuring electromagnetic fields (EMF) around wind turbines in Canada: is there a human health concern? Environmental Health 2014, 13:9

to ICNIRP guidelines, the levels of EMF measured around wind turbines were all well below levels known to cause harm to public and occupational health.



Source: McCallum et al. 2011

Figure 10.16 Magnetic Fields Comparison from Wind Turbines and 500 kV Power Lines with Common Household Electrical Devices

The maximum calculated electric field, which occurs directly under the base of the turbine and decreases outwards, does not exceed the recommended ICNIRP occupational exposure limits. The EMF impact from the wind turbines is considered Negligible**.**

10.5.4.4.2 Additional Mitigation Measures

Whilst no EMF specific additional mitigation and management measures are recommended; to enhance safety, it is recommended to place warning signs prohibiting climbing on wind turbines and incorporating design elements that prevent climbing of the wind turbines. It is also recommended to provide emergency contact information by placing signage at each wind turbine containing emergency phone numbers.

10.5.4.4.3 Residual Impact

The residual impact to occupational and public health from WTG related EMF is considered to be Negligible.

10.5.4.4.4 Monitoring and Auditing

No specific monitoring and auditing is recommended.

10.6 Shadow Flicker Assessment

10.6.1 Scope of Assessment

Within windfarms, shadow flickering can have significant impacts on surrounding communities; this section is included to assess and address this particular impact. The likelihood and duration of the flickering effect usually depends upon a number of factors, including:

- The direction and distance of the property relative to the turbine (the further the observer is from the turbine, the less pronounced the effect will be)
- Turbine height and rotor diameter
- Time of the day and year linked to climatology conditions in the area
- Wind direction (that affect potential wind turbine orientation)
- General weather conditions (presence of cloud cover, fog, humidity reduces the occurrence of shadow flicker as the visibility itself of the turbine is reduced)
- Windows structure (e.g. window direction, window coverings, materials)
- Topography and presence of natural or anthropic barriers (i.e. vegetation, other buildings etc.)

In general, shadow flickering effect occurs during clear sky conditions, when the sun is low on the horizon (sunrise and sunset). Due to the change the angle of elevation of the sun from the horizon changes throughout the year, in addition to the topographical relief, each location experiences and is influenced by the shadow flickering effect phenomenally different. Hence, specific shadow receptors can be disturbed in different periods of the day or year.

The theoretical number of hours of experienced shadow flickering effect each year at a given location can be calculated by utilising modelling packages (e.g. Shadow model in windPRO 3.4) incorporating the sun path, topographical relief over the Project site, and rotor diameter and hub height details of wind turbine model.

10.6.2 Applicable Standards

In August 2015, the World Bank Group published the Environmental, Health and Safety (EHS) Guidelines for Wind Energy246. These are technical reference documents containing examples of good industry practice.

The definition adopted in the EHS guidelines states that 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, workplaces, educational and/or healthcare spaces/facilities) are located nearby, or have a specific orientation to the wind energy facility.

Key points identified in the guidelines include:

- 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, workplaces, learning and/or health care spaces/facilities) are located nearby, or have a specific orientation to the wind energy facility.

246 EHS Guidelines of World Bank Group: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

- 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.
- In case of the possibilities of modifying the wind turbines' locations where neighbouring receptors experience low shadow flicker effects, it is recommended that the predicted duration of shadow flickering effects experienced at a sensitive receptor **should not exceed 30 hours per year and 30 minutes per day on the worst affected days, based on a worst-case scenario**.
- Recommended preventative and mitigation measures to avoid substantial shadow flicker impacts include **systematising wind turbines' arrangement appropriately**, **when feasible**, to avoid shadow flicker being experienced or to meet duration limits of shadow casting continuously on the shadow sensitive receptor, as set out in the paragraph above, or scheduling wind turbines to **shut down at intervals where shadow flicker limits are exceeded**.

10.6.3 Receptors

The Project is divided into two (2) lots known Ia Pech and Ia Pech 2 (Figure 2.4). Both Ia Pech and Ia Pech 2 are located in Ia Pech commune, Ia Grai district, Gia Lai province. The Project area is characterised by agroforestry with a majority of coffee plantations on plateau terrain.

As mentioned in Section 5.3.3, the Area of Influence (AoI) for Shadow Flicker[247] was identified as 10 times rotor diameter (1,640 km). There is a total of 2,303 potential receptors identified within the AoI, as shown in Figure 10.17, which could potentially experience shadow flickering effects.

[247] Area of Influence for Shadow Flicker impact:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf

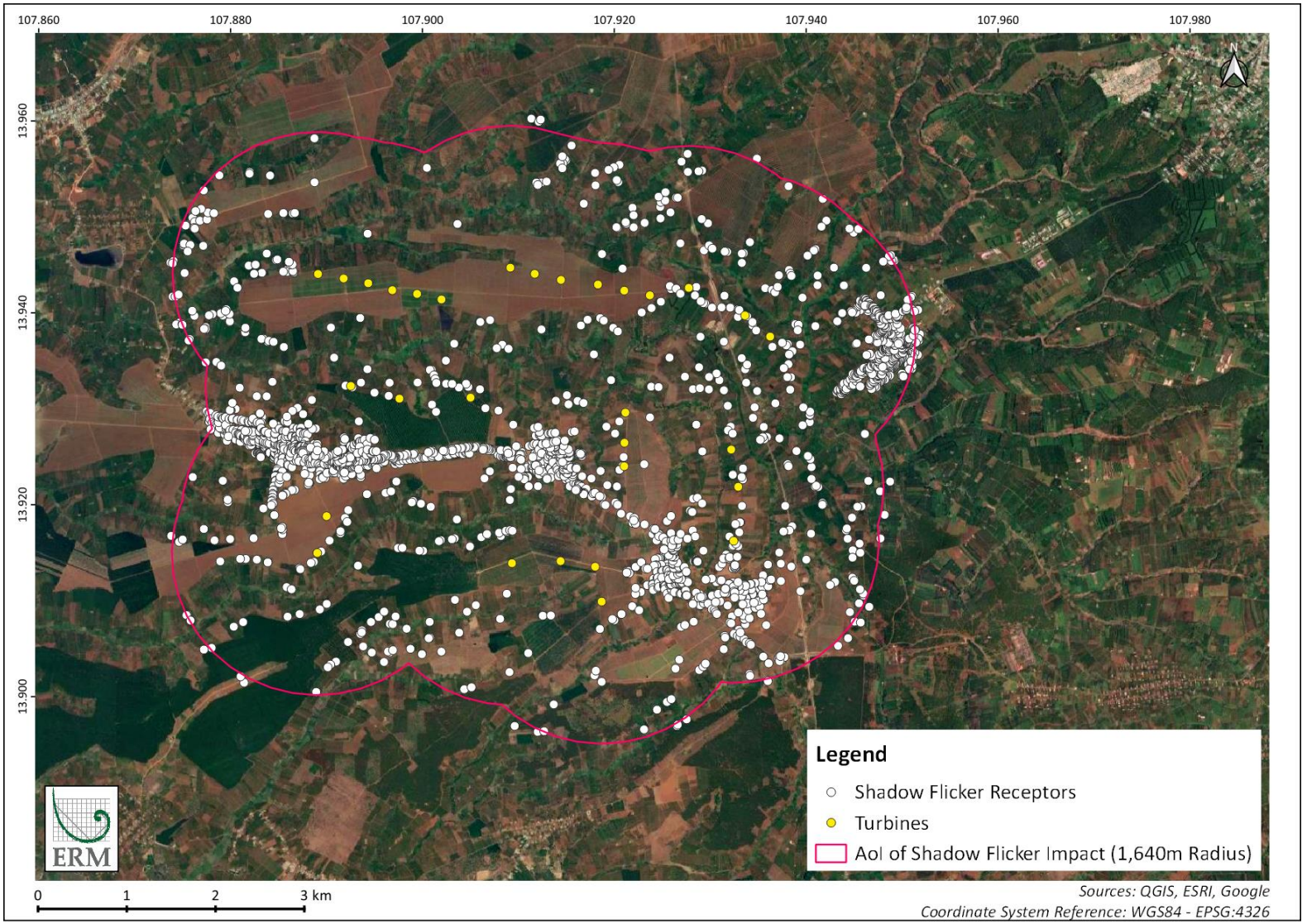

107.860
107.880
107.900
107.920
107.940
107.960
107.980
13.960
13.940
13.920
13.900
Legend
Shadow Flicker Receptors
Turbines
AoI of Shadow Flicker Impact (1,640m Radius)
ERM
0
1
2
3 km
Sources: QGIS, ESRI, Google
Coordinate System Reference: WGS84 - EPSG:4326

Figure 10.17 Shadow Flicker Area of Influence and Locations of Receptors

10.6.4 Shadow Flicker Analysis

This assessment was performed using windPRO 3.5©; a computer software which is widely used by the wind industry. The software package includes a Shadow Flicker Module (SHADOW) that calculates the frequencies and the intervals in which a specific neighbouring receptor or area will be affected by one or more wind turbines.

Two scenarios have been considered and modelled: Worst Case Scenario (maximum potential risk) and Real Case Scenario.

It should be noted that even the assessment was performed under such assumptions is leading to an overestimation in terms of annual number of hours of shadow flicker at a specific location mainly because of the following local conditions have not been included:

- The occurrence of cloud cover has the potential to significantly reduce the number of shadow flickering hours that the observer can be experienced.
- The presence of aerosols in the atmosphere have the ability to influence the flickering duration as the length of the shadow cast by a WTG depends on the angle of direct sunlight hits, which is strictly determined by the amount of fine solid particles/liquid droplets in between the observer and the rotor.
- The analysis has not considered the presence of vegetation or any other physical barriers around a receptor that are able to block the view (at least partially) of the turbine.

Both scenarios have been modelled with a chronological resolution of 1 minute (if shadow flicker is predicted to occur in any 1-minute period, the model records this as 1 minute of shadow flicker).

Independent of the selected scenario, the model calculates outputs according to the principles presented in Figure 10.18.

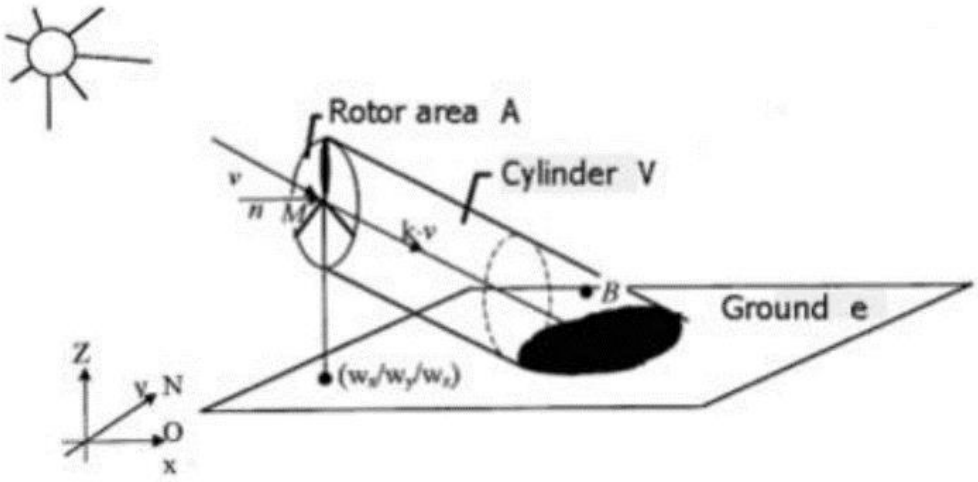


Figure 10.18 Shadow Flickering Theory

10.6.4.1 Worst Case Scenario

The following assumptions have been reflected in the modelling setting for the WC:

- Rotors are always rotating
- The Sun is shining all the day, from sunrise to sunset
- Local topography has been obtained from NASADEM
- No cloud cover or any other meteorological conditions that could potentially reduce visibility and the sunlight have been assumed

- Receptors modelled using greenhouse mode
- No physical barriers are considered

10.6.4.2 Real Case Scenario

The following assumptions have been considered in the modelling setting for Real Case Scenario:

Public data of average daily sunshine hours at Pleiku meteorological station (approximately 8.8 km from the Project) is presented in Table 10.32.

Table 10.32 Average Daily Sunshine Hours at Pleiku Meteorological Station

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
8.34	8.9	8.44	7.89	6.96	5.65	5.58	4.98	5.13	6.14	7.61	8.24

- Local topography has been obtained from NASADEM
- No cloud cover or any other meteorological conditions that could potentially reduce visibility and the sunlight have been assumed
- Receptors modelled using greenhouse mode
- No existing physical barriers have been considered (e.g. trees)
- Rotors are always rotating
- The probability distribution of wind direction according to data recorded at the Project's measurement tower at the height of 96 m from 29 Sep 2019 to 29 Sep 2020, as shown in Table 10.33.

Table 10.33 Propability Distribution of Wind Direction (Project measurement tower at the height of 96 m)

N	NE	E	SE	S	SW	W	NW	Sum
15.47%	33.31%	6.76%	3.27%	7.53%	22.77%	7.65%	3.25%	100%
1355	2918	592	286	660	1994	670	285	8760

10.6.4.3 Summary of Scenario Setting

The following table is reporting the modelling settings adopted per each scenario. However, it should be noted that the performed calculations did not consider the actual location and orientation of windows of the possible affected house, or the screening effects associated with existing, site-specific conditions and obstacles like other buildings, leading to potential of over-estimating the duration of occurrences when shadow flicker might be experienced at a specific location.

Table 10.34 windPRO Shadow Module Inputs (in bold the differences between Worst Case and Real Case Scenario)

	Worst Case Scenario	Real Case Scenario
Wind Turbine location	See Figure 2.4	See Figure 2.4
Rotor diameter and hub height	164 m	164 m
Wind Turbine Operation	Rotors are always rotating	Rotors are always rotating

	Worst Case Scenario	Real Case Scenario
Wind Turbine Visibility	A WTG will be visible if it is visible from any part of the receiver window (greenhouse mode)	A WTG will be visible if it is visible from any part of the receiver window (greenhouse mode)
Window stories dimensions	1m height / 1m large / 1m from the ground floor	1 m height / 1m large / 1m from the ground floor
Cloudiness	Not considered	Not considered
Physical barriers (i.e. vegetation)	Not considered	Not considered
Minimum sun height over horizon for influence	3°	3°
Day step for calculation	1 day	1 day
Time step for calculation	1-minute	1-minute
Shining period	**The sun is always shining all day, from sunrise to sunset**	**The sun is shining as per available local sunshine data (Pleiku meteorological station)**
Height contour	NASADEM	NASADEM
Eye Height	1.5 m	1.5 m

10.6.4.4 Receptors

All receptors in both scenarios, i.e. dwellings/groups of dwellings within the AoI, have been assessed taking into account the following characteristics:

- Single storey building. Therefore, shadow flicker has been calculated at a height of 1 m (equivalent to the ground floor windows).
- Slope of the window has been set to 90°.
- The identified receptors are simulated as fixed points with the 360° viewpoint which represented an unrealistic scenario as real windows would only face a particular direction[248].

10.6.4.5 Modelling Results

10.6.4.5.1 Worst Case Scenario

As presented above, WC Scenario has been modelled using SHADOW module of windPRO to identify the receptors potentially affected by the flickering. The project area is characterised by the presence of receptors in Ia Grai district.

Modelling outputs predicted the following shadow flickering durations at receptors:

- 485 receptors which experience greater than 30 hours per year
- 585 receptors which experience greater than 30 minutes per day
- 459 receptors which experience greater than 30 hours per year and 30 minutes per day. These receptors were considered as impacted according to IFC EHS Guidelines for Wind Energy.

[248] Worst Case Scenario in windPRO 3.5 software based on EHS Guidelines for Wind Energy

Although modelling of WC Scenario resulted in a potential of 459 impacted receptors out of 2,303 mapped ones (around 19.93% and within the impacted zone in Figure 10.20). The key potentially impacted areas are mainly located in dense residential areas:

- Plei O Gia village, Ia Pech commune within Ia Pech 2
- Plei Nang Giang village, Ia Pech commune within Ia Pech 2
- Sparse receptors within Ia Pech commune

IFC thresholds have been exceeded for both parameters: hours/year and min/day at 785 receivers with the most impacted receptor (No.2111) experiencing approximately 796 hours per year with a maximum of 337 minutes per shadow day.

The following figures present the distribution of areas where flickering is calculated according to the WC Scenario (Figure 10.21 and Figure 10.22). A summary of results for all receptors assessed under WC Scenario is attached in Appendix L.

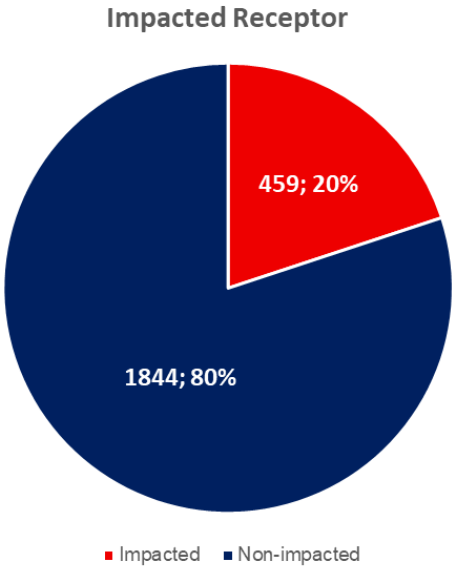


Figure 10.19 Impacted Receptors

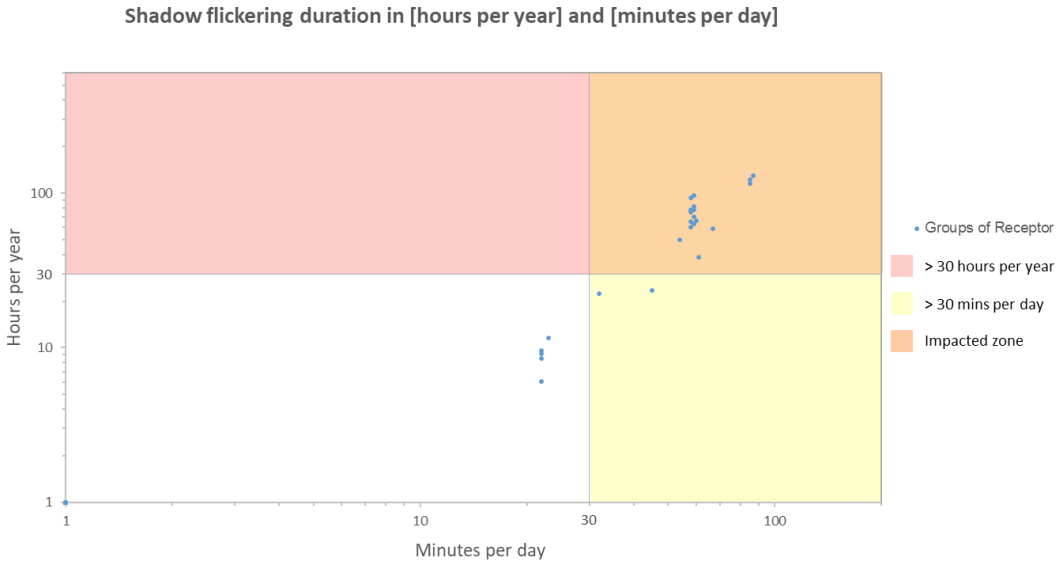


Figure 10.20 Go Zone Plot Showing the Shadow Flickering of Groups of Receptor in [hours per year] and [minutes per day]

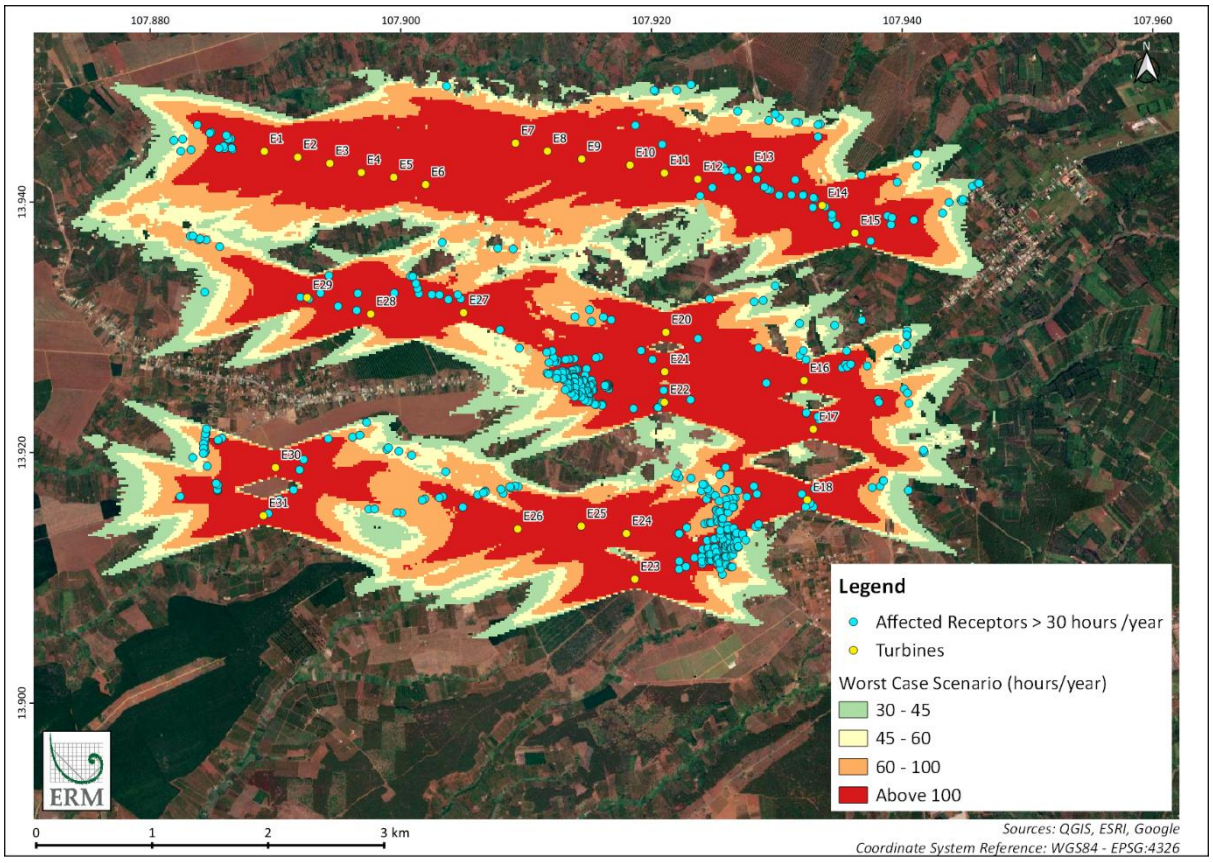


Figure 10.21 Map of Predicted Shadow Flicker for the Project (hours/year) – Worst Case Scenario

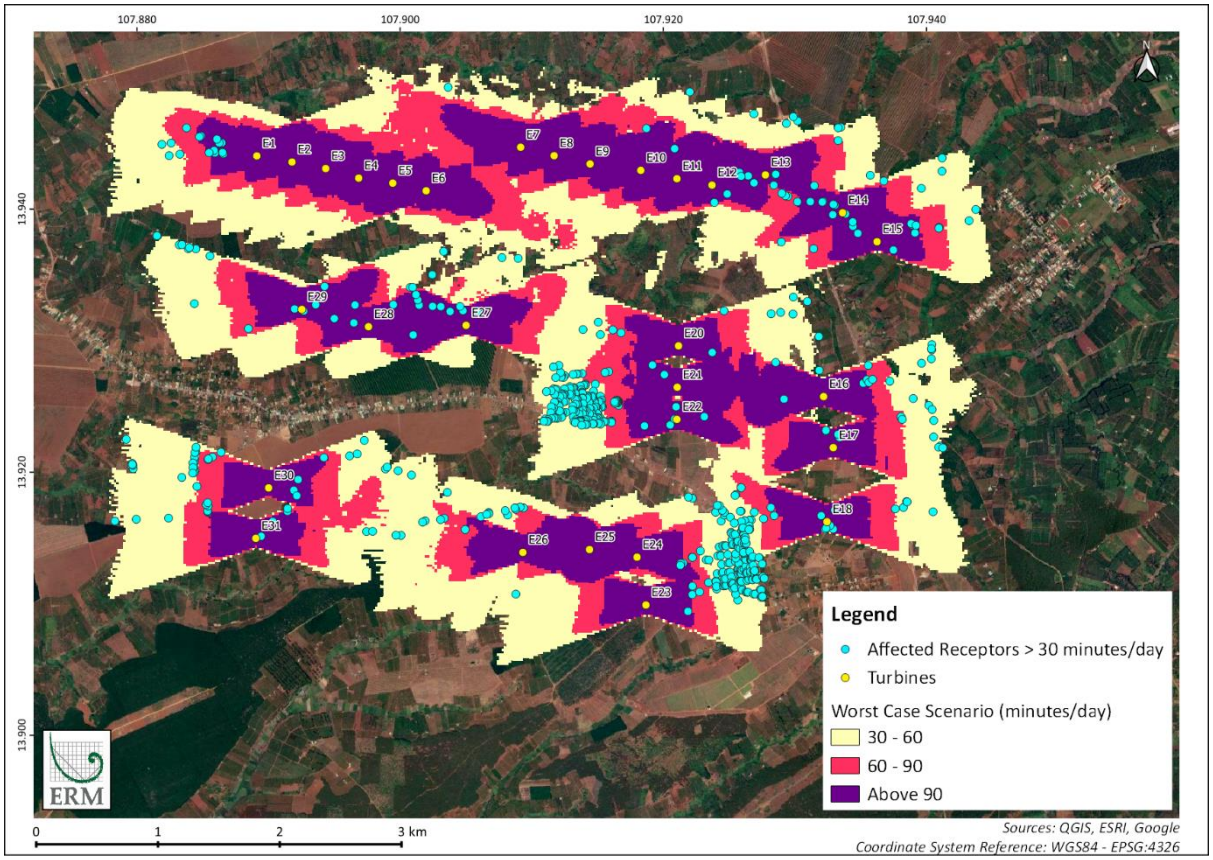


Figure 10.22 Map of Predicted Shadow Flicker for the Project (minutes/day) – Worst Case Scenario

10.6.4.5.2 Real Case Scenario

In order to assess the occurrence of shadow flickering, taking into account local conditions, a second scenario has been modelled. The predicted shadow flicker durations at receptors are presented in Figure 10.24.

Modelling confirmed that, with input of local conditions (i.e. wind directions and average daily sunshine hours), the number of impacted receptors have been reduced to 120 instead of 485 (by approximately 75.3%). In addition, most of the impacted receptors sparsely distributed. For further details on the modelling results, please refer to Appendix M.

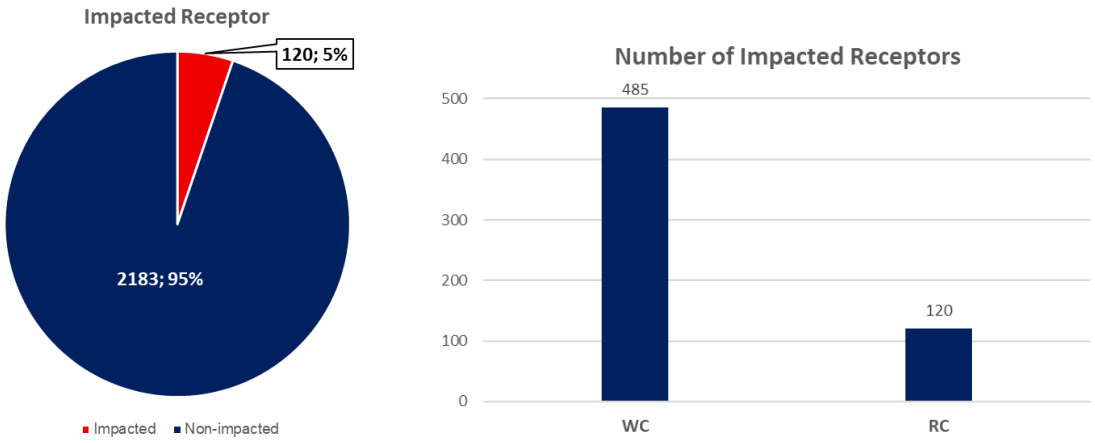


Figure 10.23 Impacted Groups of Receptors in Real Case Scenario and Comparison of Number of Impacted Groups of Receptors between Worst Case and Real Case Scenarios

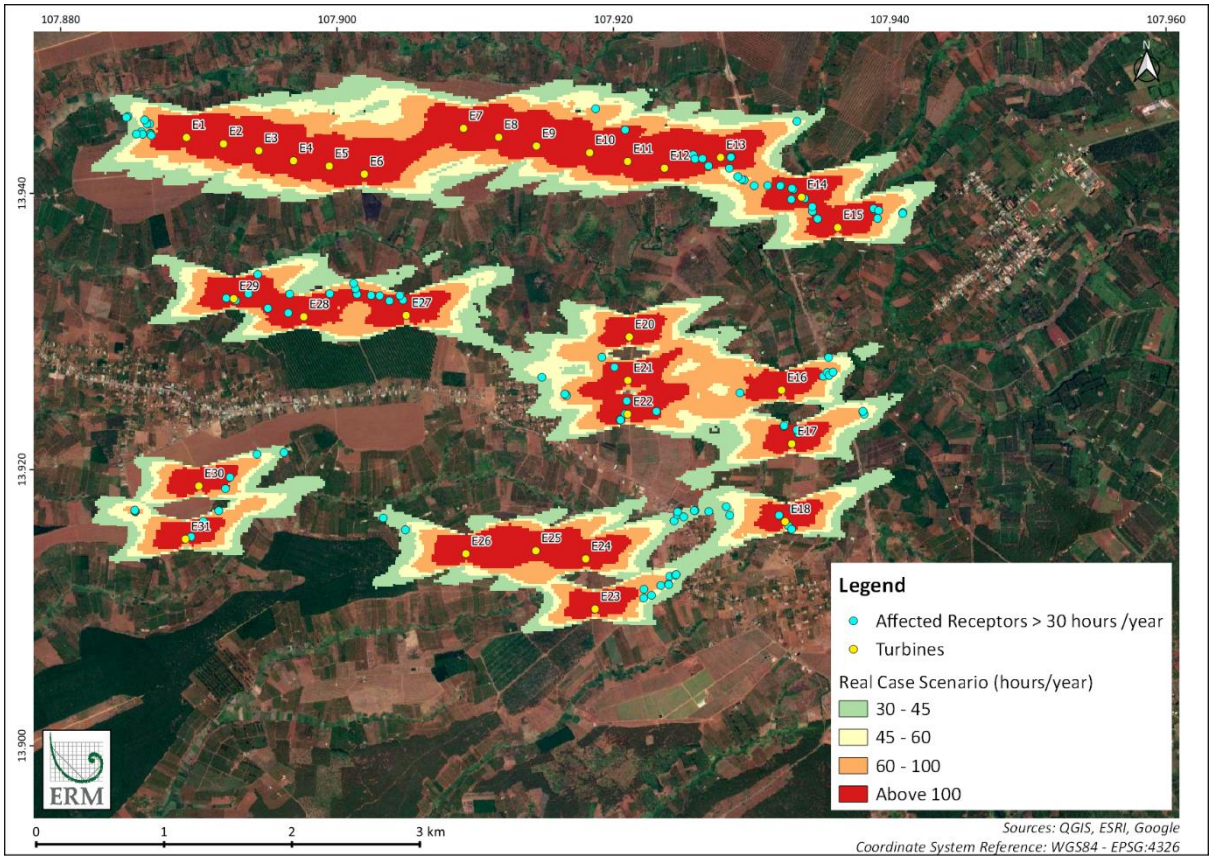


Figure 10.24 Map of Predicted Shadow Flicker for the Project (hours/year) – Real Case Scenario

10.6.5 Impact Assessment

10.6.5.1 Potential Impacts

Impact pathways of shadow flicker caused by wind turbines on human health are still under debate. Some studies suggest that flicker from turbines pose a potential risk of inducing photosensitive seizures (Harding et al, 2008; Smedley et al., 2010). However, in 2011, the UK Department of Energy and Climate Change concluded in their Update Shadow Flicker Evidence Base Brinckerhoff, 2011 report

that “on health effects and nuisance of the shadow flicker effect, it is considered that the frequency of the flickering caused by the wind turbine rotation is such that it should not cause a significant risk to health”. Despite such conclusions, other reports state that although shadow flicker from wind turbines is unlikely to lead to a risk of photo-induced epilepsy, the potential for annoyance and disturbance is still present and may lead to increased stress (Cope et al., 2009; Minnesota Department of Health, 2009; National Research Council, 2007).

10.6.5.2 Existing/ In-place Control

There are no existing controls in the regulatory EIA report.

10.6.5.3 Significance of Impact

The shadow flickering assessment has considered two scenarios as previously mentioned: a worst-case scenario and a more realistic one, embedding local meteorological conditions. In both scenarios, even though the amount of receptors in the RC Scenario had been significantly reduced comparing to WC scenario (120 versus 459 receptors), receptors under both scenarios have the potential to be impacted by shadow flickering exceeding the international maximum permissible limits. It should be noted that:

- Based on available satellite imagery, the potential impacted dwellings located within the areas of influence (1,640 m radius) are characterised by both dense residential areas and scattered receptors distributed in Cu Pong and Cu Ne communes. In those dense residential areas, buildings density could play the role of man-made barriers, likely to prevent shadow flicker effect. By contrast, scattered receptors are more likely to be affected by shadow flicker unless there is natural barrier surrounding them.
- It should be considered that receptors have been identified by the use of satellite imagery only; however they have not been confirmed through a dedicated site visit because of travelling restrictions imposed by the government due to the COVID situation in Vietnam. It is possible that some of the receptors identified using satellite imagery may not be dwellings where people permanently resided or the presence of man-made or natural physical barriers on site may mitigate the impact; ERM suggests that fieldwork is performed (as soon as the government allows it) to verify the real number of affected households by shadow flickering.
- The performed calculations do not take into account the actual location and orientation of windows or the screening effects associated with existing, site-specific conditions and physical barriers like other buildings which potentially could be leading to an overestimate of the duration of occurrences when shadow flicker might be experienced at a specific location.

Shadow flicker impacts are expected to be negative, direct and long-term during the Operation Phase of the Project. The scale of impact is limited to the extent of the Shadow Flicker AoI within which receptors present. Impact magnitude varies based on distance of receptors from the WTGs and their orientations. However, according to the worst case scenario, there were 459 out of 2,303 identified receptors based on satellite imagery considered impacted. Therefore, impact magnitude is considered as Medium.

As aforementioned in Section 10.6.5.1, on health effects and nuisance of the shadow flicker effect, it is considered that the frequency of the flickering caused by the wind turbine rotation is such that it should not cause a significant risk to health. Hence, sensitivity of receptor is considered as Medium. Overall, significance of impact is considered as Moderate.

Table 10.35 Impacts of Shadow Flickering

Impact	Shadow flickering impacts during Operation Phase				
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
Impact Extent	**Local**	Regional	Global		
Impact Frequency	The shadow flickering impact could potentially occur up to 12 hours/day				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptors Sensitivity	Low	**Medium**	High		
Significance	Negligible	Minor	**Moderate**	Major	
	The significance is **Moderate**				

10.6.5.4 Additional Mitigation Measures

Shadow flicker is considered an environmental “nuisance”, rather than a human health risk, as there is insufficient evidence to indicate that shadow flicker may results in adverse health conditions. Thus, the hierarchy of mitigation measures are identified to address issues regarding cause and effect of shadow flicker from wind turbines.

- **Confirm presence of receptors** – confirm presence of sensitive receptors, for which modelling indicated that shadow flicker could exceed 30 hours per year and 30 minutes per day, by conducting an in situ validation survey.
- **Grievance Monitoring and Reporting** – Implementing a process to assess the in situ occurrence of shadow flickering at local identified receptors (120, based on satellite imagery assessment; exact number to be confirmed based on in situ validation survey) in order to eliminate the phenomena. In case of dwellings experienced flickering shadow, a detailed grievance mechanism should be developed and the local community made aware of the existence of such grievance mechanism so they can submit complaints regarding nuisances related to shadow flicker from turbines. Ensuring close monitoring through engagement with local stakeholders including informing affected communities during the operational phase where there are predicted impacts from shadow flicker.
- **Visual Screening (Natural)** – Ascertaining the extent of existing natural visual screening in place where receptors have been confirmed to occur in situ. If no natural screening is identified, the occurrence of shadow flickering during operation could be investigated further, and if confirmed, natural screening options will be considered (e.g. planting of trees with large canopy and grow hedges surrounding dwellings to increase shielding) to minimize the effect to those dwellings that have windows facing the turbines with neither natural nor man-made barriers.
- **Visual Screening (Architectural/ Structural)** – If grievances are received linked to shadow flicker or if natural visual screening at potential sensitive receptors is found to be insufficient to mitigate the shadow flickering effect, further assessments should be performed and additional mitigation actions applied, such as installation of blinds, window shades, window tinting, awnings or fences at affected receptors, which will help to minimize the effect of shadow flicker.
- **Operational Curtailment** – In case of shadow flicker related grievances are logged and/or after visual screening has been implemented, wind turbines operations will be further investigated to determine which specific wind turbine causes shadow flicker in exceedance of 30 hours/year and 30 minutes/day on affected receptors. According to the Shadow Calendar Results (see Appendix N), all turbines are predicted to cast in the period of 6:30AM – 7:30AM and 4:30PM – 5:30PM at the majority of impacted receptors under WC scenario conditions. Based on these results,

operational curtailment (i.e. stopping operation of relevant WTGs during casting periods) could be applied to reduce the effect on the impacted receptors. This implementation of such mitigation measures will be confirmed through the conducting of additional fieldwork.

- **Relocation** – after having concluded the additional suggested fieldwork, if visual screening (both natural and architectural/ structural) and stopping operation of wind turbines fail to mitigate shadow flicker effect at impacted receptors, relocation of affected dwellings may be considered; this would require engagement with the local community by the Client for prior consent. Any relocation process will have to be performed in accordance with AIIB ESS2 related to resettlement. Prior to any actions, the implementation of community disclosure is highly recommended to clarify the significance of impact. However, it is important to understand that prior this action:
  - The Project Owner would need to conduct a detailed census or inventory of loss of all impacted receptors by the worst case scenario and set out a “cut-off’ date to avoid any new residential settlements within the impact zone after the date. In case the Project does not have enough resources, a communication channel via local authorities especially villages’ heads should be established to ensure that all impacted receptors are well-informed about the impacts, cut-off date and grievance process.
  - The Project Owner shall also strengthen the cooperation with local authorities to continuously implement local awareness raising of the Project impacts, especially shadow flickering effect, to local people, and
  - For any new settlements implemented after the cut-off date and within the impacted zone, if their settlement lands are legally classified as residential lands, the Project Owner, with the support from local authorities, shall notify them about the shadow flickering issue and provide support to such households, including building structure or surrounding environment design including natural and artificial barriers.

10.6.5.5 Residual Impacts

Residual impact following the implementation of these mitigation measures is still considered to be Moderate given the high density of potentially impacted population within and near the Project’s area. However, given the assessment is performed against WC Scenario according to IFC standards, the the impact significance is considered Minor considering the implementation and efficiency of the mitigation measures listed as well as local meteorological conditions.

10.6.5.6 Monitoring and Audit

Additional monitoring measures will be identified and implemented in accordance with the outcomes of grievance mechanism in place related to shadow flickering issue.

11. BIODIVERSITY IMPACT ASSESSMENT

In accordance with IFC PS1 and PS6, the objectives of the biodiversity impact assessment are to identify and quantify the potential Project impacts on biodiversity; design measures to avoid, minimise or mitigate potential adverse impacts; and identify likely residual impacts. The literature review and baseline studies conducted to identify relevant values have been reported in Chapter 8 . This section includes:

- Impact assessment (IA) of the Project aspects with potential to result in direct and indirect adverse impacts on biodiversity values, focussing on habitats and threatened species;
- Development of mitigation measures to avoid and minimise potential adverse impacts on biodiversity, with priority given to impacts on features with significant biodiversity value; and
- Determination of residual impacts post-mitigation. In the event significant residual impacts are predicted to occur then additional mitigation measures are developed to avoid and minimise such effects, with biodiversity offsets considered as a last option in accordance with good practice mitigation hierarchy.

11.1 Scoping of Likely Impacts to Biodiversity Values

Table 11.1 defines the aspects of the Project that have the potential to impact on biodiversity values during different phases. These impacts to biodiversity are consistent with those identified in IFC PS6 and IFC EHS Guidelines for Wind Energy (IFC, 2015), and relate to the Project activities that have been described for all phases of the Project (see Section 2.5). These aspects may occur for the duration of the project, or may only be relevant to a defined period of time (e.g. if construction areas are rehabilitated around the final Project footprint). It is acknowledged that the decommissioning phase is scoped out from the ESIA as there are no plans developed yet. Decommissioning is likely to have similar short term effects to those related to construction. These will include noise and disturbance associated with dismantling of towers and haulage for removal of materials, the detailed plans for which would be developed and assessed at a later stage if required.

Table 11.1 Scoping of Potential Impacts to Biodiversity Values

Impacts	Source of impacts
Construction	
Habitat conversion and degradation	■ Loss of habitats due to footprint of short- and long-termed land acquisition. ■ Reduction in quality of habitats due to (i) land clearance, (ii) discharge of waste, wastewater and dust and (iii) introduction and/or spreading of alien/invasive species.
Disturbance to fauna	■ Interruptions or changes to fauna behaviours caused by noise, light, vibration and visual disturbances.
Fauna mortalities	■ Fauna mortalities due to vehicle strikes, poaching and hunting and clearance of nests.
Operation	
Habitat conversion and degradation	■ Loss of habitats due to footprint of long-termed land acquisition. ■ Reduction in quality of habitats due to introduction and/or spreading of alien/invasive species and increasing edge effects.

Impacts	Source of impacts
Barriers and fragmentation effects	■ Fauna movements (e.g. daily commute between roosting and foraging sites, migratory patterns) are reduced/ hindered due to Project components
Disturbance to fauna	■ Interruptions or changes to fauna behaviours and displacement of species associated with presence and operation of infrastructure
Mortalities of birds and bats	■ Mortality of birds and bats due to potential flight into the Rotor Swept Zone (RSZ) of the wind turbines. ■ Mortality of birds due to electrocution on the transmission line

11.2 Impact Assessment Criteria

In order to assess the significance of impacts due to the Project before and after mitigation, IA matrices have been used to evaluate the severity of impacts to habitats (Table 11.2) and species (Table 11.3). The matrices take into consideration the sensitivity of receptors and the magnitude of effects caused by the Project.

Table 11.2 Habitat Impact Assessment – Significance Criteria

Habitat Sensitivity/Value		Magnitude of Effect			
		Negligible	Small	Medium	Large
Low	Habitats with no or local designation/ recognition; habitats of significance for species of Least Concern; habitats which are common and widespread within the region.	Negligible	Negligible	Minor	Moderate
Medium	Habitats within nationally designated or recognised areas; habitats of significant importance to globally Vulnerable, Near Threatened or Data Deficient species; habitats of significant importance for nationally restricted range species; habitats supporting nationally significant concentrations of migratory species and/or congregatory species; nationally threatened or unique ecosystems.	Negligible	Minor	Moderate	Major
High	Habitats within internationally designated or recognised areas; habitats of importance to globally Critically Endangered or Endangered species; habitats of importance to endemic and/or globally restricted-range species; habitats supporting globally significant concentrations of migratory species and/ or congregatory species; highly threatened and/or unique ecosystems, areas associated with key evolutionary processes.	Negligible	Moderate	Major	Critical

Magnitude of Effect Definition	
Negligible	Effect is within the normal range of natural variation
Small	Affects only a small area of habitat, but without the loss of viability/function of the habitat

Habitat Sensitivity/Value		Magnitude of Effect			
		Negligible	Small	Medium	Large
Medium	Affects a sufficient proportion of the habitat that the viability/function of part of the habitat or the entire habitat is reduced, but does not threaten the long-term viability of the habitat or species dependent on it.				
Large	Affects the entire habitat or a significant proportion of the habitat to the extent that the viability/function of the entire habitat is reduced and the long-term viability of the habitat and the species dependent on it are threatened.				

Table 11.3 Species Impact Assessment – Significance Criteria

Habitat Sensitivity/Value		Magnitude of Effect			
		Negligible	Small	Medium	Large
Low	Species which are included on the IUCN Red List of Threatened Species as Least Concern (LC).	Negligible	Negligible	Minor	Moderate
Medium	Species included on the IUCN Red List of Threatened Species as Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD). Species protected under national legislation. Nationally restricted range species. Nationally-important migratory or congregatory species.	Negligible	Minor	Moderate	Major
High	Species included on the IUCN Red List of Threatened Species as Critically Endangered (CR) or Endangered (EN). Species having a globally Restricted Range (i.e. terrestrial vertebrates and fauna having EOO less than 50,000 km^2 and marine species less than 100,000 km^2). Internationally important migratory or congregatory species.	Negligible	Moderate	Major	Critical

Magnitude of Effect Definition	
Negligible	Effect is within the normal range of variation for the population of the species.
Small	Affects a small proportion of a population, but does not substantially affect other species dependent on it, or the populations of the species itself
Medium	Affects 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.
Large	Affects an entire population or species at sufficient scale to cause a substantial decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) may not return that population or species, or any population or species dependent upon it, to its former level within several generations, or when there is no possibility of recovery.

11.3 Existing Mitigation Measures

The FS developed by the Project owner have developed some mitigation measures for potential impacts to biodiversity during construction and operation phases (see Table 11.4).

Table 11.4 Existing Biodiversity Mitigation Measures

Impacts	Existing mitigation measures
Habitat loss	*During consturction*: ■ Land clearance will only take place within the boundary consented by governmental authorities. There are no mitigation measures for habitat loss planned during operation.
Disturbance and Displacement of Terrestrial Species	*During construction*: ■ Operation of heavy-duty construction machinery will only occur during day time. *During operation:* ■ Conduct regular maintenance to ensure noise levels meet national standards.
Degradation of habitats	*During construction:* **Dust** ■ All transportation vehicles, machinery and equipment used for construction activities shall be certified by the Vietnam Registry Department. Avoid using old vehicles or equipment which do not meet present emission requirements ■ Enhancing water sprinkling as transportation, excavation, levelling, and compaction during drying season (2 times per day). Avoid overloaded transportation and travelling at night and peak hours ■ A canvas should be used to cover the truck compartment while travelling to avoid construction material (sand, stone, cement, and brick) spillage to the roads ■ Construction location shall be fenced and isolated from the surrounding areas to avoid dust and debris released to the environment. **Wastewater** ■ Arrange all working staff at the construction site to stay in rented local houses and utilise in-place toilets. ■ Contractors working for the Project shall equip portable toilets and domestic bins serving the worker's demand at the Project's locations including clearing, levelling, and backfilling areas ■ The repairing and maintenance of transportation vehicles shall be conducted at the garage in order to not release oil and grease and wastewater from car washing to the surrounding environment ■ Drainage systems are to be constructed in the construction areas. Run-off water (mainly rain water) will be collected by internal drainage system and then released into the environment by the inclination of the terrain. Regularly check and clean the drainage system to avoid blockage of soil, debris, and spoil **Solid-waste** ■ Domestic waste from the rented local houses for workers will be collected and transported to the local landfill site.

Impacts	Existing mitigation measures
	■ Construction waste shall be stored at a temporarily designated area to avoid being waterlogged and polluting to the surrounding environment ■ Construction waste materials shall be collected, classified and transported for proper treatment by licensed agency in accordance to Article 5, 6, and 7 of *Circular No. 08/2017/TT-BXD* on Construction Solid Waste Management dated 16 May 2017 by the Ministry of Construction ■ Reuse and recycle construction materials such as plank or timber pillar to compact or strengthen the low terrain, and ■ Spoil materials such as soil, stone, brick, etc. shall be properly collected and treated by the Project's owner.
Mortality of fauna	*During construction and operation:* ■ Hunting and poaching will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project

11.4 Impact Assessment

Some construction of project components (see Table 2.5) has occurred prior to the writing of the baseline and impact assessment chapters of this ESIA. During the biodiversity baseline collection, construction was still on-going; however, there were no construction activities along any of the sampling transects and in the vicinity of the selected vantage points. For the purpose of this impact assessment, impacts are assessed on the basis of the Project site being in pre-construction state. Where there is a potential change in baseline conditions due to construction, habitat and species likely to be present are inferred from the undisturbed areas surveyed.

11.4.1 Loss of Terrestrial Habitat

11.4.1.1 Significance of Impacts

11.4.1.1.1 Habitats

Based on the outcomes of the geospatial assessment undertaken to define the presence and extent of natural/modified habitat, the Project area is wholly characterized by modified habitat (see Table 8.14).

According to Table 2.6, the total area required to develop the Project represents 59.79 ha (including both long-term and short-term land use, totalling 30.94 ha and 28.85 ha respectively). Based on the remote sensing analysis conducted in Section 8.2.2.2.1, the Project footprint is only associated with modified habitats that are mostly barren land and sparse vegetation (see Figure 8.12 and Figure 8.13). The sensitivity of the modified habitats is therefore regarded as Low.

According to Table 12.6, about 19.2 ha of plantation/agricultural land (mainly coffee and rubber plantations) and 0.27 ha of built-up land (residential and public land) have already been acquired for the Project. The acquired plantation land is a relatively small area (0.8%) in comparison to the area of plantation available (2,396.35 ha) within the Project area and transmission line vicinities as identified via remote sensing (see Table 8.8). In addition, mitigation measures that the Project owner plans to apply, as outlined in Table 11.4 are considered effective to reduce the impacts of land clearance. Therefore, magnitude of impact of habitat loss is considered to be Small and the significance of impacts of land clearance on habitats is considered Negligible.

Table 11.5 Summary of Impact Assessment of Habitat Loss on Terrestrial Habitats

Impact Nature	**Negative**		**Positive**		**Neutral**
Impact Type	**Direct**		Indirect		Induced
Impact Duration	Temporary	**Short-term**		**Long-term**	Permanent
Impact Extent	**Local**		Regional		International
Frequency	The impact is continuous within its duration				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptor Sensitivity	**Low**		Medium		High
Impact Significance	**Negligible**	Minor		Moderate	Major

11.4.1.1.2 Species

Species of relative conservation concern found during field surveys comprised the Red-breasted Parakeet (IUCN NT; VRDB NE), Northern pig-tailed Macaque (IUCN VU; VRDB VU), Chinese Water Dragon (IUCN VU; VRDB VU), Tokay Gecko (IUCN LC; VRDB VU) and *Dipterocarpus obtusifolius* (IUCN NT; VRDB NE). Due to the conservation status of these species (VU), the receptor sensitivity is considered to be Medium.

Apart from these species, another 23 potential endangered species could occur in the Project area as recorded from interviews with local people and desktop review, although the presence of these could not be confirmed via field surveys. Of those species, the Smooth-coated Otter (IUCN VU; VRDB EN), Asian Small-clawed Otter (IUCN VU; VRDB VU), Stump-tailed Macaque (IUCN VU; VRDB VU), Pygmy Slow Loris (IUCN EN; VRDB EN), Bengal Slow Loris (IUCN EN; VRDB VU) and Greater Hog Badger (IUCN VU; VRDB NE) are more likely to occur in the Project area; however, any populations persisting in the Project area are expected to be small due to the high level of human activity and the sub-optimal, fragmented habitats in the Project which are not favourable to support significant populations of conservation significance species.

Fauna experience loss of habitats in two forms: direct loss due to Project footprint and indirect habitat loss due to displacement from Project aspects, including noise emissions or visual disturbance. Meawhile, the only type of habitat loss that flora species will experience is direct loss. The NT *Dipterocarpus obtusifolius* was found at sample plot 7 (see Figure 8.11), which is within the footprint of turbines.

Fauna can experience both direct and indirect habitat loss. Species of conservation concern found in the baseline surveys are most likely to occur near surface water (accounting for 0.12% of the Project area) and sparse and medium vegetated areas that are associated with plantations/agricultural land (accounting for a total of 76.81% of Project area). According to the remote sensing in Section 8.2.2.2.1, the Project footprint mostly covers plantations/agricultural land, and does not overlap any surface water.

Different from direct loss, indirect loss is harder to quantify as it is not restricted to the clearance footprint and is species-specific. Little has been studied on the distance by which fauna is displaced during the construction phase of wind turbines. The displacement of fauna during construction is considered to be mostly associated with noise. Kwon et al. (2018) modelled the level of noise emitted from different construction machinery at different distances in urban areas, based on reference noise level at 15m taken from various international standards. They predicted that at 216m, most noise levels from various construction machinery have been attenuated to below 56 dBA, except for drilling machine (62.34 dBA) and pile driver (64.90 dBA). According to the noise baseline (refer to Section 7.3.3), the average background noise within the Project area is about 42 dBA both during day-time and night-time. As a

general rule of thumb, noise attenuates by 6 dB per doubling of distance[249]. Fauna species may therefore be impacted by noise emissions within 1 km from the construction site; beyond 1 km, noise level from construction is expected to have attenuated to or below background noise level.

During operation, fauna may also avoid the vicinity of Project components, which would result in indirect habitat loss. Studies have found that non-volant fauna do not show significant avoidance behaviours to wind farms (Agha et al. 2015; Łopucki, Klich & Gielarek 2017; Łopucki & Mróz 2016; Thaker, Amod & Harshal 2018), while avoidance behaviour has been demonstrated in some specific avian species (Barré et al. 2018; Bayne, Habib & Boutin 2008; Marques et al. 2020; Masden et al. 2009a; Thaker, Amod & Harshal 2018). The effects of displacement could be up to 650m for passerine birds (Bayne, Habib & Boutin 2008) and 1,000m for bats (Barré et al. 2018), although for bats the avoidance behaviour remains inconclusive. A recent finding by Richardson et al. (2021) have contradictorily shown bat activities being higher near wind turbines.

It is therefore possible that some, mainly volant, species may be displaced during operation. This displacement effect is considered to be small and the overall significance of the impact Minor on the following basis:

- The natural habitat in the area of interest has already been impacted years ago by the establishment of plantations.
- Indirect habitat loss during construction is temporary.
- Any wild populations of non-volant fauna including otters, macaques, loris, hog badger and reptiles that may be present are either relatively insensitive to operational disturbance or can easily migrate to the undisturbed habitats/areas that still remain vast post-clearance.
- Bird and bats recorded during the baseline surveys are widespread and common. The exception is the NT listed Red-breasted Parakeet, although the key population driver for this species appears to be capture and breeding for pet trade according to IUCN. Significant alternative habitat will remain within the Project area during the life cycle of the Project. VP surveys indicated that despite the number present in the area, the time spent at collision risk height as a proportion of flights was very low (30 seconds during 108 hours of vantage point observation).
- Some studies e.g Madsen & Boertmann (2008), indicate that some species can demonstrate adaptation and show less avoidance behavior to operating wind farms over time

Table 11.6 Summary of Habitat Loss Impacts of Species

Impact Nature	**Negative**		**Positive**		**Neutral**	
Impact Type	**Direct**		Indirect		Induced	
Impact Duration	Temporary	**Short-term**		**Long-term**		Permanent
Impact Extent	**Local**		Regional		International	
Frequency	The impact is continuous within its duration.					
Impact Magnitude	Positive	Negligible	**Small**		Medium	Large
Receptor Sensitivity	Low		**Medium**		High	
Impact Significance	Negligible	**Minor**		Moderate		Major

249 https://www.acoustical.co.uk/distance-attenuation/how-sound-reduces-with-distance-from-a-point-source/

11.4.1.2 Additional Mitigation Measures

In addition to the embedded mitigation listed in Table 11.4 the following additional mitigation will be implemented to reduce impacts:

During construction:

- A *Wildlife Shepherding Protocol* is to be used pre-construction to ensure that no active nests or wildlife remain in the affected zone prior to any clearance and construction work. Wherever possible, fauna and flora are to be relocated to their point of origin or similar natural adjacent areas;
- Use of appropriate noise suppression techniques (such as silencer, noise barrier) where applicable to limit the extent of indirect habitat loss.

During operation:

- Temporary land will be restored to its original state. For natural habitats, areas will be restored using native vegetation.

11.4.1.3 Monitoring and Audit

The following monitoring measures are recommended for habitats and habitats of species of conservation significance:

- Regular (weekly) inspections during construction are to occur along all Project boundaries and Project footprint to ensure compliance with clearing within marked boundaries/zones;
- Records of inspections and violation cases are to be kept and available when required; and
- During operational phase, monitoring of rehabilitation success/failure is to occur on all replanting sites. Monitoring frequency for revegetation can be conducted quarterly (at the same time with other monitoring program such as for noise and EMF); however, this may change accordingly to the plant species use for revegetation that will needs expert consultations. Where plant rehabilitation is determined to have failed, re-establishment is to occur with corrective measures after review of reasons of failure. Indicators for vegetation re-establishment should be at least 75% successful coverage.

11.4.1.4 Significance of Residual Impacts

The residual impacts from loss of terrestrial habiats are likely to be Small to Negligible.

11.4.2 Disturbance to Terrestrial Species

The disturbance and displacement of terrestrial fauna species will primarily be caused by noise, light, presence of human and construction machinery during construction. During operation stage, the disturbance to terrestrial species (caused by noise and visual disturbance) might lead to avoidance behavior, the effects of which have been discussed in section 11.4.1.1.2.

11.4.2.1 Significance of Impacts

11.4.2.1.1 Birds

According to the field surveys conducted in the Project area, avifauna species consist of mostly IUCN LC species, except for the Red-breasted Parakeet (IUCN NT; VRDB NL). The receptor sensitivity is therefore assessed as Medium.

It is known from the literature that auditory hair cells of birds can be regenerated after acoustic trauma (Janas, Cotanche & Rubel 1996; Köppl 2011) and physical damages to birds occur at a relatively high noise level (more than 140 dBA for a single blast, 125 dBA for multiple blasts and more than 110 dBA

for continuous [more than 72 hours] noise during construction) (Dooling & Popper 2007). A study conducted by Kwon et al. (2018) showed that at 15m, noise level of different machinery ranged from 60 to 71 dBA. Therefore, to experience acoustic trauma, the birds would be required to occur very close to the noise source. This is very unlikely, as presence of human and construction machinery are likely to have displaced bird outside of the construction zone already before construction starts.

Success of vocalizations of birds (e.g. mating calls) might be impacted in noisy environments (Berger-Tal *et al*. 2019). This might impact a portion of a species' population living near the construction zone, but does not substantially affect other species dependent on it, or the overall population of the species itself. The effects of displacement could be about 1km from the construction source as defined in section 11.4.1.1.2. The effect of displacement during construction is likely to be temporary, with alternative habitat available for these species. Therefore, the magnitude of impact is Small. The impacts of noise and visual disturbances to birds during operation phase that may lead to indirect habitat loss are also considered as Small (see section 11.4.1.1.2)

Therefore, the significance of impact from disturbance during construction and operation on birds are considered to be Minor.

11.4.2.1.2 Bats

The field surveys found seven bat species, all IUCN LC and VRDB NE. The receptor sensitivity is low as only LC species are affected.

Night-time construction activities of the Project may have negative effects on bats. Literature indicates that the foraging success of bats may be reduced in a noisy environment (Bunkley et al. 2014; Luo, Siemers & Koselj 2015). The effects of construction noise causing auditory damage on bats are poorly-studied. In terms of light disturbance, a study showed that bats were shown to avoid areas up to 50m from streetlights (Azam et al. 2018).

It is not clear what construction activities will take place at night from the the EIA report; however, it will not involve heavy machinery work that emits loud noise that will disturb nearby human communities (see Table 11.4). Small noise and light disturbance is likely to limited to a small area restricted around the construction site and is expected to be temporary. Bats were recorded in low abundances within the Project area based on results of field surveys (see Section 8.2.2.2.3). The magnitude of effect is therefore considered to be Small. During operation, bats might avoid wind turbines; however, evidence of such avoidance behavior remained inconclusive in the literature. The species involved are widespread and common, and collisions are unlikely to have a population level effect at anything other than a local level.

Overall, the significance of impact of disturbance during construction and operation on bats is considered to be Negligible.

11.4.2.1.3 Non-volant Mammals

Non-volant mammals found during the field surveys included the VU Northern pig-tailed Macaque. The receptor sensitivity is therefore considered Medium.

The auditory system of primates is similar to that of humans, resulting in similar psychophysical temporal and spectral thresholds (Burton et al. 2019). A study on macaques showed that a 4-hr exposure to a 2-kHz noise at 120 dB SPL caused no Permanent Threshold Shift (PTS), and a 4-hr exposure at 140 dB SPL produced a PTS of < 20 dB (Valero et al. 2017). This indicates that primates are less susceptible to noise-induced PTS and hair-cell loss. The primates are unlikely to occur close to the construction site where it will be exposed to a loud noise over a long enough time to result in auditory damage. However, non-volant mammals could be temporarily displaced by noise during construction phase. During operation, non-volant mammals are shown not to be significantly avoiding

wind farms (Łopucki, Klich & Gielarek 2017; Łopucki & Mróz 2016). The magnitude of effects are considered to be Small for construction and Negligble for operation.

The significance of impact of disturbance on non-volant mammals are overall is considered to be Minor (mostly due to the impacts during construction).

11.4.2.1.4 Reptiles

Unlike other taxon, reptiles generally move slower and it was shown that they might 'freeze' as a species-specific response to threats including noise (Mancera et al. 2017), which increases exposure time to noise emissions and therefore makes them more vulnerable to auditory damage. Some reptiles (i.e. snakes) are only sensitive to vibration. As vibration effects are generally localized within the immediate surroundings of the construction site (10 to 14m from the source) (Chen et al. 2019), it is unlikely that reptiles will experience significant impacts from vibration.

The reptilian diversity within the Project area includes two species of conservation significance – the Tokay Gecko (IUCN LC; VRDB VU) and Chinese Water Dragon (IUCN VU; VRDB VU). The receptor sensitivity is therefore considered Medium. A small number of individuals (particularly, those near the construction site) might 'freeze' in exposure to noise and be vulnerable to auditory damages, but it is unlikely to threaten the long-term viability of these species' populations nationally or regionally. The magnitude of impact is considered to be Minor during the construction phase. Magnitude of effects during operation is considered to be Negligible, as reptiles do not significantly avoid wind farms (Agha et al. 2015; Thaker, Amod & Harshal 2018).

The significance of impact of disturbance on reptiles are overall is considered to be Minor (mostly due to the impacts during construction).

Table 11.7 Summary of Impacts of Noise Disturbance on Terrestrial Species

Impact Nature	**Negative**		**Positive**		**Neutral**
Impact Type	**Direct**		Indirect		Induced
Impact Duration	Temporary	**Short-term**	Long-term		Permanent
Impact Extent	**Local**		Regional		International
Frequency	The impact is impulsive and quite frequent within is duration				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptor Sensitivity	**Low**		**Medium**		High
	Low for bats. Medium for birds, non-volant mammals and reptiles.				
Impact Significance	**Negligible**	**Minor**	Moderate		Major
	Negligible for bats. Minor for birds, non-volant mammals and reptiles.				

11.4.2.2 Additional Mitigation Measures

Additional mitigation measures are recommended.

During construction phase:

- A *Wildlife Shepherding Protocol* is to be used pre-construction to ensure that no active nests or wildlife remain in the affected zone prior to any clearance and construction work. Wherever possible, fauna and flora are to be relocated to their point of origin or similar natural adjacent areas;
- *Injured Wildlife Management Protocol* is to be applied when injured individuals are found during daily inspection;

- Fencing is to be placed around major project sites during construction to restrict access to local fauna, and therefore prevent wildlife becoming trapped or harmed by works;
- Use of appropriate noise suppression techniques (such as silencer, noise barrier) where applicable;
- Regularly maintain machinery;
- Use cowl, hood and shield to minimize light spill.

During operation phase:

- *Injured Wildlife Management Protocol* is to be applied when injured individuals are found during site visit (e.g. for monitoring and maintenance)
- Regularly maintain machinery;
- Use cowl, hood and shield to minimize light spill.

11.4.2.3 Monitoring and Audit

- Conduct daily supervision on the implementation of mitigation measures to manage fauna disturbances during construction phase;
- Records of daily inspections, violation cases, records of construction schedule in which how many machines work at a same time, records of vehicle maintenance are to be kept and available when required.

11.4.2.4 Significance of Residual Impact

With the application of mitigation measures, the significance of all impacts of disturbance and displacement are likely to be Negligible.

11.4.3 Barrier Creation, Fragmentation and Edge Effect Impacts

11.4.3.1 Significance of Impacts

11.4.3.1.1 Barrier Creations

Animals may need to spend extra energy to detour around the wind turbines and the resulting energetic costs may affect body condition and utimately survival and reproductive success. However the effects of cumulative energy loss associated with barrier effects remain poorly-understood (Masden et al. 2009b). To date there has been little evidence of substantive effects arising from barrier avoidance amongst birds, and displacement of non-volant animals appears to be unlikely, with the landscape remaining permeable for these species. The receptor sensitivity is Medium due to the VU species recorded during field surveys.Any negative effects resulting from barrier creation are considered to be Negligible.

11.4.3.1.2 Fragmentation

The Project area's landscape has already been significantly fragmented by large existing roads/built-up land. The development of additional internal access roads (which are generally shorter in lengths) adds negligible impacts to the existing level of fragmentation within the Project area. Non-flying species are unlikely to be fragmented by roads of this size, while birds and bats can easily cross these. Although the receptor sensitivity is considered as Medium due to the presence of VU species, the impact of fragmentation is deemed Negligible.

11.4.3.1.3 Edge Effects

There are no natural habitats located in the Project footprint (in other words, the Project components do not lead to clearance of the outermost of any natural habitats). The habitat receptor sensitivity is therefore considered Low, and Edge effects have not been assessed further as unlikely to occur.

Table 11.8 Summary of barrier Creation, Fragmentation and Edge Effect Impacts on Species

Impact Nature	**Negative**		**Positive**		**Neutral**
Impact Type	**Direct**		**Indirect**		Induced
Impact Duration	Temporary	Short-term		**Long-term**	Permanent
Impact Extent	**Local**		Regional		International
Frequency	The impact is continuous within its duration.				
Impact Magnitude	Positive	**Negligible**	Small	Medium	Large
Receptor Sensitivity	**Low**		**Medium**		High
	Low for Edge Effects, Medium for Barrier and Fragmentation effects				
Impact Significance	**Negligible**	Minor		Moderate	Major

11.4.3.2 Additional Mitigation Measures

No additional mitigation measures are proposed.

11.4.3.3 Monitoring and Audit

No additional monitoring and audit programs are proposed.

11.4.3.4 Significance of Residual Impact

The significance of impacts is likely to be Negligible.

11.4.4 Degradation of Habitat Impacts

11.4.4.1 Potential Impacts and Consequences

Habitats within the Project area have previously been degraded by human modification (e.g. extensive coffee plantations). A range of Project activities have the potential to lead to degradation of flora and fauna habitats including excavation, construction, land clearing, movement of vehicles, drilling, refuelling, hazardous materials storage and maintenance, through the generation of dust, runoff; as well as release of potential contaminants; and introduction or spread of invasive species. Such aspects of Construction activities including: erection of transmission towers, erection of wind turbines and installation of cables/wires and installation of associated infrastructure (such as the substation and laydown area) have been assessed below.

11.4.4.2 Dust

11.4.4.2.1 Significance of Impacts

During construction on land, the movement of vehicles as well as clearing and excavation activities have the potential to generate dust which may settle on vegetation adjacent to the construction area. Excessive dust deposition on flora may act to suppress growth through limiting photosynthesis and the

dusty foliage may also become unpalatable to herbivores. However, due to the extent of modified habitats in the Project area, the receptor sensitivity is considered Low. Project construction activities will be temporary and dust generation is likely to be localised to active work areas. However, rainfall and wind will generally remove dust from foliage; furthermore existing mitigation measures that Project owner has committed to implementing will significantly reduce dust emissions. The impacts from dust are therefore considered to be Negligible.

Table 11.9 Summary of Impact from Dust Emissions on Habitats

Impact Nature	**Negative**			**Positive**			**Neutral**	
Impact Type	**Direct**			Indirect			Induced	
Impact Duration	Temporary	**Short-term**		Long-term			Permanent	
Impact Extent	**Local**			Regional			International	
Frequency	The impact is very frequent within its duration.							
Impact Magnitude	Positive	**Negligible**		Small			Medium	Large
Receptor Sensitivity	**Low**			Medium			High	
Impact Significance	**Negligible**	Minor		Moderate			Major	

11.4.4.2.2 Additional Mitigation Measures

No further mitigation measures are proposed.

11.4.4.2.3 Monitoring and Audit

No further monitoring programs are proposed.

11.4.4.3 Waste and Wastewater

11.4.4.3.1 Significance of Impacts

Accidental release or spill of these wastes and wastewater can be toxic to flora and fauna locally if substances are released into the aquatic environment. Runoff from construction sites has the potential to carry contaminants a substantial distance downstream. Construction activities such as refuelling, storage and other activities that involve oil and hazardous substances have the potential to result in accidental releases.

Due to the extent of modified habitats in the Project area, the receptor sensitivity is considered Low. However, with the existing mitigation measures that the Project owner commits to implement for waste and wastewater, the potential threats of habitat degradation are unlikely to happen. These measures will also support the maintenance of existing water quality within the wetlands, meaning no significant impact is predicted on aquatic foraging habitats. The impact is considered to be Negligible with the application of existing mitigation measures.

Table 11.10 Summary of Impact from Waste and Wastewater on Habitats

Impact Nature	**Negative**			**Positive**			**Neutral**	
Impact Type	**Direct**			Indirect			Induced	
Impact Duration	Temporary	**Short-term**		**Long-term**			Permanent	
	The impact exists in construction phase and continuous into operation phase							

Impact Nature	**Negative**		**Positive**		**Neutral**
Impact Extent	**Local**		Regional		International
Frequency	Impact is continuous within its duration.				
Impact Magnitude	Positive	**Negligible**	Small	Medium	Large
Receptor Sensitivity	**Low**		Medium		High
Impact Significance	**Negligible**	Minor		Moderate	Major

11.4.4.3.2 Additional Mitigation Measures

No further mitigation measures are proposed.

11.4.4.3.3 Monitoring and Audit

No further monitoring programs are proposed.

11.4.5 Invasive Species

11.4.5.1 Significance of Impacts

According to the FS, the Project does not have any measures planned to mitigate impacts from invasive species.

During construction, invasive species have the potential to be introduced or further 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 and affect the success of revegetation.

The field surveys recorded 13 invasive species within the Project area (see Table 8.13). Other invasive species that have been recorded in Gia Lai province are listed in Table 8.6. These were commonly found within the Project area during baseline field surveys.

The magnitude of impact of invasive species is small as it affects a small area of habitat but without the loss of viability/functions of the habitats. The Project area only consists of modified habitats; therefore the receptor sensitivity is Low. Overall the impact significance from invasive species is Negligible; however, additional mitigation measures for invasive species are recommended to prevent introduction of new species and spread of existing species, as per IFC PS6 requirements.

Table 11.11 Summary of Impacts from Invasive Species on Habitats

Impact Nature	**Negative**		**Positive**		**Neutral**
Impact Type	Direct		**Indirect**		Induced
Impact Duration	Temporary	**Short-term**	Long-term		Permanent
	The potentials to spread invasive species mostly exist in construction period, thus is short-term.				
Impact Extent	**Local**		Regional		International
Frequency	Continuous within its duration				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptor Sensitivity	**Low**		Medium		High

Impact Nature	Negative	Positive	Neutral	
Impact Significance	Negligible	Minor	Moderate	Major

11.4.5.2 Additional Mitigation Measures

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

- Existing populations and the introduction of new invasive species are to be managed. These measures are to be outlined in an *Invasive Species Management Plan* and will include measures such as:
  - The provenance of any fill material brought onto the site is to be checked for invasive species contamination.
  - Transportation vehicles should be inspected before entering site and washed down on arrival and departure.
- Temporarily used land will be rehabilitated using native species after construction.

11.4.5.3 Monitoring and Audit

- During construction, daily supervision on the implementation of the *Invasive Species Management Plan* should be conducted. Records of inspections, violations should be kept and available when required. On a monthly basis, inspections should be done in the Project area to identify any new proliferations and eradicate invasive species.
- During operation, monthly monitoring should be done in rehabilitated areas to check for presence of invasive species and remove any found.

11.4.5.4 Significance of Residual Impact

With the application of mitigation measures, the significance of residual impacts is likely to be negligible.

11.4.6 Mortality Impacts – Birds

11.4.6.1 Significance of Impacts

During construction

Mortality of fauna species has the potential to result from different aspects of the construction and operation phases. During construction, vehicle or machinery strikes, falling debris, cutting down of trees that have juveniles nesting in them, and increased hunting or poaching conducted by workers pose risks to wildlife survival. The effects are considered to be small as species in the proximity of the construction site are likely to be displaced by multiple anthropogenic disturbances before construction starts. However, if wildlife do not abandon the area (particularly hatchlings), the effects could be more severe. Further additional mitigation measures are recommended (e.g. *Wildlife Shepherding Protocol)* during construction stage to ensure impacts to wildlife are minimised. The receptor sensitivity is Medium based on the presence of Red-breasted Parakeet (NT) recorded during field surveys.

During operation

For avifauna, risks of death are higher during the operational phase due to potential collision with Project facilities, mostly with turbine blades and transmission line. Transmission line risks include both collision with wires and accidental electrocution associated with perching on pylons. Large gliding species, such as raptor and heron species, are more prone to electrocution on transmission lines due to their large wing size that can span the distance between two energized or grounded components (e.g. two wires, or between a wire and a non-insulated pole or pole equipment such as conductors).

The risk of collision with turbines varies depending on species present, numbers present, flight behaviour, location of the project in the landscape, local topography and habitat within and surrounding the site. This may include areas of aggregation and congregation, even where these may be kilometres away from the wind farm.

Baseline studies conducted for the Project have identified 19 bird species that are prone to mortalities from collisions with turbine blades and electrocution on transmission lines (see Table 8.9). The impacts of mortalities are assessed within their global population backgrounds (see Table 11.12).

From the assessment in Table 11.12, two species, the Edible-nest Swiftlet and Large-billed Crow (both are IUCN LC; VRDB NE), were identified as having high abundance within the Project area and also spending a large amount of time flying in band 2 compared to other species. Based on a conservative approach, the mortality events for these two species per year may reach 0.1% of the global population, although estimations of their populations are not available. This initial assessment does not take into account the avoidance rates of birds, the impacts of which could make the actual mortalities lower than roughly estimated here. Given that both species are widespread and common any population level effects associated with mortality are likely to be localised. As such no significant effects are predicted.

The NT Red-breasted Parakeet is known to fly in flocks, which could make this species more vulnerable to collisions; however, parakeets were not recorded flying at collision risk height during the field surveys. Significant mortality from collision with Project infrastructure affecting their abundant population in the Project area is unlikely.

Although there is limited data available for global populations of the 19 species, and avoidance behaviours are species-specific, it is concluded that on a precautionary basis the Edible-nest Swiftlet and Large-billed Crow are likely to experience Small impact on their local populations. As the affected species may include NT bird species, the receptor sensitivity is conservatively assessed to be Medium. The overall impact significance is therefore Minor. A monitoring program during operation is recommended to verify the impact assessment and inform adaptive management if required.

Table 11.12 Assessment of Mortality Potential at 0.1% Population Levels

S/N	English name	IUCN	VRDB	Flying in band 2	Raptor sp.	Large wing span (>50 cm)	Flying in flock (>10 individuals)	Global population (min)	0.1% Global population	Field survey number	Time flying in band 2 (seconds	Justification of possibility of reaching mortality events equal to 0.1% global population
1	Besra	LC	NE	Yes	Yes	Yes	No	100,000	100	2	105	Unlikely due to small abundances and low time flying in band 2
2	Crested Goshawk	LC	NE	Yes	Yes	Yes	No	20,000	20	4	135	Unlikely due to small abundances and low time flying in band 2
3	Eurasian Sparrowhawk	LC	NE	Yes	Yes	Yes	No	3,300,000	3,300	2	120	Unlikely due to small abundances and low time flying in band 2
4	Black-winged Kite	LC	NE	Yes	Yes	Yes	No	N/A	N/A	6	30	Unlikely due to small abundances and low time flying in band 2
5	Common Kestrel	LC	NE	Yes	Yes	Yes	No	4,300,000	4,300	1	150	Unlikely due to small abundances and low time flying in band 2
6	Vinous-breasted Myna	LC	NE	Yes	No	No	No	N/A	N/A	40	45	Unlikely due to small abundances and low time flying in band 2
7	Common Myna	LC	NE	Yes	No	No	No	N/A	N/A	6	45	Unlikely due to small abundances and low time flying in band 2

S/N	English name	IUCN	VRDB	Flying in band 2	Raptor sp.	Large wing span (>50 cm)	Flying in flock (>10 individuals)	Global population (min)	0.1% Global population	Field survey number	Time flying in band 2 (seconds	Justification of possibility of reaching mortality events equal to 0.1% global population
8	**Edible-nest Swiftlet**	**LC**	**NE**	**Yes**	**No**	**No**	**No**	**N/A**	**N/A**	**1,130**	**5,565**	**Possibly due to high number of contacts and high time spent in band 2**
9	Ashy Woodswallow	LC	NE	Yes	No	No	No	N/A	N/A	83	405	Unlikely due to relatively small contacts and low time flying in band 2
10	**Large-billed Crow**	**LC**	**NE**	**Yes**	**No**	**Yes**	**No**	**N/A**	**N/A**	**436**	**930**	**Possibly due to high number of contacts, high time spent in band 2 and had large wing span**
11	Asian Palm-swift	LC	NE	Yes	No	No	No	N/A	N/A	11	255	Unlikely due to small abundances and low time flying in band 2
12	Asian House Martin	LC	NE	Yes	No	No	No	N/A	N/A	8	105	Unlikely due to small abundances and low time flying in band 2
13	Black-winged Kite	LC	NE	Yes	Yes	No	No	N/A	N/A	5	30	Unlikely due to small abundances and low time flying in band 2
14	Black-collared Starling	LC	NE	Yes	No	No	No	N/A	N/A	45	255	Unlikely due to small abundances and low time flying in band 2

S/N	English name	IUCN	VRDB	Flying in band 2	Raptor sp.	Large wing span (>50 cm)	Flying in flock (>10 individuals)	Global population (min)	0.1% Global population	Field survey number	Time flying in band 2 (seconds	Justification of possibility of reaching mortality events equal to 0.1% global population
15	Barn Swallow	LC	NE	Yes	No	No	No	290,000,000	290,000	33	180	Unlikely due to small abundances and low time flying in band 2
16	Burmese Shrike	LC	NE	Yes	No	No	No	N/A	N/A	200	15	Unlikely due to low time flying in band 2
17	Asian Green Bee-eater	LC	NE	Yes	No	No	No	N/A	N/A	260	135	Unlikely due to low time flying in band 2
18	Red-breasted Parakeet	NT	NE	Yes	No	No	Yes	N/A	N/A	419	30	Unlikely due to low time flying in band 2
19	Red-wattled Lapwing	LC	NE	Yes	No	No	No	50,000	50	2	75	Unlikely due to small abundances and low time flying in band 2
20	Scaly-breasted Munia	LC	NE	No	No	No	Yes	N/A	N/A	100	N/A	Unlikely due to small abundances and not flying in band 2
21	Chestnut-headed Bee-eater	LC	NE	No	No	No	Yes	N/A	N/A	8	N/A	Unlikely due to small abundances and not flying in band 2
22	House Sparrow	LC	NE	No	No	No	Yes	896,000,000	896,000	1	N/A	Unlikely due to small abundances and not flying in band 2

S/N	English name	IUCN	VRDB	Flying in band 2	Raptor sp.	Large wing span (>50 cm)	Flying in flock (>10 individuals)	Global population (min)	0.1% Global population	Field survey number	Time flying in band 2 (seconds	Justification of possibility of reaching mortality events equal to 0.1% global population
23	Chestnut-tailed Starling	LC	NE	No	No	No	Yes	N/A	N/A	3	N/A	Unlikely due to small abundances and not flying in band 2
24	Plain-backed Sparrow	LC	NE	No	No	No	Yes	N/A	N/A	48	N/A	Unlikely due to small abundances and not flying in band 2
25	Black-collared Starling	LC	NE	Yes	No	No	Yes	N/A	N/A	62	225	Unlikely due to low time flying in band 2
26	Chinese Pond-heron	LC	NE	Yes	No	No	Yes	1,000,000	1,000	30	225	Unlikely due to small abundances and low time flying in band 2
27	Cattle Egret	LC	NE	Yes	No	No	Yes	9,850,000	9,850	27	150	Unlikely due to low time flying in band 2
28	House Sparrow	LC	NE	No	No	No	Yes	1,310,000,000	1,310,000	1	N/A	Unlikely due to low time flying in band 2

Table 11.13 Summary of Impacts from Blade Collision and Electrocution on Species

Impact Nature	**Negative**	Neutral	Positive	
Impact Type	**Direct**	Indirect	Induced	
Impact Duration	Temporary	Short-term	**Long-term**	Permanent
Impact Extent	**Local**	Regional	Global	
Impact Frequency	Continuous throughout life time of project.			
Impact Magnitude	Negligible	**Small**	Medium	Large
Receptors Sensitivity	Low	**Medium**	High	
Impact Significance	Negligible	**Minor**	Moderate	Major

11.4.6.2 Additional Mitigation Measures

11.4.6.2.1 During Construction Phase:

- A *Wildlife Shepherding Protocol* is to be used within the Project Area to ensure that no active nests/dens or wildlife remain in the affected zone prior to any clearance and construction work. Wherever possible, fauna are to be relocated to their point of origin or similar natural adjacent areas.
- *Injured Wildlife Management Protocol* is to be applied when injured individuals are found during daily inspection on construction phase and during site visit during operation (e.g. for monitoring and maintenance);
- 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;
- The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to the fauna/flora awareness, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations.

11.4.6.2.2 During Operation Phase:

- A Collision Risk Modelling is recommended to be undertaken to further assess collision risks for the Edible-nest Swiftlet and Large-billed Crow;
- Ensure that power towers and transmission lines meet safety standards such as Avian Power Line Interaction Committee (APLIC)[250] to minimise birds and bats electric shock risk:

[250] APLIC offers a variety of training resources and guidance documents that identify causes and minimization methods for bird electrocutions and collisions with power lines. These resources include:

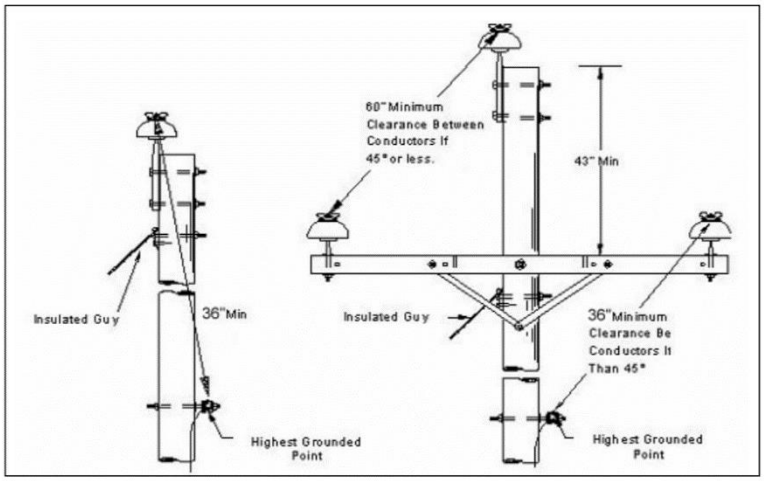
Avian Protection Plan (APP) Guidelines

Suggested Practices for Avian Protection on Power Lines document

Reducing Avian Collisions with Power Lines: State of the Art in 2012

Sage-grouse BMPs: Best Management Practices for Electric Utilities in Sage-grouse Habitat and Click here to view the Press Release

- Framing structures so that there is adequate separation between phases or phases and grounds to accommodate large perching birds. Based on the dimensions of eagles, APLIC recommends 132 cm of horizontal separation and 88 cm of vertical separation;
- Applying covers on phases or earth wire where adequate separation is not feasible. Examples of covers include insulator/conductor covers, bushing covers, arrester covers, cut-out covers, and jumper wire covers. Cover designs should be evaluated and approved by company engineers prior to use. (Note: bird/animal protection covers are not intended for human protection);
- Image below illustrates the typical avian safe structures: single phase (left), three-phase with lowered 8-foot crossarm (right). On three phase structures, a vertical clearance of at least 105 cm between un-insulated conductors, earth wires and earthed hardware on poles with 8-foot crossarms will provide the 196 cm required clearance.



- Development of an *Biodiversity Management Plan* is recommended. The plan should include:
  - Post-construction monitoring (see section Monitoring and audit below) to verify the impact assessment and limits of acceptable of number of mortalities (triggers).
  - *Adaptive Management Plan* should be undertaken if exceeding triggers, which may involve:
    - Installation of bird multi-sensor monitoring system and deterrent system;
    - Turbine shut down on demand systems.

11.4.6.3 Monitoring and Audit

11.4.6.3.1 During Construction

- Supervise the implementation of anti-hunting and poaching policy for all labour forces and inspection for any wildlife in construction areas daily during construction phase;
- Where fauna is identified during regular inspections, this is to be confiscated (if poached) and photographed for record keeping. Records of injured and/or shepherded wildlife should be kept;
- Records are to be kept and regularly reviewed (quarterly) for implementation of the workforce training program for fauna/flora awareness.

11.4.6.3.2 During Operation

Monitoring of birds during operation will be required as part of the *Adaptive Bird Management Plan*:

- Conduct carcass monitoring during operations in the vicinity (within 85m radius) of the turbines (Zimmerling et al. 2013) and along the transmission line frequently (monthly) by trained personnel/dogs and bird experts. All carcasses or feather spots (remains of at least 10 feathers indicating a fatality whose carcass has been largely removed by scavengers) will be GPS referenced, photographed and notes taken on the following:
  - Species (this may require investigation of remains or photographs by bat/ ornithological specialist);
  - Sex and age (if known; or may require specialist input);
  - Date and time collected;
  - Turbine number, distance and compass direction (in degrees) from base;
  - Conditions (intact - fresh and no signs of scavenging; scavenged; feather spot - 10 or more feathers at one location indicating scavenging); and
  - Comments (e.g. any evidence of cause of death; recent weather conditions).
- Carcasses will be bagged and removed, and any not identified to species, age and sex held for examination, by a bird specialist.
- Periodic unannounced calibration checks will be undertaken to assess the finding efficiency (taking into account removal of carcasses by scavengers and observer variation) of observers and their dogs.
- Bird studies including vantage point surveys and transect surveys in year 1 and year 2 of operation, including ongoing monitoring to detail the understanding of bird utilization of the Project area. If species with significant conservation status are detected or monitoring during these surveys, indicating that turbines have a higher than predicted collision risk, additional mitigation measures are to be considered as identified in the *Adaptive Management Plan*. Bird studies are recommended to be performed twice a year during the migration period (from October to May).

11.4.6.4 Residual Impacts

Residual impacts are predicted to be Minor for bird mortality. With the application of pre-construction wildlife shepherding, Collision Risk Modelling and post-construction monitoring to verify this assessment, and an adaptive management plan to address any unexpected changes in that assessment, residual impacts for bird mortality are predicted to be Negligible.

11.4.7 Mortality Impacts – Bat

11.4.7.1 Significance of Impacts

11.4.7.1.1 During Construction

Threats to bats during construction phase are largely related to incidental death from clearing of vegetation where bats may be roosting. Further additional mitigation measures are recommended during construction stage to ensure wildlife deaths are from small to negligible.

11.4.7.1.2 During Operation

During the operation phase, besides collision with turbine blades, barotrauma (tissue damage provoked by rapid pressure change) occurring when flying close to the blades is another cause of bat mortality. Mortality of bats are influenced by species-, environmental- and structure-related factors (Thaxter et al. 2017).

Fatality risk are associated with different bats' foraging preferences, which are described in Table 11.14 (Neil Furey, pers. comm.). Bat fatalities can also be correlated with environmental factors, such as weather, as most of the worldwide studies found that higher mortality rates occur on low-wind nights (Arnett et al. 2013). Lights, colour and heat emissions could lure prey insects close to the turbines, which consequently lead to increased bat presence in the vicinity of the turbines (Rodrigues et al. 2015).

There were seven bat species found in the surveys (all are IUCN LC and VRDB NL species). The receptor sensitivity is therefore considered Low. Two species – the Javan Pipistrelle and Nepalese Whiskered Bat use a foraging strategy high above the ground (foraging strategy III) which is associated with high collision risk, while the rest of the species' strategies are considered low to medium risk (see Table 8.10 and Table 11.15).

There is limited information about the global populations of these species; therefore the effects that collision resulting from the Project might have at population levels are difficult to assess quantitatively. However, the global population trends of the species are noted to be stable or increasing according to IUCN Red List. The general abundance of bats within the Project area is also considered relatively low, so it is unlikely that mortalities resulting from the Project would have significant impacts in a global context. At this time, on a conservative view, the impact magnitude is considered to be Small. The overall significance of the impact is therefore Negligible. However, monitoring is necessary to validate this assessment.

Table 11.14 Bat Foraging Preferences and Associated Collision Risk

Categories	Description	Collision Risk
I	Insectivorous species that forage in the highly cluttered airspace within the forest interior (or forest interior specialists).	Low
II	Insectivorous species that forage in the partially cluttered airspaces such as clearings, streams, or other tunnels within the forest or just above the canopy (edge and gap foragers).	Medium
III	Insectivorous species that forage in the unobstructed airspaces found in large clearings or high above the forest canopy (open-space foragers).	High
IV	Fruit and nectar-eating bats that fly into the partially cluttered airspaces between tree canopies, roost in small numbers and forage locally.	Low
V	Fruit and nectar-eating bats that fly in unobstructed airspaces, roost in large colonies and forage over large areas.	Low

Source: Neil Furey, pers. comm.

Table 11.15 Risk Assessment of Bat Recorded in Field Surveys

S/N	Scientific Name	English name	IUCN	VRDB	Foraging behaviour	Collision risk
1	*Rhinolophus sinicus*	Chinese Horseshoe Bat	LC	NE	Insectivorous species that forage in the highly cluttered airspace within vegetation interior.	Low
2	*Rhinolophus* cf. *pusillus*	Least Horseshoe Bat	LC	NE		

S/N	Scientific Name	English name	IUCN	VRDB	Foraging behaviour	Collision risk
3	*Rhinolophus* cf. *shameli*	Shamel's Horseshoe Bat	LC	NE		
4	*Megaderma spasma*	Lesser False Vampire Bat	LC	NE		
5	*Hypsugo cadornae*	Cadorna's Pipistrelle	LC	NE	Insectivorous species that forage in the partially cluttered airspaces such as clearings, streams, or other "tunnels" within the forest or just above the canopy (edge and gap foragers).	Medium
6	*Myotis muricola*	Nepalese Whiskered Bat	LC	NE	Insectivorous species that forage in the unobstructed airspaces found in large clearings or high above the canopy (open-space foragers).	High
7	*Pipistrellus javanicus*	Javan pipistrelle	LC	NE		

Table 11.16 Summary of Impacts of of Mortality on Bats

Impact Type	**Direct**	Indirect	Induced		
	These impacts are a direct consequence from building the Projects.				
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
	The direct mortality of bats are on-going throughout the Projects' operation and construction phase.				
Impact Extent	**Local**	Regional	International		
Impact Frequency	The threat is continuous but restricted to night time				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptor Sensitivity	**Low**	Medium	High		
Impact Significance	Negligible	**Minor**	Moderate	Major	

11.4.7.2 Additional Mitigation Measures

11.4.7.2.1 During Construction Phase:

- A *Wildlife Shepherding Protocol* is to be used within the Project Area to ensure that no active bat roosts remain in the affected zone prior to any clearance and construction work. Wherever possible, fauna are to be relocated to their point of origin or similar natural adjacent areas;
- *Injured Wildlife Management Protocol* is to be applied when injured individuals are found during daily inspection on construction phases and during site visit on operation phase (e.g. for monitoring and maintenance);

- 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;
- The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to the fauna/flora awareness, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations.

11.4.7.2.2 During Operation Phase:

- Using lights that have low ultraviolet wavelengths (reduce insect congregations around lights that bats forage on);
- Develop an *Biodiversity Management Plan* that includes:
  - Post-construction monitoring (see section below) and limits of acceptable change of number of mortalities (triggers).
  - *Adaptive Management Plan* should be undertaken if reaching triggers:
    - Installation of suitable bat detectors fitted to the turbine or bat deterrent system;
    - Increase cut-in speed for rotors, as evidence suggests bats are more likely to collide with turbines in calmer conditions as low wind conditions provide better foraging and flying conditions than conditions with strong winds.

11.4.7.3 Monitoring and Audit

11.4.7.3.1 During Construction

- Supervise the implementation of anti-hunting and poaching policy for all labour forces and inspection for any wildlife in construction areas daily during construction phase;
- Where fauna is identified during regular inspections, this is to be confiscated (if poached) and photographed for record keeping. Records of injured and/or shepherded wildlife should be kept;
- Records are to be kept and regularly reviewed (quarterly) for implementation of the workforce training program for fauna/flora awareness.

11.4.7.3.2 During Operation

Monitoring of bats during operations will be required as part of the Bat Management Plan:

- Conduct carcass monitoring within 85m radius from the turbines (Zimmerling et al. 2013) during operations on a monthly basis by trained personnel and bat experts (within the first year). All carcasses will be GPS referenced, photographed and notes taken on the following:
  - Species (this may require investigation of remains or photographs by bat/ ornithological specialist);
  - Sex and age (if known; or may require specialist input);
  - Date and time collected;
  - Turbine number, distance and compass direction (in degrees) from base;
  - Conditions (intact - fresh and no signs of scavenging; scavenged); and
  - Comments (e.g. any evidence of cause of death; recent weather conditions).

- Carcasses will be bagged and removed, and if species or age and sex are not identified , a bat specialist will be consulted;
- Periodic unannounced calibration checks will be undertaken to assess the finding efficiency (taking into account removal of carcasses by scavengers and observer variation) of observers and their dogs.
- Seasonal bat studies in year 1 and year 2 of operation, including ongoing monitoring to detail the understanding of bat utilisation of the Project area. If species with significant conservation status are detected during these surveys, indicating that turbines have a higher than predicted collision risk, additional mitigation measures are to be considered as identified in the *Adaptive Management Plan*. Bat studies are recommended to be performed once a year, targeting dry season (early November to early May).

11.4.7.4 Significance of Residual Impacts

Impacts are predicted to be minor for bat mortality. With the application of pre-construction wildlife shepherding, and post-construction monitoring to verify this assessment, and an adaptive management plan to address any unexpected changes in that assessment, residual impacts for bat mortality are predicted to be negligible.

11.4.8 Mortality Impacts – Other Fauna

11.4.8.1 Significance of Impacts

The mortalities of other fauna (including herpetofauna and non-volant mammals) mostly pertain to the construction phase. Threats include increased hunting and poaching risks due to a temporary increase in numbers of people (e.g. workers) in the Project area and vehicle collisions with fauna. The receptor sensitivity is Medium based on the presence of VU species including the Northern pig-tailed Macaque, Tokay Gecko and Chinese Water Dragon. The impacts is considered to be Small as works are confined to existing modified habitats, and populations of these species are unlikely to be significant at anything other than the local scale.

Table 11.17 IA of Mortality of Other Fauna

Impact Nature	**Negative**		**Positive**		**Neutral**	
Impact Type	**Direct**		Indirect		Induced	
Impact Duration	Temporary	**Short-term**		Long-term		Permanent
Impact Extent	**Local**		Regional		International	
Frequency	The impact is impulsive and quite frequent within is duration					
Impact Magnitude	Positive	Negligible	**Small**		Medium	Large
Receptor Sensitivity	Low		**Medium**		High	
Impact Significance	Negligible		Minor	**Moderate**		Major

11.4.8.2 Additional Mitigation Measures

- A *Wildlife Shepherding Protocol* is to be used within the Project Area to ensure that no active nests/dens or wildlife remain in the affected zone prior to any clearance and construction work. Wherever possible, fauna are to be relocated to their point of origin or similar natural adjacent areas;

- *Injured Wildlife Management Protocol* is to be applied when injured individuals are found during daily inspection and during site visit on operation phase (e.g. for monitoring and maintenance);
- 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;
- The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to the fauna/flora awareness, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations

11.4.8.3 Monitoring and Audit

- Supervise the implementation of anti-hunting and poaching policy for all labour forces and inspection for any wildlife in construction areas daily during construction phase;
- Where fauna is identified during regular inspections, this is to be confiscated (if poached) and photographed for record keeping. Records of injured and/or shepherded wildlife should be kept;
- Records are to be kept and regularly reviewed (quarterly) for implementation of the workforce training program for fauna/flora awareness.

11.4.8.4 Significance of Residual Impacts

With the additional mitigation measures and monitoring program, the residual impact is considered to be Negligible.

11.5 Next Steps

Based on the findings of these biodiversity impact assessments, the recommended next steps for the Project should involve:

- A Biodiversity Management Plan (BMP) to bring together all the mitigation and monitoring requirements and give details about how they should be carried out. This is recommended in the Environmental and Social Action Plan (ESAP);
- As part of the BMP, an adaptive management plan with agreed levels of acceptable change (action triggers) linked to the findings of monitoring and with indications of what actions will be taken when limits are exceeded (e.g. when survey finds that impacts on birds and bats exceed what has been predicted, additional mitigations will be required to further reduce the effects);

12. SOCIO-ECONOMIC IMPACT ASSESSMENT

12.1 Introduction

This section analyses the potential socio-economic impacts that may result from the pre-construction, construction, and operation of the Ia Pech and Ia Pech 2 Wind Power Projects. The assessment has been conducted based on the impact assessment methodology detailed in Section 4 and social data gathered (via secondary and primary means). Baseline data covering categories such as demographics and governance of the impacted villages, income and livelihoods, land use and ownership, community health, access and quality of local services, and infrastructure has been gathered from recent secondary information and a socio-economic baseline survey conducted in August 2021. The baseline survey focus group discussions, key interviews with local authorities, and surveys that were conducted with those households identified as having economic and physical displacement due to health and safety reasons, or experiencing restricted land activities due to the Project development. The baseline data has been analysed and is presented in Section 9 of this Environmental and Social Impact Assessment (ESIA) report.

It should be noted that the social baseline survey was conducted during the period of time in Vietnam when travel restrictions were strictly imposed by the Government in order to prevent and control the outbreak of Covid-19 cases. The survey had to be facilitated remotely through telephones and other virtual communication platforms. There were admittedly limitations to this change in the methodology because the ESIA report writing process had not been initially set up to accommodate a social survey being conducted without site visits.

This section aims to:

- Define the scope of the social impact assessment, including the area of influence and receptors considered;
- Identify the potential/existing social impacts associated with the pre-construction, construction, and operation activities of the Project. Issues concerning the perceptions and values of local residents are also put into consideration;
- Present existing controls to the impacts, which the Project Owner has already developed and implemented;
- Propose meaningful and effective mitigation measures and, where possible, enhance Project benefits; and
- Recommend an appropriate monitoring and auditing schedule.

12.2 Scope of Social Impact Assessment

The social receptors are defined as communities currently residing in the Area of Influence (AoI) of the project of interest, which includes the communes that are part of the project footprint. Based on the scoping outcomes from Section 5, the Area of Influence for social impacts to the community is defined in Figure 12.1, including:

- Ia Pech commune (wind turbine, 22kV transmission line, 22-110kV substation, internal roads, access roads, 110kV transmission line); and
- Ia Kha Townlet, Ia Der commune, and Ia Hrung commune (110kV transmission line).

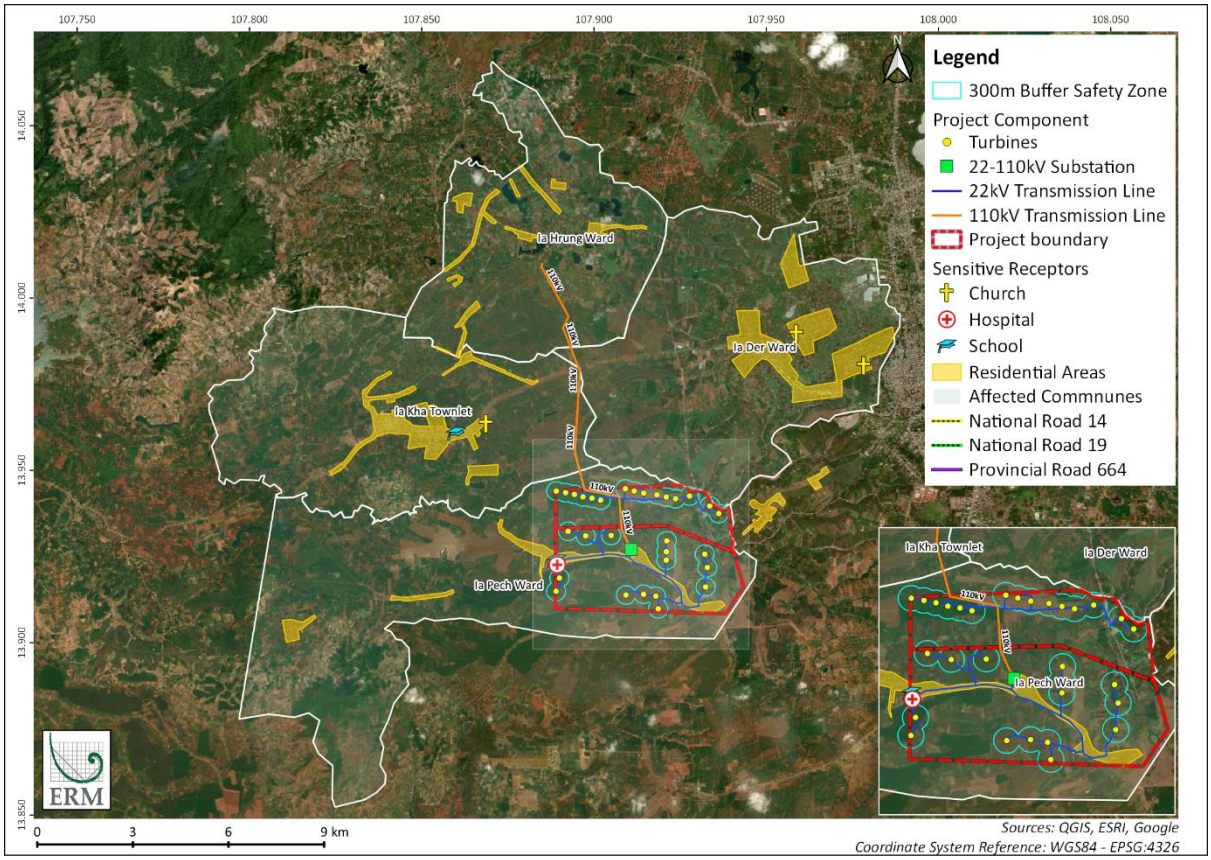


Figure 12.1 Area of Influence of Social Impacts

12.3 Approach for Assessing Social Impacts

The assessment is based on the impact assessment methodology explained in Section 4 and the social baseline data presented in Section 9 of this ESIA report, which was based in remote fieldwork due to traveling restrictions imposed by the government due to Covid situation at the time of this assessment. It is important to note, that while Section 4 provides an umbrella methodology for the ESIA report as a whole, there might be modifications in the methodology used for each of the aspect considered in the report simply due to the differences in the nature of the aspects the team had to face due to different restrictions imposed by government which limited the fieldwork required for certain topics. When undertaking a social and health impact assessment, several important criteria must be considered: the magnitude of impact, vulnerability of receptor, stakeholder perceptions, and Project planning and development objectives, as illustrated in Figure 12.2. The first three criteria are explained in detail in the next sections, while the latter Project planning and development activities are explained in detail in Section 1 of this report.

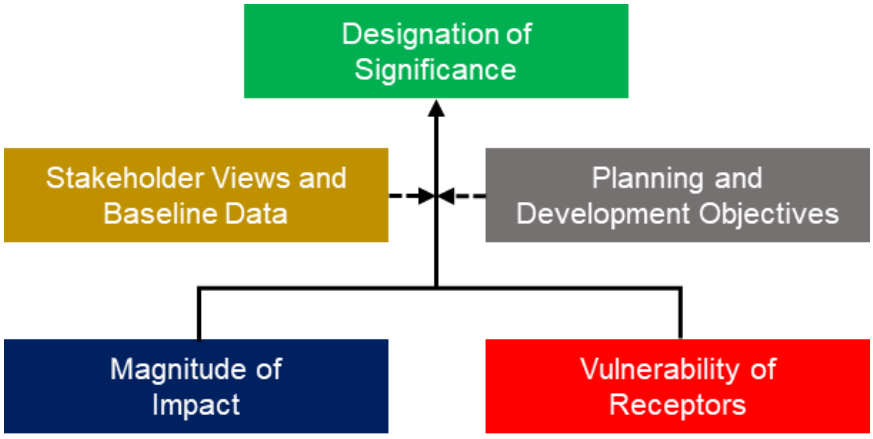


Figure 12.2 Evaluation of Social Impact Significance

12.3.1 Magnitude of Social Impact

The magnitude of social and health impacts is understood as a reflection of the "size" or degree of change caused by social and community impacts. A description of the social magnitude rating is provided in Table 12.1.

Table 12.1 Designation of Social Impact Magnitude

Designation of Magnitude	Description
Negligible	Change remains within the range commonly experienced within the household or community.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare, affects a small proportion of households, and is of a short duration.
Medium	Clear evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional, and impact may be regional in scale.
Large	Change dominates baseline conditions. Affects the majority of the area or population in the area of influence and/or persists for many years. The impact may be experienced over a regional or national area.
Positive	In the case of positive impacts, it is generally recommended that no magnitude be assigned, unless there is ample data to support a more robust characterisation. It is usually sufficient to indicate that the Project will result in a positive impact, without characterising the exact degree of positive change likely to occur.

12.3.2 Sensitivity of Receptor

In the social and community health context, sensitivity is the accepted term for describing the social receptor's sensitivity that will experience the impact. Sensitive receptors are defined as stakeholders who:

- are less resilient than others within their socio-cultural context;

- have a reduced ability to respond to, cope with, and manage change and 'shocks'; and
- are less able to access resources and development opportunities.

It is important to understand the sensitivity context as it will affect the social receptor's ability to adapt to any changes brought about by the Project in a direct, indirect or induced manner. A higher level of sensitivity can result in increased susceptibility to negative impacts or a limited ability to take advantage of positive impacts. A Project may also exacerbate existing sensitivities if individuals and communities' status and their coping mechanisms are not adequately understood or considered. Evaluation is made based on the pre-existing status of receptors, as well as their proximity to the Project components, to define the receptor's level of sensitivity, as presented in Table 12.2.

Table 12.2 Level of Sensitivity of Social Receptor

Ranking	Definition
Low	Minimal sensitivity; consequently, with a high ability to adapt to changes brought on by the Project and opportunities associated with it.
Medium	Some, but few areas of sensitivity; still retaining an ability to, at least in part, adapt to change brought on by the Project and opportunities associated with it.
High	Profound or multiple levels of sensitivity that undermine the ability to adapt to changes brought on by the Project and opportunities associated with it.

12.3.3 Evaluation of Impact

The impacts are evaluated based on the Project-specific considerations, assumptions, and social-economic/cultural data. These parameters are then used to inform the significance of the impact across the Project phase cycle (i.e. pre-construction, construction, and operation). The social impact evaluation by ERM includes the following components:

- Consideration of the interaction of Project activities with the social receptors based on data provided by Project Owner and/or presented in the Feasibility Study (FS) report ;
- Identification of the receptors, sensitivity/vulnerability and perceptions (if any) based on social-economic baseline data and consultations;
- Identification of potential impacts and benefits based on the method described above;
- Documentation of existing controls based on data provided by the Project Owner and/or presented in the Project FS;
- Evaluation of impact significance taking into account the vulnerability of the receptor and the magnitude of the impact;
- Development of additional mitigation/management (or enhancement) measures determined by understanding the impact and significance based on best practice; and
- Assessment of residual impact following an assumption that the mitigation and or management measures proposed are implemented effectively. In some cases, further discussion may be required to reassess Project design and/or how monitoring can play a part in the management process.

Each social impact was identified as part of the Project scoping process set out in the scoping methodology. These impacts have been selected based on a robust understanding of the proposed activities in the Project description (set out in the Project FS) and primary and secondary data gathered in the affected villages via household survey, FGDs, KII with local communities and local authorities.

The significance of social and health impacts is then evaluated, taking into account the magnitude of the impact and the vulnerability of the affected receptors. The matrix provided in Section 5 is used to assign social and health impact significance for both negative and positive impacts. Table 12.3 shows how the different designations of significance may be interpreted from a social perspective. These are highlighted to reflect the Project context and setting, specifically reflected in planning and stakeholder views as appropriate.

While the default is not to rate the significance of positive impacts, as it is not possible to gather exact data to measure the positive impact accurately, it is important to describe how the impact may differentially benefit vulnerable groups.

Table 12.3 Description of Social and Health Impact Assessment Significance Rankings

Significance	Social Impact	Health Impact
Negligible	■ Inconvenience caused, but with no consequences to livelihoods, culture, or quality of life.	■ Receptors may experience annoyance, minor irritation, or stress associated with change with minimal impact to perceived quality of life. Does not require treatment. No long-term consequences for the health of individuals and the community.
Minor	■ Impacts are short term and temporary and do not result in long term reductions in livelihood or quality of life.	■ Temporary reduction to health status of certain individuals that can be easily treated and does not result in long term consequences for community health. Impacts may lead to greater health inequalities in the Project area.
Moderate	■ Adverse impacts that notably affect livelihood or quality of life at the household and community level. Impacts can mainly be reversed but some households may suffer long term effects.	■ High risk of diseases or injuries as well as exposure to Project operational risks to the local community. May result in long term but reversible community health impacts.
Major	■ Diverse primary and secondary impacts that will be impossible to reverse or compensate for, possibly leading to long term impoverishment, or societal breakdown.	■ Loss of life, severe injuries or chronic illness requiring hospitalisation. Exposure to and incidence of diseases not commonly seen previously in the area. Likely to have long-term consequences for community health.

Initially, the significance of the impact has been evaluated in general for communities to be impacted. The evaluation has also taken into account whether the identified vulnerable groups will be impacted differently. When this is the case, the impact on these vulnerable groups would be differentiated in the assessment (i.e. an impact may receive an overall significance rating of moderate, but a high rating when considered in relation to a particular group of vulnerable receptors).

It is common that the affected people may have different perceptions on an impact (either lower or higher) than it is actually in reality. This does not mean that their perception, even though different, would be disregarded in this assessment. But these will be captured as “Perceived impacts” and will be differentiated from “Actual impacts”. However, it should be carefully noted that “Perceived Impacts” are no less important than “Actual Impacts” with respect to addressing community acceptance towards the Project. In some cases, failure to adequately assess such “Perceived Impacts” and develop supporting mitigation could likely result in Project delays as in the case of actual impacts.

The assessment considers not only the magnitude and vulnerability ratings but also the stakeholders' perceptions on their sensitivity to the impacts as well as any planning and development plan for the administrative area in which the Project is located. The impact significance would discuss pre- and post-mitigation implementation, with the residual impact being as low as practicable. If the residual rating is still not acceptable, the impact and Project activities will require further discussions with the Project Owner to agree on a more appropriate design or technology that will result in a lower impact significance.

Impacts and benefits have been considered across the Project lifecycle (i.e. construction, and an operation phase of approximately 20 years).

12.3.4 Management Measures and Residual Impacts

The impacts identified during the social impact assessment will be mitigated and/or managed, aiming to reduce them to acceptable residual levels. Ideally, the Project Owner will adopt the proposed measures and implement them effectively throughout the appropriate Project phase. At times, in reality, however, the measures cannot be implemented as suggested and alternative actions are required; these are to be identified through monitoring. As such, the residual impact in a few cases cannot always be determined as an acceptable level.

12.4 Summary of Potential Social Impacts, Receptors, and Areas of Influence

Project development activities causing potential impacts to stakeholders who are identified as receptors are summarised in Table 12.4. In each section, the Project's area of influence for a specific resource or receptor is described in the context of the identified impacts.

Table 12.4 Summary of Potential Impacts, Receptors and Area of Influence

Project Activities	Potential Impacts	Receptors	Areas of Influence
Pre-construction Phase			
Land acquisition process	■ Loss of income because the project acquired agriculture land including land for rubber plantation; ■ Loss of land asset as the government chooses to compensate affected households with cash, not with similar size land ■ Loss of standing crops on the acquired agricultural land ■ Restriction of crop height for agricultural land within the safety corridor of the transmission line ■ Social/cultural tension from dissatisfaction towards the compensation price and/or the unequal compensation between the affected households under government-led process and negotiation-based process.	Affected communities by the land acquisition process including Gia Rai People. According to the available data to ERM at the time of writing the ESIA report, there were approximately 160 households whose land had been acquired for the Project (both long-term and short-term). The exact number of households affected by land acquisition could not be determined from the land acquisition documents provided to ERM, especially on the Enclosed confirmation of compensation value for land and assets on land for each slot of land issued by Ia Grai DPC, the land use right owners of several land slots were not identified.	Project footprint includes turbine foundations, internal access roads, substations, laydown areas and Right Of Way (ROW) of transmission line
Construction Phase			
Labour recruitment for construction activities	*Local employment and business:* ■ Increased local employment and income	■ Opportunity seeker and business owners	■ Ia Grai district.

Project Activities	Potential Impacts	Receptors	Areas of Influence
	■ Temporary direct employment for the Project and induced employment opportunities by local suppliers ■ Opportunities for small and medium local businesses ■ Community discontent due to high expectation to be hired as unskilled workers ■ Reduction of economic opportunities to local business due to employee demobilization at the end of the construction phase	■ Gia Rai People and the general local community	
	Worker Rights, Occupational Health and Safety ■ Impacts to rights of contracted workers engaged by contractors ■ Employment of children or other minors, forced or bonded labour ■ Potential for discriminatory practices to occur in the hiring process ■ Potential for discrimination against workers that join unions (or other similar organisations) or take part in collective bargaining ■ Inappropriate or delayed payments to workers ■ Lack of clarity information on workers' rights ■ Gender inequality during contractual processes ■ Unjustified dismissals ■ Non-payment of overtime *Working conditions* ■ Accidents, injuries, fatalities or other health and safety risks, which can arise from inappropriate working or unsafe conditions, such as excessive working hours, lack of appropriate training, insufficient lock-out/tag-out practices as well as equipment failure ■ Higher risk activities include working at height, lifting operations, live electrical work, use of vehicles/heavy equipment *Operation of worker's accommodation* ■ Impacts on worker's health and safety due to poor management of worker's accommodation	Project's worker	■ Construction sites ■ Worker's accommodation (their houses or hostels, camps) ■ Ia Pech commune

Project Activities	Potential Impacts	Receptors	Areas of Influence
■ Land clearance, lay down area usage during construction of wind turbine pole, and construction for Project components (wind turbine pole, transmission line, substation, access road) ■ Higher risk activities include working at height, lifting operations, live electrical work, and use of vehicles/heavy equipment ■ Construction of turbine foundations, transmission line pylons, internal road, auxiliary works, and turbine installation ■ Wastes, emissions, and discharges generation, handling, and disposal ■ Operation of associated facilities such as concrete batching plant	*Community way of life, health, safety and security due to construction activities (Non-influx issues)* ■ Impacts on mental health and wellbeing of people residing in the Project footprint and adjacent areas due to induced noise vibration, dust and gas emissions from vehicles ■ Risk of disease to the local population via contamination of groundwater (from borehole) and surface water (from ponds) ■ Risk of disease to the local population due to lack of proper hazardous and non-hazardous waste management ■ Risk of injury to local persons gaining unauthorised access to the construction or restricted sites	■ Gia Rai People and the general community in the project area	■ Construction sites ■ Ia Grai district
Presence of influx and operation of worker's accommodation	*Community way of life, health, safety and security due to the presence of influx* ■ Risk of communicable disease spread (such as sexually transmitted infections, dengue, malaria, influenza, diarrheal) ■ Increased pressure on local health facilities/capacities ■ Increased pressure on local governance ■ Tension with local communities due to issues of cultural conflict	■ Project worker ■ Gia Rai People and the general community	Ia Pech commune

Project Activities	Potential Impacts	Receptors	Areas of Influence
	■ Security-related impacts or concerns (such as drinking, drugs consumption, gambling, theft) ■ Risk posed by Project security arrangements to those within and outside the Project site ■ Risk of gender-based violence, violence against children, sexual harassment/abuse due to the increase in number of non-local male workers ■ Risk to vulnerable groups as prostitution and/or child labour		
■ Equipment and material transport and supply ■ Project vehicular movement (movement of trucks and lorries, transport of large-heavy equipment)	*Traffic safety due to increase transportation volume* ■ Increased risk of traffic accidents and interaction between Project vehicles and local communities	■ Project worker ■ Gia Rai People and the general community	■ Access roads ■ Local roads in and near Nang Long O Sor, O Gia, and Sat Tau villages ■ Transportation route of the Project
Operation phase			
■ Labour recruitment and supply demand ■ General operation activities	*Project positive impacts and benefit sharing* ■ Direct employment for the Project ■ Opportunities for small and medium local businesses	■ Project worker ■ Gia Rai People and the general community ■ Business owner	Ia Pech commune
	Health, safety and general disturbance ■ Relocation of houses used to watch farms due to health and safety reasons ■ Impacts on mental health and wellbeing of people residing in the Project footprint and adjacent areas due to induced noise vibration and shadow flicker due to the presence of turbines ■ Visual impact due to the presence of turbines	Project worker & Affected Communities	Ia Pech commune

Project Activities	Potential Impacts	Receptors	Areas of Influence
	Physical displacement ■ Household relocation due to health and safety reason	Community living within the 300 m safety zone	Ia Pech commune
Project lifecycle			
Project land acquisition, construction and operation activities	*Impacts on Indigenous People Way of Life* ■ Disturbance on ethnic minority way of life	Gia Rai People and other ethnic minorities	Ethnic minority settling in agricultural area in Ia Pech commune
	Impact on Gender ■ Distubance on ethnic minority way of life ■ Maintenance of gender inequality	Project workers and Affected Communities	Ia Pech, Ia Kha, Ia Hrung, and Ia Der communes
	Impact on Human Rights ■ Disturbance on ethnic minority way of life ■ Human Rights unprotected	Right-holders	■ Gia Lai Province ■ Ia Grai District ■ Ia Pech, Ia Kha, Ia Hrung, and Ia Der communes

12.5 Pre-construction – Economic Displacement Impact due to Land Acquisition

12.5.1 Summary of Project's Land Use and Land Acquisition

12.5.1.1 Project's Land Use Scope

The land occupied for the Project includes permanent and temporary acquisition of land with a total area of 30.94 hectares and 28.85 hectares, respectively. In which, the permanent land acquisition is being used for WTG foundation, transformer foundation, 220 kV substation and maintenance road, while the temporary land is being used for crane yard, construction and production facilities, cable trench, and construction road. The land area for the Project has been identified as agriculture land, residential land in the rural area[251], garden land, public land and rubber plantation land (see Table 12.5).

Table 12.5 Area of Land for the Project

Activity	Ia Pech (ha)	Ia Pech 2 (ha)
Long-term land acquisition	**17.08**	**13.86**
Internal roads and underground cable	13.75	11.67
Wind turbine foundation	2.07	2.07
Substation and administration building	0.90	N/A
Foundation of 110kV transmission line	0.32	N/A
Foundation of 22kV transmission line	0.04	0.13
Short-term land acquisition	**14.42**	**14.43**
Internal roads	7.00	7.00
Crane yard	6.36	6.36
Construction of cable and substation	0.07	0.07

Source: Feasibility Study – Dien Xanh Gia Lai Investment Energy JSC

[251] Residential land used by households or individuals in rural areas includes land for construction of houses and facilities for livelihood, gardens and ponds within one land parcel in a rural residential area which is established in accordance with the land use master plan and the master plan for development of rural residential areas already approved by competent state agencies, Article 143, Vietnam Land Law 2013. Based on the review of Notification on disclosing Compensation and Support Plan with the Enclosed confirmation of compensation value for land and assets on land, all cases where the land type was identified as "residential land in rural area", there were no housing structures on land but typical fruit trees, crops, and garden plants such as apricot blossom trees or Bougainvillea, etc.

12.5.1.2 Project Land Acquisition Process

It is important to note that the land acquisition for the Project did not follow the standard government-led process detailing in the previous section for the whole Project's components. The process was a hybrid between the Client's efforts in negotiations with the land users and support from the competent authority which is Ia Grai District People's Committee (DPC) for some Project areas as detailed below.

Table 12.6 Acquired land Area by Project Components

Component	Acquired land Area (m^2)[252]	Affected Land Type	Involuntary Resettlement	Land transaction methods	Affected Households
Long-term land acquisition					
Internal roads and underground cable	254,200	APL	Yes	GL	33
Wind turbine foundation	41,400	APL, RP	Yes and No	GL and WSWB	10
Substation and administration building	9,000	APL	Yes	GL	N/A[253]
Foundation of 110kV transmission line	3,200	APL	Yes	GL	30
Foundation of 22kV transmission line	1,700	APL, RL, GL, PL	Yes	GL	76
Short-term land acquisition[254]					
Internal roads	140,000	APL	No	WSWB	N/A[255]
Crane yard	127,200	APL	No	WSWB	11
Construction of cable and substation	1,400	-	-	-	-

Note: APL-Agriculture Production Land, RL-Residential land in rural area, GL- Garden land, PL-Public land, RP-Rubber plantation, GL- Government led, WSWB-Willing seller-willing buyer

[252] This was the land area acquired for both Ia Pech Wind Power Project and Ia Pech 2 Wind Power Project.

[253] Based on the land acquisition documents available to ERM at the time of writing this report, this information could not be specified.

[254] The documents related to short-term land acquisition available to ERM at the time of writing this report only identified the temporary land acquisition for the crane yard and part of the internal roads.

[255] There is a part of the internal roads (access to turbines E20-E22) under the land use right ownership of Highland Dairy Cattle Co., Ltd, a private company. However, this part only accounts for 340m^2 of the total area land acquired for this component.

The Project land acquisition was started in March 2021 when Ia Grai DPC issued Decision 300/QD-UBND establishing the Compensation, Support and Ground Clearance Committee (“the Committee”). The responsibilities of the Committee are as follows:

- Coordinate and support Gia Lai Investment Energy Joint Stock Company in the process of organising the implementation of compensation, support and ground clearance for Ia Pech Wind Power Project and Ia Pech 2 Wind Power Project;
- Monitor the progress of the Company's compensation work, promptly advise the District People's Committee to handle difficulties and obstacles in the implementation process to ensure the harmony of rights and interests between the Company and other organisations as well as people affected by the Project;
- Check and advise on the certification of relevant documents under the authority of the District People's Committee and the Compensation, Support and Ground Clearance Council upon the written request of the Project Owner.

As the result of the stakeholder engagement and document review during the baseline survey, the land acquisition of the Project is confirmed:

- On-going at the time of the ESIA reporting;
- Only result in economic displacement of 160 households, of which 149 households affected by the permanent land acquisition and the remaining 11 households only disturbed by the temporary land occupation during the construction. No physically displaced case was reported by the local authorities and Project Company;
- Economic displacement of two organisation, including Chu Pah Rubber Single-member LLC via permanent land acquisition and Highland Dairy Cattle Company Limited;
- Being underway on an ad-hoc basis using both government-led (GL) and willing-seller-willing-buyer (WSWB) approaches; and
- All compensation and support are in cash.

Detail of case by case identification is provided in Table 12.7.

Table 12.7 Documents Provided to ERM in Relation to the Land Acquisition for the Project Components

No	Component	Land acquisition method	Document[256]	Date	Issued by	Proof of payment[257]	Status based on available documents provided by July 2021	Next step
Long-term land acquisition								
1	Access road to turbines E16-18	GL	Notification on disclosing Compensation and Support Plan 03/TB-HDBT Enclosed confirmation of compensation value for land and assets on land[258]	25 March 2021	Ia Grai DPC Compensation, Support and Ground clearance Committee	No	Based on the content of the Notification, the Confirmation of compensation value for land and assets on land would be published from 25 March to 02 April 2021. This is Step 2 in the Government-led land acquisition process.	The completion of the process is suggested to be verified during the Land Acquisition Audit.
2	Access road to turbines E20-22	GL	Notification on disclosing Compensation and Support Plan 04/TB-HDBT Enclosed confirmation of	06 April 2021	Ia Grai DPC CSSCC	No	Based on the content of the Notification, the Confirmation of compensation value for land and assets on land would be published from 07 to 02 April 2021. This is Step 2 in the	The completion of the process is suggested to be verified during the Land Acquisition Audit.

[256] These documents were provided to ERM in July 2021.

[257] These proof of payment were provided to ERM in July 2021.

[258] This document is the result of Step 1 in the government-led land acquisition process.

No	Component	Land acquisition method	Document[256]	Date	Issued by	Proof of payment[257]	Status based on available documents provided by July 2021	Next step
			compensation value for land and assets on land				Government-led land acquisition process.	
3	Access road to turbines E20-22	GL	Notification on disclosing Compensation and Support Plan 05/TB-HDBT Enclosed confirmation of compensation value for land and assets on land	26 April 2021	Ia Grai DPC CSSCC	No	Based on the content of the Notification, the Confirmation of compensation value for land and assets on land would be published from 26 April to 15 May 2021. This is Step 2 in the Government-led land acquisition process.	The completion of the process is suggested to be verified during the Land Acquisition Audit.
4	Turbine E00 Foundation	GL	Record of payment of compensation and support 2711/BB/DXGL	27 November 2020	Dien Xanh Gia Lai Investment Energy JSC	Yes	Complete payment	
			Decision on land acquisition 1163/QD-UBND	21 December 2020	Ia Grai DPC			
5	Turbine E1-12 foundation	GL	Minutes of meeting between Chu Pah Rubber Single-member LLC	04 February 2021	Vietnam - VRG Rubber Industry Corporation	No	The completion of this process is unknown.	The completion of the process is suggested to be verified during the Land Acquisition

No	Component	Land acquisition method	Document[256]	Date	Issued by	Proof of payment[257]	Status based on available documents provided by July 2021	Next step
					Chu Pah Rubber Single-member LLC			Audit. Or the status can be updated once the payment proof is available.
6	Turbine E13 foundation	GL	Record of payment of compensation and support 156/BB/DXGL	2021 Unknown day and month	Dien Xanh Gia Lai Investment Energy JSC	Yes	Complete payment	
7	Turbine E14 foundation	GL	Record of payment of compensation and support 2711/BB/DXGL	27 November 2020	Dien Xanh Gia Lai Investment Energy JSC	Yes	Complete payment	
			Decision on land acquisition 1165/QD/UBND	21 December 2020	Ia Grai DPC			
8	Turbine E15 foundation	GL	Record of payment of compensation and support *Unknown document number*	18 March 2021	Dien Xanh Gia Lai Investment Energy JSC	Yes	Completed	
9	Turbine E16 foundation	GL	Record of payment of compensation and support	26 November 2020	Dien Xanh Gia Lai Investment Energy JSC	Yes	Completed	

No	Component	Land acquisition method	Document[256]	Date	Issued by	Proof of payment[257]	Status based on available documents provided by July 2021	Next step
			2611/BB/DXGL					
			Decision on land acquisition 1164/QD/UBND	21 December 2020	Ia Grai DPC			
10	Turbine E17 foundation	GL	Record of payment of compensation and support 155/BB/DXGL	2021 Unknown day and month	Dien Xanh Gia Lai Investment Energy JSC	Yes	Completed	
11	Turbine E18 foundation (A)	WSWB	Deposit Agreement 168/TTDC-MD	13 May 2021	N/A (Civil agreement)	No	Unknown if the payment has been made to the land use right owner.	The completion of the process is suggested to be verified during the Land Acquisition Audit. Or the status can be updated once the payment proof is available.
12	Turbine E20 foundation	GL	Record of payment of compensation and support 158/BB/DXGL	2021 Unknown day and month	Dien Xanh Gia Lai Investment Energy JSC	Yes	Complete payment	
13	Turbine E21-22	WSWB	Deposit Agreement 150/TTDC-MD	Unknown	N/A (Civil agreement)	No	Unknown if the payment has been made to the land use right owner.	The completion of the process is suggested to be verified during the Land Acquisition

No	Component	Land acquisition method	Document[256]	Date	Issued by	Proof of payment[257]	Status based on available documents provided by July 2021	Next step
	foundation (B)							Audit. Or the status can be updated once the payment proof is available.
14	Turbine E23-26 foundation	GL	Minutes of meeting between Chu Pah Rubber Single-member LLC	04 February 2021	Vietnam - VRG Rubber Industry Corporation Chu Pah Rubber Single-member LLC	No	The completion of this process is unknown.	The completion of the process is suggested to be verified during the Land Acquisition Audit. Or the status can be updated once the payment proof is available.
15	Turbine 27 foundation (C)	WSWB	Deposit Agreement *Unknown document number*	22 December 2020	N/A (Civil agreement)	No	Unknown if the payment has been made to the land use right owner.	The completion of the process is suggested to be verified during the Land Acquisition Audit. Or the status can be updated once the payment proof is available.
16	Turbine E28 foundation	GL	Record of payment of compensation and support *Unknown document number*	2020 Unknown day and month	Dien Xanh Gia Lai Investment Energy JSC	Yes	Complete payment	

No	Component	Land acquisition method	Document[256]	Date	Issued by	Proof of payment[257]	Status based on available documents provided by July 2021	Next step
			Decision on land acquisition 1188/QD/UBND	21 December 2020	Ia Grai DPC			
17	Turbine E29 foundation	GL	Record of payment of compensation and support *Unknown document number*	16 December 2020	Dien Xanh Gia Lai Investment Energy JSC	Yes	Complete payment	
			Decision on land acquisition 1187/QD/UBND	28 December 2020	Ia Grai DPC			
18	Turbine E30-31 foundation	GL	Minutes of meeting between Chu Pah Rubber Single-member LLC	04 February 2021	Vietnam - VRG Rubber Industry Corporation Chu Pah Rubber Single-member LLC	No	The completion of this process is unknown.	The completion of the process is suggested to be verified during the Land Acquisition Audit. Or the status can be updated once the payment proof is available.
19	110kv transmission line pole foundation	GL	Notification on disclosing Compensation and Support Plan 10/TB-HDBT	07 May 2021	Ia Grai DPC CSSCC	No	Based on the content of the Notification, the Confirmation of compensation value for land and assets on land would be published from	The completion of the process is suggested to be verified during the Land Acquisition Audit. Or the status can be updated once

No	Component	Land acquisition method	Document[256]	Date	Issued by	Proof of payment[257]	Status based on available documents provided by July 2021	Next step
			Enclosed confirmation of compensation value for land and assets on land				10 to 30 May 2021. This is Step 2 in the Government-led land acquisition process.	the payment proof is available.
20	110kv transmission line pole foundation	GL	Notification on disclosing Compensation and Support Plan 12/TB-HDBT Enclosed confirmation of compensation value for land and assets on land	19 May 2021	Ia Grai DPC CSSCC	No	Based on the content of the Notification, the Confirmation of compensation value for land and assets on land would be published from 18 May to 08 June 2021. This is Step 2 in the Government-led land acquisition process.	The completion of the process is suggested to be verified during the Land Acquisition Audit. Or the status can be updated once the payment proof is available.
21	22kv transmission line pole foundation	GL	Notification on disclosing Compensation and Support Plan 13/TB-HDBT Enclosed the confirmation of compensation value for land and assets on land	01 June 2021	Ia Grai DPC CSSCC	No	Based on the content of the Notification, the Confirmation of compensation value for land and assets on land would be published from 01 to 20 June 2021. This is Step 2 in the Government-led land acquisition process.	The completion of the process is suggested to be verified during the Land Acquisition Audit. Or the status can be updated once the payment proof is available.

No	Component	Land acquisition method	Document[256]	Date	Issued by	Proof of payment[257]	Status based on available documents provided by July 2021	Next step
Short-term land acquisition								
22	Crane yard	WSWB	Land rental Agreement *Unknown document number*	25 February 2021	N/A (Civil agreement)	Yes	Complete payment	
23	Crane yard	WSWB	Land rental Agreement 130/HDTD	26 February 2021	N/A (Civil agreement)	Yes	Complete payment	
24	Crane yard	WSWB	Land rental Agreement 131/HDTD	26 February 2021	N/A (Civil agreement)	Yes	Complete payment	
25	Crane yard	WSWB	Land rental Agreement 132/HDTD	26 February 2021	N/A (Civil agreement)	Yes	Complete payment	
26	Crane yard	WSWB	Land rental Agreement 134/HDTD	27 February 2021	N/A (Civil agreement)	Yes	Complete payment	
27	Crane yard	WSWB	Land rental Agreement 135/HDTD	03 March 2021	N/A (Civil agreement)	Yes	Complete payment	

No	Component	Land acquisition method	Document[256]	Date	Issued by	Proof of payment[257]	Status based on available documents provided by July 2021	Next step
28	Crane yard	WSWB	Land rental Agreement 137/HDTD	06 March 2021	N/A (Civil agreement)	Yes	Complete payment	
29	Crane yard	WSWB	Land rental Agreement 136/HDTD	13 March 2021	N/A (Civil agreement)	Yes	Complete payment	
30	Crane yard	WSWB	Land rental Agreement 137/HDTD	13 March 2021	N/A (Civil agreement)	Yes	Complete payment	
31	Crane yard	WSWB	Land rental Agreement 141/HDTD	18 March 2021	N/A (Civil agreement)	Yes	Complete payment	
32	Crane yard	WSWB	Land rental Agreement 142/HDTD	20 March 2021	N/A (Civil agreement)	Yes	Complete payment	

12.5.2 Potential Impacts

It was observed during the scoping site visit and via the document review that the Project area is occupied by local people mainly for coffee, acacia trees, avocado, and other fruit trees, rubber plantation, and residing as detailed above. However, the maximum land acquisition area of the residential land is only approximately 24m^2 for the 22kv tramission line and was not reported to cause physical displacement. A few farm structures used by the local farmers to overlook their agriculture fields and livestock were also observed in the turbine area during the scoping survey. The impact of these farm structures due to health and safety reason is discussed in Section 12.9.

In the limited of information in the land acquisition related documents, LURC status of the affected households and the land price applied for the government-led cases are not available for the assessment.

According to the Law on electricity[259], the restriction/safety corridor for the transmission line will be established at 3 meters from the 110kV transmission line/tower conducting line. The trees' height in the safety corridor should not reach 3 meters as the project owner would have to cut trees higher than 3 meters. As observed during the field survey, some perennial trees were observed along the transmission line and thus, any trees higher than 3 meters will be cut out, the trees cut during pre-construction or construction phase are not be re-planted in the future. As a result, this could affect the income and requires the affected farmers to have a new crop of which height is not higher than 3 meters.

Additionally, the different approaches in land acquisition can lead to unequal compensation among the affected households. While land acquisition affected Indigenous Peoples have less access to Project information and land acquisition process in general, they can be at the disadvantage in these negotiation. During the social survey, ERM conducted remote interviews with 23 households affected by the land acquisition (out of the approximate number of 160 in total). Over two-thirds of the interviewed households confirmed that they had participated in the land acquisition process (69.6% or 16 households, including 10 Gia Rai and six Kinh households) while the remaining households (30.4%) were not involved in any stages of land acquisition process.

Also from the social baseline data, nearly two thirds of the 23 affected households (60.9% or 14 households, including 10 Gia Rai and four Kinh households) by land acquisition for the Project were dissatisfied with the compensation amount because they could not find any alternative land plots with that amount. Meanwhile, only one Kinh household (4.4%) is satisfied with the price. There might be other cases of affected households that were dissatisfied towards the compensation price, particularly to the affected households under the government-regulated CSR framework.

In general, the potential impacts due to the land acquisition activities for the Project include:

- Loss of income because the project acquired agriculture land including land for rubber plantation;
- Loss of land asset as the government chooses to compensate affected households with cash, not with similar size land
- Loss of standing crops on the acquired agricultural land
- Restriction of crop height for agricultural land within the safety corridor of the transmission line
- Social/cultural tension from dissatisfaction towards the compensation price and/or the unequal compensation between the affected households under government-led process and negotiation-based process.

[259] The Law on Electricity No. 28/2004/QH11 was approved by the National Assembly of the Socialist Republic of Vietnam at its 6th session on December 03, 2004, and Decree No. 14/2014/ND-CP dated February 26, 2014 stipulates in detail the implementation of The Law on Electricity, especially regarding electricity safety.

12.5.3 Existing Controls

Based on the information provided by the Client during the scoping visit in May 2021, affected households would receive the compensation payment in cash in accordance with the results of negotiations between these households and the Client. There is no other compensation or supporting methods to be applied to assist affected households. At the time of writing this report, ERM did not have any further updates on whether or not there have been any other compensation or supporting methods added into the existing controls.

12.5.4 Significance of Impacts

The nature of land acquisition is considered to have negative impacts as it directly removes people's immediate source of livelihoods in those directly impacted by the project due to this action. The land acquisition process will result in either short-term (land occupation during the 18-month-construction) or permanent land loss. According to the available data to ERM on land acquisition at the writing of this report, there were approximately 160 households[260] whose land had been acquired for the Project (both permanently and short-term), including 149 households that permanently lost production land and 11 households that temporary lost part of their production land. Of which, government-led process resulted in 146 economically displaced households and the remaining cases are identified as commercial transaction via WSWB process. As such, the impact could be significant for 146 affected households who lost the land permanently by involuntary land acquisition process, and the maximum land loss of one affected household is approximately 6,000 m^2, which is about 37% of the total land owned by a local people in the Project area in the worst case. Therefore, the land acquisition impact magnitude is predicted as Large.

The vulnerability profile among affected households is considered High in terms of local dependency on land-based livelihoods and the presence of ethnic minority communities. For vulnerable households, losing their land to land acquisition can be perceived as high impact to them as it might not be their intention to sell their land as it is the source of their livelihood as farmers.

The overall impact significance is found Major. It is noted that this significance is assessed for the involuntary land acquisition only.

Table 12.8 Economic Displacement and Loss of Livelihood

Impact Description	Economic Displacement and Loss of Livelihood			
Impact Nature	**Negative**	Positive	Neutral	
Impact Type	**Direct**	Indirect	Induced	
Impact Duration	Temporary	**Short-term**	Long-term	**Permanent**
Impact Extent	**Local**	Regional	International	
Impact Magnitude	Positive	Negligible	Small	Medium	**Large**
Receptor Sensitivity	Low	Medium	**High**	
Impact Significance	Negligible	Minor	Moderate	**Major**

[260] The exact number of households affected by land acquisition could not be determined from the land acquisition documents provided to ERM, especially on the Enclosed confirmation of compensation value for land and assets on land for each slot of land issued by Ia Grai DPC, the land use right owners of several land slots were not identified.

12.5.5 Additional Mitigation and Management Measures

In addition to the existing controls, the following measures are recommended in order to meet international standards:

- Disclose the Community Grievance Mechanism (CGM) that is developed as part of the Stakeholder Engagement Plan (SEP) as soon as it is finalised, to support the local authorities in receiving and addressing land acquisition-related grievances. CGM should be disclosed to the affected communities, including affected ethnic minorities so that the affected community is aware of communications grievance lines and understand how to submit a grievance. Continuously coordinate with local authorities to solve any submitted grievance relevant to land acquisition activities. Train affected communities on the use of the CGM.
- Disclose the SEP to ensure effective Project information disclosure and communication with affected households as well as relevant government stakeholder. Immediate disclosure of the Project update, ESIA findings, land acquisition and CSR policies should be conducted with land affected households through a culturally appropriate communication plan consisting of visual/graphic demonstration (e.g. leaflets, signs, video) and outreach activities (e.g. community events, informed sessions, open houses, meetings).
- Conduct a Land Acquisition Audit (LAA) to identify the gaps between the government-led process, the Project's practice and AIIB and IFC requirements on land acquisition and resettlement and current practices within the project. Specific actions to minimize the gaps in providing appropriate compensation should be recommended and implemented.
- Develop and implement a Livelihood Restoration Plan (LRP) to support the economically displaced households in restoring their livelihoods at least equal to similar level of livelihood condition before land acquisition. The LRP should take the women, poor, and other vulnerable groups into account to ensure improvement of their standards of living to at least national minimum standards, they are not overlooked during Project implementation and left worse off.
- Assist the local community via an Indigenous People Plan (IPP) focusing on affected communities to ensure that local communities who are mostly indigenous peoples can benefit from the project. IPP will include community based development initiatives and programs to support the local communities where the project is located. An IPP would be implemented throughout the Project life.

12.5.6 Residual Impacts

As a result of the implementation of the proposed measures, the economic displacement and loss of livelihood impacts will be reduced to **Moderate**.

12.5.7 Monitoring and Audit

The following monitoring and audit programs are required:

- Creation and maintenance of a Consultation and Grievance record in relation to land acquisition.
- Implement the monitoring as required by the SEP and IPP.

12.6 Construction – Local Employment and Business during the Project Construction

12.6.1 Potential Impacts

The potential impacts on local employment and business during the Project's construction phase are considered as follow:

a. Increase local employment and income;

b. Provide temporary direct employment for the Project and induced employment opportunities by local suppliers;

c. Provide opportunities for small and medium local businesses; and

d. Community discontent due to high expectation in business and worker recruitment.

Baseline information showed that the large proportion of the surveyed population obtained primary and lower secondary education. As such, it can be assumed the education level in the Project area is low, which qualifies people for unskilled work.

The construction is expected to employ approximately 322 workers during peak times through direct hire and subcontractor recruitment. The Project Owner is committed to hiring 213 local people within Ia Grai district including 146 male and 67 female employees. Within the local construction workforce, 62% are unskilled, 22.1% are semi-skilled and 16% are skilled positions. It is foreseen that without training, local people could meet maximum 62% of the required number of local employment for unskilled positions, and to increase the employment opportunities for local people, training should be considered by the Project Owner.

With the high percentage of local workers, the demand for services (e.g. groceries, restaurants, hairdressers, and transport) and induced jobs are predicted not significant increased.

By the end of the construction phase, worker demobilization will occur and only 10 workers are required for operation phase in total. In the worst case, if none of local people satisfy the operation recruitment there will be a significant reduction in local workforce, as a result, will reduce the local community's income, but the skills and experience gained during the construction could remain and increase the job opportunities in other industries nearby for such local workers.

12.6.2 Significance of Impacts

Given the Project Owner's commitment to optimize local employment and procurement, the appearance of the Project would likely bring a positive impact to local communities. However, enhancing measures should be applied to improve positive impact and reduce community discontent due to high expectations to be employed and benefit from Project activities. The Project can give direct benefit to the local economy via tax to the local government. The impact during construction time is categorized as short-term impact as it is 18 months. Given the number of opportunities possibly created by the Project is small compare to the job demand in the locality (213 local workers to be hired among 8,920 unemployed labour from 15 years old and above in Gia Rai district), the impact magnitude is considered small. The sensitivity to economic changes of local people surrounding the Project location is considered high as they did not have a chance to experience with any other nearby industries before. Furthermore, based on high percentage of surveyed individuals not completed secondary education (71.81%)[261], local people might not have education level required for semi-skilled (secondary education) or skilled worker (higher education) .

[261] This statistics were achieved from household surveys conducted in August 2021 by ERM.

Table 12.9 Local Employment and Business during the Project Construction

Impact Description	Local Employment and Business during the Project Construction				
Impact Nature	Negative	**Positive**	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptor Sensitivity	Low	Medium	**High**		
Impact Significance	Negligible	Minor	**Moderate**	Major	

12.6.3 Existing Enhancement Measures

No existing enhance measures in place

12.6.4 Proposed Enhancement Measures

Based on the above analysis, the Project is expected to have a positive impact in terms of employment, procurement, and induced job opportunities and increase the economic conditions of the local people. In order to enhance positive impacts, the following measures are recommended:

- Facilitate employment for local workers (e.g. un-skilled workers and provide adequate training for the tasks to be performed);
- Encourage contractors to hire local labour by the provision of a clear stipulation/commitment of using local labour, particularly in regards to 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;
- Communicate clear information about Project-related employment and business opportunities and prioritize local people wherever feasible. Such communication should be conducted at least two weeks before recruitment so that local people have enough time to prepare for the recruitment process (for example, preparing administration documentation for job application.);
- As locals are more likely to qualify for low-skilled jobs, the Project Owner should negotiate with Contractors to provide detailed requirements on educational qualifications and skills for each job opportunity;
- Work closely with local/relevant authorities to synchronize the Project's needs in terms of local labour as well as locals' capacity;
- Provide grievance mechanism process from the beginning of Project construction process to manage community complaints and expectation on job hiring and purchasing process.

12.6.5 Residual Impacts

With enhancement measures proposed, the impact is expected to remain moderate significance during the period of Project construction.

12.6.6 Monitoring and Audit

The following records are required to be kept:

- Number of local and non-local workers hired
- Type and frequency of information disclosed to community and government on workforce hiring
- Number of grievances received regarding workforce recruitment

12.7 Construction – Impacts on Worker Rights, Occupational Health and Safety

12.7.1 Potential Impacts

There are international regulations (International Labour Organization) as well as Vietnamese national regulations which are in place to set out the conditions of employment, including working hours, occupational health and safety, the protection of wages of employment, the control of employment agencies, and compensation of workers disabled by accidents or disease contracted in the course of their employment. However, in some cases, the lack of understanding and knowledge of these regulations leads to violations of workers' rights and their health and safety.

The construction duration of Ia Pech and Ia Pech 2 wind farms will last for 18 months. Although the nature of wind farm projects do not mobilize large amount of workers in a long time, there are still some potential impacts regarding the workers' rights as well as their occupational health and safety.

Impacts of Project employment on worker's rights

As mentioned above, due to its short construction duration, the Project of Ia Pech and Ia Pech 2 wind farms and its contractors might take into consideration the following potential impacts:

- Lack of awareness on worker's rights and contractual terms (both long-term and short-term contracts);
- Violation of worker's rights encountered by contractors;
- Potential employment of children, forced or bonded labour. This risk is often higher for vulnerable groups (e.g., migrant labour, or labour from ethnic minorities);
- Potential occurrence of unpaid extra working hours
- Potential for discriminatory practices to occur in the hiring process;
- Potential for discrimination against workers that join unions (or other similar organisations) or take part in collective bargaining;
- Inappropriate or delayed payments to workers;
- Unjustified dismissals; and
- Risk of association with contractors (e.g., service contracts) or third parties (e.g., recruitment agents) adhering to relevant laws and international standards and guidance.

Worker's health and safety

Besides the potential impacts to worker's rights, the nature of the Project and its construction activities presents a combined range of health and safety risks. There are some impacts particular to wind farms that might put the Project workforce (including those hired by the Project owner and the contractors) at risks:

Potential risks related to workforce safety include:

- Accidents and injuries: which may occur as a result of construction and transportation activities. Some examples include:
  - Injury/fatality risks associated with over-exertion, slips and falls, work at heights (e.g., excavation, foundation construction, scaffolding, cranes), confined spaces, movement of the vehicle and large mobile plant equipment such as backhoes, bulldozers, graders and mobile cranes;
  - Risk to life and safety due to uploading and unloading super heavy and large equipment such as turbine tower, or blades.
  - Injury/fatality risks associated with transporting super heavy and large equipment (such as turbine tower or blades) in rough terrain;
  - Non-compliance with health and safety programs, poor safety culture, and inappropriate use of worker PPE may place workers at risk of accidents and injuries;
  - A surge in vehicle usage increases the potential for an accident or injury to occur; and
  - Manual handling associated with day-to-day construction activities can result in injuries.

The above is not an exhaustive list of potential risks and hazards but presents examples of the types of activities that could contribute to an accident or injury during construction.

Potential risks related to workers' health:

- Occupational diseases: that are caused or aggravated by exposure to workplace hazards and are often categorised into the following groups - musculoskeletal disorders, mental disorders, noise-induced hearing loss, infectious and parasitic disease, respiratory diseases, contact dermatitis, cardiovascular diseases, and occupational cancer. These diseases often develop as a result of poor working conditions and poor hygiene. Some occupational diseases manifest shortly after exposure, while others take longer to manifest after exposure. Examples include:
- Hearing impairment due to exposure to high noise levels during equipment transport and use of large machinery;
- Respiratory disease due to exposure to dust and reduced ambient air quality; and
- Repetitive work movements which may cause lateral epicondylitis (i.e., tennis elbow);
- Infectious diseases are illnesses caused by a diverse range of pathogens that can be transmitted through means such as:
  - Disease vectors (e.g., mosquitos), which may result in diseases such as dengue fever or malaria;
  - Ingestion of unsanitary food and water, which may result in a parasitic infection or diseases such as salmonella, *E.coli*, and listeria; and
  - Human or pest contact, which may result in diseases such as STI, tuberculosis, influenza and rabies.
  - Workers' may contract infectious diseases via a number of pathways. Examples include:
  - Interactions with local community members, which can expose workers to a range of communicable diseases (e.g., STI, influenza.);
  - Un-hygienic and unsanitary facilities; and
  - Stagnant bodies of water created during the land clearing process, which can create disease vector habitat.

- The global COVID-19 situation is fluid and the duration of the crisis is yet unknown. Potential risks of spreading virus workers, especially from migrant workers from other provinces and countries, are still expected.

Health and safety risks can impact workers in a range of ways – e.g., temporary illness to long-term health impacts. The worst-case scenario would be a fatality, or multiple fatalities, which has occurred in other large-scale developments in Vietnam during the construction phase. It appears that workplace fatalities in Vietnam, particularly in the construction sector, are on the rise. In most cases, the accidents were caused by low awareness and ignorance about occupational safety regulations by employers and employees.

12.7.2 Existing Controls

In the FS report, the risks of workers' health and safety have been mentioned. However, no concrete mitigation controls have been proposed.

12.7.3 Significance of Impacts

In addition to general accidents, injuries and infectious diseases, construction sites often involve activities that generate large amounts of noise and dust, involve repetitive activities, interactions with hazardous substances. Such activities can present potential occupational diseases. Although practices in Vietnam are improving, there continues to be allegations of violations of worker rights in the construction industry. A large number of workforces in the industry are low-skilled with limited awareness of their rights; therefore, poor working conditions, long working hours, and delayed payment of wages violations frequently remain unreported. As such, the vulnerability of the Project construction workforce was considered High. As the number of workers during the construction phase might comprise of both locals, non-locals and expats, the magnitude would be Large as well. Therefore, the overall impact significance of workers' rights, health and safety risks during the construction phase was assessed as Major.

Table 12.10 Impact on Worker Rights, Occupational Health and Safety

Impact Description	Worker Rights and Occupational Health and Safety				
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Magnitude	Positive	Negligible	Small	Medium	**Large**
Receptor Sensitivity	Low	Medium	**High**		
Impact Significance	Negligible	Minor	Moderate	**Major**	

12.7.4 Additional Mitigation and Management Measures

Worker's Rights

- EPC Contractors shall ensure and maintain labour contracts which clearly mention all employee wage and benefits for all workers and ensure that contractual terms are clear to all workers;
- EPC Contractors shall establish employment practices that ensure workers are paid appropriately in accordance with working hours and in a timely manner, informed by national standards and industry benchmarks;

- Project Owner and their EPC Contractors shall comply with Vietnam Labour Code requirements related to the hiring of labour and with applicable requirements from the EHS international guidelines;
- Special attention shall be given to establishing clear contractual agreements through the inclusion of particular clauses between Project Owner and all of their subcontractors to avoid child labour, forced labour, and human trafficking and other violations of human rights;
- EPC Contractors shall establish employment practices to check legal worker's age in identification document upon recruitment to ensure no child labour or forced labour and avoidance of unjustified dismissals;
- EPC Contractors shall establish employment practices that ensure workers are not discriminated against on the grounds of ethnicity, sex, religion, political opinion, social origin, age, marital or relationship status, sexual orientation, or trade union activity. As part of the hiring process, age checks will be conducted;
- EPC Contractors shall ensure workers are made aware of their rights as part of the induction process;
- EPC Contractors should implement a "zero tolerance" policy towards inappropriate behaviour from and amongst the workforce;
- EPC Contractors Ensure workers have a right to join unions;
- Project Owner and EPC Contractors shall establish a grievance mechanism for workers. This should include an option for grievances to be lodged anonymously. All workers, including those employed through the Project's supply chain, should have access to a grievance mechanism to ensure that their issues and concerns are identified and addressed. Contractors should be required to inform the Project about grievances raised.

Occupational Health and Safety

- EPC Contractors shall provide the required PPE to in compliance with the applicable regulations;
- EPC Contractors shall ensure all workers are provided with proper training on health and safety role prior to commencing work;
- Project Owner and their EPC Contractors shall arrange bi-annual health checks for all workers to ensure workers are fit for work;
- Project Owner and their EPC Contractors shall ensure the inspection of critical equipment and their components is conducted periodically;
- EPC Contractors shall establish operation and safety procedure for each equipment and make available for the workers involved;
- EPC Contractors shall ensure that only appropriately skilled and trained employees are assigned to the operation and maintenance of the corresponding equipment and machinery;
- Project Owner and their EPC Contractors shall not encourage working under unfavourable weather conditions such as rain, typhoon, or high heat; and
- EPC Contractors shall perform audits of different subcontractors involved in terms of health and safety topics to ensure these companies comply with the findings and remedial action follow-up;
- EPC Contractors shall establish health and safety internal rules and ensure worker's awareness of these rules;
- EPC Contractors shall ensure day to day compliance with the health and safety requirements (i.e., procedures, equipment usage, PPE usage, demonstration of safe behaviours, competent personnel, compliance with work permit system);

- EPC Contractors shall ensure safety measures are in place before workers perform high-risk tasks, such as working-at-height, loading and unloading of equipment, hot work, electrical works, use of scaffolds and heavy machinery;
- EPC Contractors shall monitor and report health and safety performance through site inspections to all involved subcontractors, using appropriate health and safety metrics, operations auditing as well as senior management review and follow-up in accordance with applicable regulations;
- EPC Contractors shall monitor and report high-risk sites to restrict entry and prevent near misses, injuries and fatalities;
- EPC Contractors shall ensure training programs to adequately include the usage of appropriate PPE, good hygiene practices, awareness of infectious diseases, and the management of risks and hazards in accordance with applicable regulations;
- EPC Contractors shall provide first aid box and competent first-aider at all construction sites and worker's accommodation facilities;
- Project Owner and their EPC Contractors shall conduct medical assessments of workers before they are mobilized to the site, including screening for infectious diseases and other health issues. This is to ensure workers are fit for work;
- Project Owner shall implement a system for selection and management of contractors/subcontractors/suppliers with clear criteria on required environmental and safety management capabilities;
- If worker accommodation is needed, the Project Owner and their EPC Contractors shall develop and implement a Worker Accommodation Management Plan in accordance with local and national regulations and requirements to ensure the well-being of the workforce as well as the health, safety and security of local communities;
- Minimum requirements for the worker's accommodation facilities shall include:
  - Free of charge to workers, meaning that workers do not have to pay if they choose to stay in workers' camp built or owned by the Project Owner or the contractors;
  - Adequate living space for each worker (i.e., minimum space between beds of 1 meter);
  - At least one toilet shall be arranged for every 15 workers;
  - At least one shower/bathroom is provided for each 15 persons;
  - Wastewater, sewage, food and other waste materials shall be adequately discharged in compliance which Vietnam standard;
  - Male and female toilet/shower/bathroom shall be separated;
  - Sanitary, laundry and cooking facilities and potable water;
  - Adequate health, fire safety measures, including first aid and medical facilities;
  - Adequate heating and ventilation; and
  - Non-restrictive to workers' freedom of movement to and from the accommodation.
- Project Owner shall conduct regular audits of workers´ accommodation sites of all involved subcontractors.

12.7.5 Residual Impacts

While Project mitigation measures will help prevent impacts on workers' health and safety, there is the potential for accidents to occur as a result of human error, occupational diseases to occur as a result of work activities/conditions, and diseases to spread. To reduce the impact significance to Moderate (or

Minor), it will be important that the Project Owner's existing policies and procedures (which are designed to protect the health and safety of workers) are implemented and regularly monitored to ensure that the policies and procedures are being effectively implemented.

12.7.6 Monitoring and Audit

Ongoing monitoring of the health and safety practices as well as labour contracts and management will be required to all supply chain involved in the project. This can be conducted through bi-annual audits, particularly of all the involved contractors, to ensure the Project Owner's expectations regarding health and safety practices are being implemented.

12.8 Construction – Impact on Community Way of Life, Health, and Safety and Security due to Construction Activities (Non-influx Issues)

12.8.1 Potential Impacts

Health hazards caused by dust and emissions

Construction activities and vehicles often generate a large amount of dust and emission. Dust is defined as particular matter up to 75µm and comprised both suspended and deposited dust. Particular matter is a mass fraction of airborne particles with an aerodynamic diameter of 10 microns or less.

Dust and emission are one of the risk factors for respiratory illnesses which affect the lungs and other parts of the respiratory system, and can either be acute or chronic in nature. Exposure to these air pollutants can increase the susceptibility to and exacerbate the health effects of both acute and chronic respiratory illnesses.

Patients with respiratory diseases as asthma, Chronic Obstructive Pulmonary Disease (COPD), or lung cancer when exposing to air pollutants (such as PM2.5) emitted from transportation vehicles during construction phase can endure negative health impacts. In addition, exposure to a short-term increase in PM2.5 is linked to the development of acute lower respiratory infection (ALRI) in young children, as well as additional doctor visits.

Besides, particular matter, emission such as O_3, SO_2, and NO_2 also contribute to increase health risks in human. According to WHO, the possible health risks caused by above-mentioned emission are as follows:

- Excessive ozone can cause breathing problems, trigger asthma, reduce lung function and cause lung diseases.
- Epidemiological studies have shown that symptoms of bronchitis in asthmatic children increase in association with long-term exposure to NO2.
- SO2 can affect the respiratory system and the functions of the lungs, and causes irritation of the eyes. Inflammation of the respiratory tract causes coughing, mucus secretion, aggravation of asthma and chronic bronchitis and makes people more prone to infections of the respiratory tract. Hospital admissions for cardiac disease and mortality increase on days with higher SO2 levels.

Health hazards caused by noise

According the WHO, community noise which include noise emitted from all sources such as road, rail and air traffic; industries; and construction and public work. Noise pollution can cause adverse health impacts such as sleep disturbance, annoyance or hearing impairment. Below are some possible health hazards caused by noise pollution presented by WHO.

- *Hearing impairment* is typically defined as an increase in the threshold of hearing. Hearing deficits may be accompanied by tinnitus (ringing in the ears). Hearing impairment is not expected to occur at LAeq, 8h levels of 75 dB(A) or below, even for prolonged exposure.

- *Speech intelligibility* is adversely affected by noise. Most of the acoustical energy of speech is in the frequency range of 100–6000 Hz, with the most important cue-bearing energy being between 300–3000Hz. Speech interference is basically a masking process, in which simultaneous interfering noise renders speech incapable of being understood.
- *Sleep disturbance* is a major effect of environmental noise. It may cause primary effects during sleep, and secondary effects that can be assessed the day after night-time noise exposure. Uninterrupted sleep is a prerequisite for good physiological and mental functioning, and the primary effects of sleep disturbance are: difficulty in falling asleep; awakenings and alterations of sleep stages or depth; increased blood pressure, heart rate and finger pulse amplitude; vasoconstriction; changes in respiration; cardiac arrhythmia; and increased body movements. For a good night's sleep, the equivalent sound level should not exceed 30 dB(A) for continuous background noise, and individual noise events exceeding 45 dB(A) should be avoided.
- *Mental Illness*. Environmental noise is not believed to cause mental illness directly, but it is assumed that it can accelerate and intensify the development of latent mental disorders. Studies on the use of drugs such as tranquillizers and sleeping pills, on psychiatric symptoms and on mental hospital admission rates, suggest that community noise may have adverse effects on mental health.
- *Social and Behavioural Effects of Noise; Annoyance*. These effects are often complex, subtle and indirect and many effects are assumed to result from the interaction of a number of non-auditory variables. Noise above 80 dB(A) may also reduce helping behaviour and increase aggressive behaviour.
- *Health effect on vulnerable group* are people with particular diseases or medical problems (e.g. high blood pressure); people in hospitals or rehabilitating at home; people dealing with complex cognitive tasks; the blind; people with hearing impairment; fetuses, babies and young children; and the elderly in general. People with impaired hearing are the most adversely affected with respect to speech intelligibility. Even slight hearing impairments in the high-frequency sound range may cause problems with speech perception in a noisy environment.

Vector-borne diseases caused by stagnate water in the construction site

Potential increase in vector-borne (such as Dengue infection, Malaria) and other zoonotic diseases are associated with earth moving activities, habitat disturbance, and possible stagnant water creation (i.e., mosquito breeding sites) during construction.

Construction site is often place for accumulation of stagnant water which is a favourable conditions for mosquitoes breeding. Open water containers, store building and/or any receptacles that can hold water in the construction site can increase mosquitoes in the nearby areas. In additions, in the construction area, when water is contaminated with organic matter (such as organic waste, grass, leaves), it is high chance for mosquito larvae to survive and increase the number of mosquitoes. Most of construction workers will work outdoor which is one of the risk factors for them to be bite by mosquitoes. The immigrant workers may carried relate pathogen (such as DENV virus, malaria-related parasites, and other pathogen) to the local. There is no vaccines for dengue infection available in Vietnam and Vietnam is still one of the dengue infection hot spots. Meanwhile, malaria's prevention and treatment programs have been effective in the country with the sharp decline in number of cases the recent years.

Health hazards due to lack of proper hazardous and non-hazardous waste management

Waste generated during construction activities include, but not limited to, concrete, forming and framing lumber, steel, bricks, wires, paint, and products containing mercury. These kinds of waste, both hazardous and non-hazardous ones, can be harmful to the local people's health if not well-managed.

There is also a potential increase in non-communicable diseases (such as cancer) from exposure to left-over chemical hazards during construction activities. Using recycled big paint containers and drum

as household tools are very common in rural areas of Vietnam, especially in the areas where water is scared. The recycled items can be used as domestic water containers or food containers which might lead to non-communicable diseases such as cancer if they locals recycled the containers in the long time.

12.8.2 Existing Controls

Although the possible health hazards were identified in the FS report, no mitigation measure has been proposed.

12.8.3 Significance of Impacts

Impact magnitude

Within the scope of this ESIA, no calculation related to dust and emission which was generated from the construction activities was conducted. It is noted that earthwork and construction activities occur mainly at the site preparation and construction foundations, internal roads, poles of the transmission line. These areas are scattered around the project area and can be considered as individual sources. Additionally, the construction time of Ia Pech and Ia Pech 2 wind farms is reported in a short-term of 18 months, the estimated amount of dust and emission from construction activities is likely not significant. The magnitude of the impact can be rated as small as a result.

Regarding the noise impact, section 10.1 (Noise and Vibration Impact Assessment) assessed the magnitude of noise impact during construction phase as small. Noise from construction activities comes from different sources such as: site preparation, construction and installation works associated with each of the turbines, site preparation and building construction works associated with any permanent facilities, construction and installation of the internal electrical network and associated transmission lines; and the use of specialised (e.g concrete batching plants) or unforeseen wind farm construction equipment, or any activities that are to be undertaken.

Related to the risk of infectious diseases, as mentioned above, the construction of Ia Pech and Ia Pech 2 wind farms will last only 18 months, the magnitude of impact related to infectious disease due to creation of stagnate water from construction activities will be small.

In terms of impact of health hazards associated with hazardous and non-hazardous waste management, section 10.3 assessed the magnitude of impact of solid waste within this project is small. As such, the magnitude related to human health is also considered small.

Receptor Vulnerability

From the satellite imagery, it is observed that residential areas are located surrounding the Project components and some structures are identified close by within 300m from each turbine foundation (Figure 12.3). These households and the structures with people living in, will be the receptors for impacts of noise, vibration, dust and emission, and waste generated from the Project construction activities. The nearest identified sensitive receptor is only approximately 19 m away from WTG E22. Vulnerability of these receptors in conjunction with health and safety impact due to construction activities is predicted from high to medium depending on what impact they will receive. According to noise and waste impact assessment sections, the vulnerability of the receptor is high and medium, respectively.

All the impacts are considered direct, negative, local within the short term of the construction phase. Overall significance ranking is considered moderate.

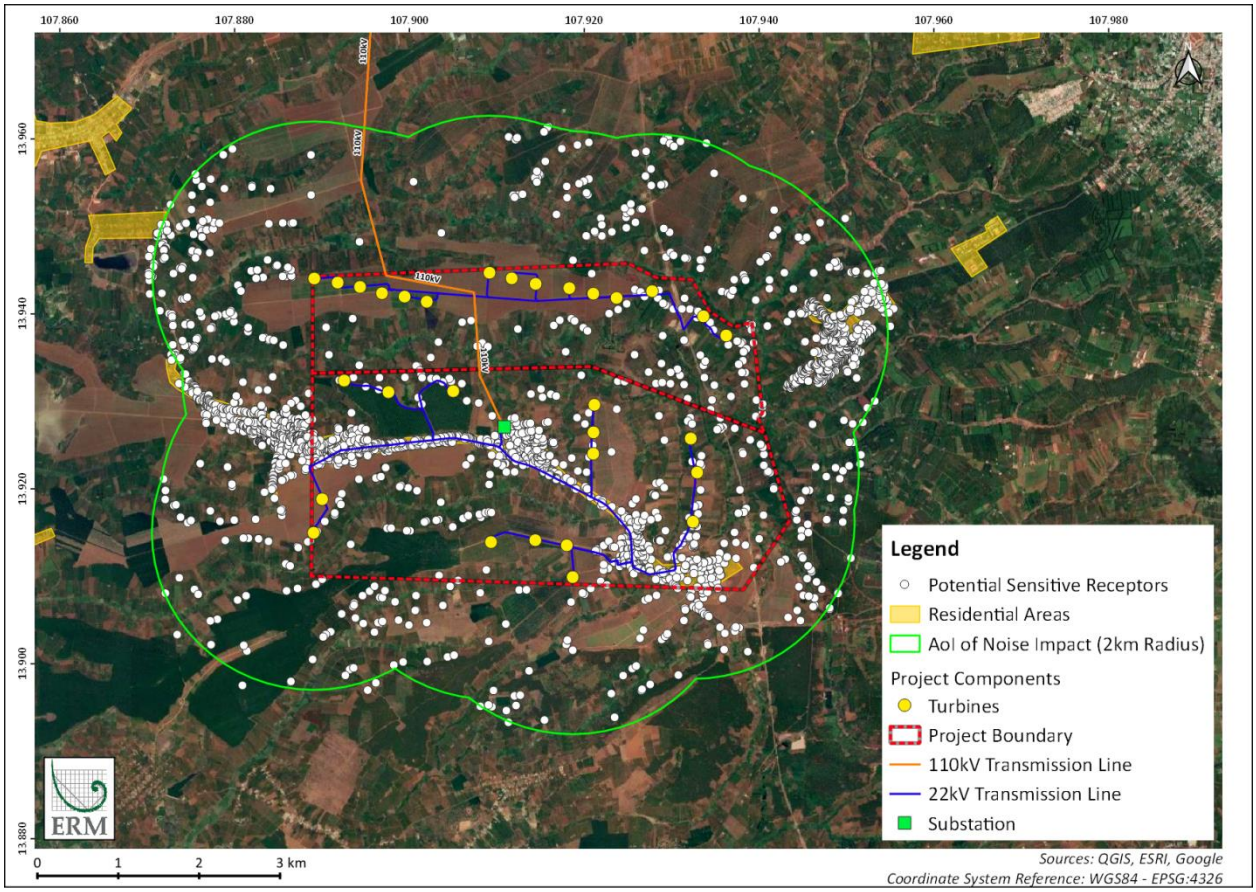


Figure 12.3 Potential Sensitive Receptors within and Residential Areas nearby the Project

Table 12.11 Significance of Impact Related to Community Way of Life, Health and Safety and Security due to Construction Activities (non-influx issues)

Impact Description	Community Way of Life, Health, and Safety and Security due to Construction Activities (Non-influx Issues)				
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptor Sensitivity	Low	**Medium**	**High**		
Impact Significance	Negligible	**Minor**	**Moderate**	Major	

12.8.4 Additional Mitigation and Management Measures

For health hazards caused by dust and emission:

- The Project should have a traffic management plan to manage all the traffic activities. This plan should be strictly applied by the Project and its contractors. Some suggestions for plan include:

All the vehicles should be washed before entering and existing the Project site.

Vehicles which carry construction material such as sand or soil should be covered with carefully to refrain from falling out during transportation.

Vehicles should be regularly checked for emission in accordance with the related national standards and regulations.

Vehicles which are too old or do not meet the related national standards should not be used.

- The Project should establish a system to receive feedback from the local on the related issues and take necessary measurements once incidents happen (see more in Stakeholder Engagement Plan).

For health hazards caused by noise

- Drivers should be trained about the traffic safety and their compliance should be monitored and evaluated regularly.
- Vehicles should not be allowed to use horn at the residential, hospital, school, and market areas.
- Transportation of material and equipment should only be done in day time, except for the rush hours.
- The Project should work closely with the local authority to manage the transportation time

For management of hazardous and non-hazardous material

- Additional mitigation measures suggested in waste management section (section 10.3)
- The Project and its contractors should have a clear and detailed waste management plan. Waste, both hazard and non-hazardous ones, should be classified and treated in accordance with the related national standards and regulations. It is advised that the Project should work with a professional waste collector company to ensure that the waste will be properly collected, transferred, and treated.
- The Project should disseminate information (via leaflet or bulletin) on the health risks caused by exposing with construction waste among workers and local people. The Project can collaborate with local authority (local communal PC or district CDC) regarding this matter.

12.8.5 Residual Impact

With all the additional mitigation measures applied, the residual impact is assessed at minor.

12.8.6 Monitoring and Audit

For management of dust and emission from vehicles used in the construction activities:

- Imposing speed limit to trucks and other vehicles wherein the vehicles must not exceed 10 km/h within the project boundary;
- Arranging wheel washing facilities at site exit where heavy trucks are washed before leaving the site;
- Planning traffic routes inside project boundary to minimize the movement of vehicles over the areas of construction, stockpiles and other exposed soils by applying the traffic control management plan;
- Covering trucks during the transportation of construction materials.

For management of solid waste:

- Solid waste management monitoring should follow recommendations mentioned in section 10.3-Solid Waste Management Impact Assessment.

For management of noise and vibration:

- Noise monitoring and audits should follow recommendations mentioned in section 10.1 - Noise and Vibration Impact (Monitoring and audits for noise impact during construction phase)

12.9 Construction – Impact on Community Way of Life, Health, Safety and Security due to the Presence of Influx

12.9.1 Potential Impacts

Increasing of infectious diseases

Impacts on community health related to influx during the construction phase can be associated with infectious diseases as migrant workers can bring these diseases to the local community. Some common communicable diseases in this case includes:

- STIs and HIV/AIDS. The majority of construction workers may consist of male due to the nature of the work. The construction workers may come from different parts of the countries and may bring with them various STIs' pathogen.
- Respiratory infectious diseases. Those diseases may include, but not limited to, tuberculosis (TB), and COVID-19 of which Vietnam has high prevalence. Local community may contract these diseases when contacting with workers from the Project.
- Vector-borne diseases. Influx of workers may introduce pathogen, which causes dengue infection and malaria to the areas.

Pressure on local health facilities

Increase burden on local health and emergency services due to presence of immigrant construction workforce and likely associated influx.

- The workforce for construction activities of the Project will probably associate with their family which will increase the population of the commune during the construction phase.
- This might increase put pressures on the current health facilities in AoI considering all the health impacts mentioned above.

Pressure on local safety and local governance

The Ia Pech and Ia Pech 2 wind farms will last for around 18 months (from June 2020 to November 2021). During ERM scoping visit, it is confirmed that no accommodation for construction workers will be provided. Given the heterogeneous of ethnicities in Ia Pech commune, the influx can affect the safety and security of local people in the following ways:

- Dense concentration of workers around large construction projects can promote the use of alcohol, narcotics, and commercial sex in the local area.
- The influx of construction workers who come from different parts of the country might trigger cultural conflict with the local, especially local ethnic minorities in this case. This might lead to increasing of violence among the community.
- Those incidents related to insecurity and safety can cause associated stress and anxiety among the local people.
- These will put pressure on the local police and government for the safety and security governance.

12.9.2 Existing Controls

No existing controls were mentioned in any documents provided by the Project.

12.9.3 Significance of Impacts

- The impact nature is Negative as it might lead to the above-mentioned consequences.
- The impact type is Direct and the duration is Short-term (only during the construction phase)
- The migrant workers might seek accommodation among community near the construction site. Thus, the impact is considered to affect community in Ia Pech commune and surrounding communes where most of the project component, turbines, substations, access road and part of the transmission lines are located.
- The impact magnitude is assessed at Medium as the number of construction workers required for wind farms is rather small compared to other industrial projects. In addition, the construction time is rather short compared to other power plant projects (18 months).
- Based on the results of the baseline study, in Ia Pech commune, there is only one health facility at communal level (the Communal Health Station). The health station has only four staff with limited equipment for emergency service. Ia Pech commune recently had some recurrent cases of diphtheria (02 cases in 2020) which had not detected in the country for a long time. The vulnerability of receptors, as such, is assessed at high.

Table 12.12 Impact on Community Way of Life, Safety, and Security due to the Presence of Influx

Impact Description	Community Way of Life, Health, Safety and Security due to the Presence of Influx				
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low	Medium	**High**		
Impact Significance	Negligible	Minor	**Moderate**	Major	

12.9.4 Additional Mitigation and Management Measures

For diseases prevention

- The Project should work with the Ia Grai district health center as well as Ia Pech communal health station to support their current programs on control and prevention of vector-borne diseases such as: mosquito disinfection spraying, providing disinfected bed-nets, and other health promotion on preventions of the diseases. In case if the impacts could affect other communes, the Project should solicit support from Gia Lai Department of Health to identify the communal health units that might support the mitigation measures.
- Mosquito disinfection spray should also be conducted inside the Project construction site.
- The Project should also promote information on the diseases prevention measures (such as eliminating mosquito breeding sources, using bed nets and mosquito's repellent, keeping a hyenic environment) to all construction workers.

- The Project should design staff to conduct weekly inspection to tide up the construction site to avoid any accumulation of stagnant water and ensure the sanitation and hygiene of the construction site.
- The Project should work with the Ia Pech communal health station, the Ia Grai district health center and/or Gia Lai provincial CDC to support their current health promotion programs on STIs and HIV/AIDS. These programs should be promoted among the construction workers as well as local people before and during the commencement of the project.
- The Project should have a code of conduct for construction workers. This code of conduct should set ethical standard and behaviour expected from the workers and also include non-discrimination work policy toward STIs and HIV infected people. Some recommendations for the non-discrimination work policy includes:
  - No mandatory HIV screening of workers or job applicants.
  - Ensure strict confidentiality related to HIV testing and HIV status of workers.
  - No dismissal of workers due to HIV.
  - Prevention and protection of workers living with HIV against harassment.
  - Provide education and awareness raising services to workers.
  - Provide psycho social support and counselling for workers and their families living with HIV/AIDS

For strengthening the local safety

- The Project should equip their workers with information on the local regulations and laws as well as cultural norms. Information could be disseminated through handbooks (or could be in workers' policies book) distributed to workers when they arrive for the construction phase. Culturally appropriate behaviours should be included in the worker code of conduct.
- Local police and emergency service numbers should be distributed to workers.
- The Project could work with the Ia Pech Communal People's Committee to disseminate general information on the Project to the local people. The transparency in providing information will help gain trust from the local people.
- The Project should have a clear grievance mechanism for the community to log their complaints about security issues and a clear policy of how these complaints should be logged (see Stakeholder Engagement Plan).

12.9.5 Residual Impacts

With the strictly implication of additional mitigation measures, the impact could be assessed at Minor.

12.9.6 Monitoring and Audit

Monitoring and audit can be done through monthly reports of the local Communal Health Station and local Communal People Committee. The Project should work closely with local authority to monitor the situation of local health and safety during the construction phase.

12.10 Construction – Impact on Traffic Safety due to Increased Transportation Volume

12.10.1 Potential Impacts

The traffic safety assessment considers the potential effects of construction traffic on the road network within the vicinity of Ia Pech and Ia Pech 2 Wind Farm on the following aspects of traffic and transportation:

- The capacity of the existing road network to accommodate the traffic volumes generated by the Project; and
- Transportation safety on public roads due to Project-related traffic.

The key activities that are likely to have negative impacts on the local infrastructure and traffic safety include:

- Transport of equipment (turbines, transmission line components and other construction materials) from Nam Van Phong and Phu My port to the Project site; and
- Daily movement of construction workers.

According to the information provided by the Project Owner, the principal components (i.e. the oversized pieces, which were defined as heavier than five tons and as larger than the standard size would be transported, such as piles, nacelles, rotor blades, wind turbine generator towers and other oversized equipment) were planned to be imported by ship from overseas specialist manufacturers. Upon arrival in Vietnam, the equipment would be imported via waterway route to Nam Van Phong port in Khanh Hoa province or Phu My port in Ba Ria Vung Tau province. The components will be temporarily stored at the ports and then transported to the site location via following routes:

- For Nam Van Phong port: National Road 26 → National Road 1A → Tran Quy Cap street → National Road 26 → DT31 Road → National Road 29 → National Road 14 with a travel distance of approximately 290 km. Figure 12.4 shows the intended transportation route from Nam Van Phong port to the Project site.
- For Phu My port: Tran Hung Dao street → National Road 51 → National Road 1A → Thien Tan street → DT768 Road → DT746 Road → HL416 → HL502 → DT741 → National Road 14 → Unknown Road → National Road 14 with a travel distance of approximately 542 km. Figure 12.5 shows the intended transportation route from Phu My port to the Project site.

The Project Owner could not confirm the above traffic routes because at the time of compiling this report, they had not established a traffic management plan for the transportation of the principal components. The above routes were predicted and assessed by ERM based on the assumption that the oversized pieces would be transported by overweighed and oversized load trailer trucks[262].

[262] The definition of overweighed and oversized load trailer trucks is regulated in Chapter IV, Article 12 of Circular No. 46/2015/TT-BGTVT

Available at: https://thuvienphapluat.vn/van-ban/Giao-thong-Van-tai/Thong-tu-46-2015-TT-BGTVT-tai-trong-kho-gioi-han-luu-hanh-xe-qua-tai-trong-qua-kho-gioi-han-duong-bo-290003.aspx

Access date: 17 September 2021

Figure 12.4 Equipment Transport Route from Nam Van Phong Port

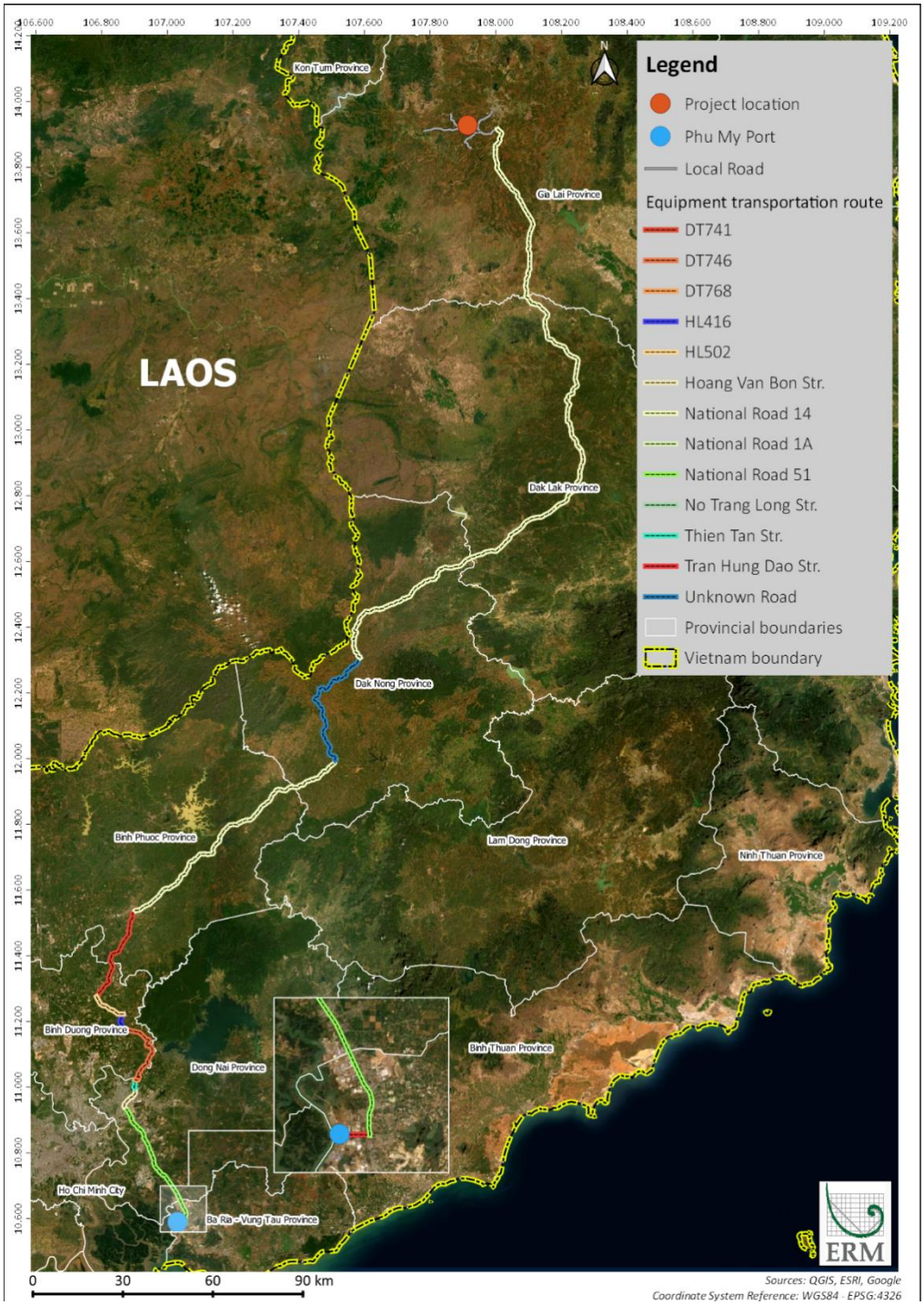


Figure 12.5 Equipment Transportation Route from Phu My Port

Materials/equipment, including transmission tower parts, would be delivered to the onshore construction sites by truck, using the transportation route as described in Figure 12.4 and Figure 12.5 as well as the Project-specific local access roads. Routing would be selected to avoid passing through villages where practicable. Currently, the Project land use, including the substation and transmission line, is mainly agricultural land. The area is sparsely populated, with arterial roads passing through and connected to National Road 14. It is noted that at the time reporting, the Safety Transportation Management Plan and Traffic Management Plan for the Project have not been available yet.

There are 213 workers hired from Ia Pech and other communes in Ia Grai district together with 109 workers hired in Gia Lai province (e.g Pleiku city) for the construction phase. All of them will be required to use the National Road 14 [**Client to confirm this information**] and access road for daily transportation since there are no worker camps built for the Project. In the absence of shuttle buses, a large number of personal motorcycles/cars are likely to circulate in and out the site every day. This may result in an increase in the risk of accidents and damage to the National Road 14 during the 18 months of construction. The precise extent of this impact will depend upon the location of off-site accommodation for workers. Accordingly, the impact of increasing daily movement of project workers compared to ordinary traffic movement is anticipated significant since the total number of worker in the construction phase is about 322.

As such, a cumulative increase of heavy trucks presence is likely to pose potential impacts to Ia Pech, Ia Kha, Ia Hrung and Ia Der commune in terms of:

- Degradation of the public road infrastructure and network due to heavy load vehicle and worker daily movement;
- Traffic congestion due to an increase of traffic movement; and
- Increase of local traffic incidents.

12.10.2 Existing Controls

Existing controls proposed in the FS are as follows:

- Obtaining licence from the Vietnam Registry Department for the means of transport used for the project;
- Installing temporary barriers made of plastic or corrugated iron at the construction site near residential areas and roads;
- Ensure the truck carrying construction materials is not overloaded. For oversized and overloaded machinery and equipment, there must be a separate transport vehicle to avoid damaging the road; and
- During the construction phase of the Project, existing roads will be utilised to transport materials and equipment. If damage or deterioration of roads occurs due to the construction process of the Project, the Project Owner is responsible for repairing, restoring and returning the original condition to ensure the circulation of people.
- Also, a Stakeholder Engagement Plan (SEP) including a Community Grievance Mechanism (CGM) has been developed within this ESIA package.

12.10.3 Significance of Impacts

As stated in Section 12.10.1, even though the Project is in construction at the time of this reporting the Safety Transportation Management Plan and Traffic Management Plan of the Project are currently not available. In the absence of a local EIA which is not required for this Project, the number of truck's movements per day for the whole construction period and during the peak time for construction materials and equipment is also not available in the FS. However, the transportation period is to occur over a 18 month period, which is considered short in terms of impact duration.

Regarding road infrastructure, the wind turbine equipment, cranes, and accompanying parts are normally transported by super-length and super-heavy trucks, which cause potential damages of road and bridge deterioration along the transportation routes. The source of traffic congestion and delays will be the movement of oversized turbine components. Heavy trucks will likely move slower than a typical vehicle, particularly at bends or intersections. Based on the observation from the site survey, it is noted

that the Project area is connected with the National Road 14, which are completely asphalted and the widths of those roads are quite large.

As such, Project impacts to traffic density and road infrastructure as a result of increased vehicle movement during the construction phase were assessed as Moderate significance. Impact duration was considered a Short-term effect to users of this road during the turbines and material transportation period. The magnitude was assessed as Medium considering that the wide national roads and inter-communal roads have already experienced heavy truck traffic. Given the Project Area located nearby the national road, it can be predicted that the receptor is experience the heavy traffic and potentially aware of traffic safety. However, there are no other industries surrounding the Project, the sensitivity of the receptor was assessed as Medium.

Table 12.13 Impacts on Traffic Safety due to Increased Transportation Volume

Impact Description	Impacts on Traffic Safety due to Increased Transportation Volume				
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
Impact Extent	**Local**	Regional	International		
Frequency	Frequent over 18 months of the construction period.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low	**Medium**	High		
Impact Significance	Negligible	Minor	**Moderate**	Major	

12.10.4 Additional Mitigation and Management Measures

The Project Owner should implement the following additional measures to manage the potential negative impacts associated with increased traffic volume from construction activities:

- EPC Contractors shall schedule deliveries to the site so that disruption to local amenities and traffic is minimized;
- EPC Contractors shall disclose to the local authority and community the transportation plan including the time and route of the large and heavy equipment transportation prior to the transportation;
- EPC Contractors shall ensure all trucks are inspected regularly and carefully to ensure safety;
- EPC Contractors should train drivers on traffic safety and regulations. Driving under influence (DUI) is strictly prohibited;
- EPC Contractors shall install speed limit signs within the Project area and the external routes;
- EPC Contractors shall provide warning lights during movement at night;
- EPC Contractors shall plan a drive-through site to eliminate the need for vehicles to back up and ensure that mobile equipment backup alarms are audible above ambient noise levels;
- EPC Contractors shall establish designated pedestrian routes through worksites and use signs to indicate them;

- EPC Contractors shall prevent unauthorized workers or bystanders from entering a danger zone; when appropriate, install barricades and signs around the danger zone;
- EPC Contractors shall assign a flagman at the conjunction between the National Road 14 and the access roads to coordinate trucks entering the Project site;
- Project Owner shall inspect transport routes before movement, avoid roads with high risk of erosion;
- Project Owner and their EPC Contractors shall coordinate with Ia Pech commune Peoples Committee to organise the traffic in and near Project site when necessary;
- Project Owner and their EPC Contractors shall develop and implement a Safety Transportation Management Plan and Traffic Management Plan, especially focusing on the management of transportation plan for oversized and overweighed load trailer trucks in according with Circular No. 46/2015/TT-BGTVT

12.10.5 Residual Impacts

As a result of implementation of proposed additional measures, the residual impact is expected to be Minor.

12.10.6 Monitoring and Audit

Monitoring and audits are also required to be conducted in accordance to the schedule proposed in the Safety Transportation Management Plan and Traffic Management Plan.

12.11 Operation – Positive Impact on Local Employment and Community Development

12.11.1 Potential Impacts

During the operational phase, the local economy will be positively influenced by an increase in taxation revenue of the Province, and demand for materials and services. It is expected that the Project will employ 10 employees for the wind farm operation, and all of them will be recruited from Ia Grai district. Most of the labourers during the operation phase will be skilled labourers (comprise of 60% of total employees) and thus, to satisfy the local employment expectation, the Project Owner should consider training local people.

With the presence of an industry in the locality, in addition to local employment, the Project would benefit the local community with its corporate social responsibility activities and ethnic minority development programs as suggested in this ESIA.

12.11.2 Existing Enhancement Measures

No existing enhance measures in place

12.11.3 Significance of Impacts

Given the Project Owner’s commitment to optimise local employment and procurement, and community development, it is therefore very likely that the Project would positively impact local communities. The Project Owner is expected to have small contribution to the community in long term with the Project's lifetime of 20 years. However, the positive impact cannot be achieved without enhancing measures since the proportion of local workers hired accounts only 0.1% of unemployed local population and could create community discontent due to high expectations to be employed and benefit from Project activities. With experience about the Project benefits, such as local employment, during the construction period, the receptor sensitivity could reduce to medium. The local people may have the awareness of

the recruitment procedure of the Project and understanding of the requirements for working in an industry. Overall, the Project would bring a minor benefit to the local community and economy.

Table 12.14 Local Employment and Community Development during the Project Construction

Impact Description	Local Employment and Business during the Project Construction				
Impact Nature	Negative	**Positive**	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptor Sensitivity	Low	**Medium**	High		
Impact Significance	Negligible	**Minor**	Moderate	Major	

12.11.4 Proposed Enhancement Measures

In order to further enhance positive impacts associated with the Project, the following additional measures are recommended:

- Facilitate employment for local workers (e.g. un-skilled workers and provide adequate training for the tasks to be performed).
- Communicate clear information about Project-related employment and business opportunities and prioritize local people wherever feasible. Such communication should be conducted at least a month before recruitment so that local people have enough time to prepare for the recruitment process (for example, preparing administration documentation for job application.)
- Provide vocational training to maximise the job opportunities for local people in the Project;
- Implement activities to contribute to community development, especially for the ethnic minority community;
- Continue to disclose the Project grievance mechanism process during the Project operation to manage community complaints and expectation on job hiring and purchasing process; and
- Develop an Indigenous Peoples Plan (IPP) for local community as well as Indigenous Peoples..

12.11.5 Residual Impacts

With enhancement measures in place, the impact expected to stay at minor significance during the period of Project operation.

12.11.6 Monitoring and Audit

The following records are required to be kept:

- Number of local and non-local workers hired
- Type and frequency of information disclosed to community and government on workforce hiring

- Number of grievances received regarding workforce recruitment;
- Feedbacks obtained from community regarding positive impacts of the Project;
- The monitoring report of IPP implementation.

12.12 Operation – Health and Safety Impacts and General Disturbance to Local Community

12.12.1 Potential Impacts

Wind turbines emit a relatively weak but characteristic noise. The noise is mainly generated by the movement of the blades through the air. This produces a swishing sound in rate with the rotation of the blades, as well as noise from the turbine machinery.

Noise from different levels can cause several health hazards from mild to serious. Research and literature have proven some possible health effects of the induced noise vibration.

- Noise annoyance: according to research and studies, the relation between wind turbine sound and annoyance can be compared with those for road, rail and aircraft sound. Some studies found that wind turbine sounds described as ‘swishing’, ‘lapping’ or ‘whistling’ were more annoying while the least annoying sounds were described as ‘grinding’ and ‘low frequency’. Whether the type of environment affects the levels of annoyance is not yet clear. It can be assumed that people in rural areas are more likely to hear and see wind turbines than in more built-up urban areas with more buildings and a less open view.
- Sleeping disturbance: Sound is one of the factors that can disturb sleep or affect the quality of sleep. Several biological reactions to night time sound from different sources have been described in the literature: increased heart rate, waking up, difficulty in falling asleep and more body movements during sleep. It is conceivable that the relatively small but frequently occurring sound peaks just above the threshold for sleep disturbance due to the rhythmic character of wind turbine sound cause sleep disturbance. An increase in sound level above 45 dBA increased the probability of awakening. According to the WHO, sleep disturbance can occur at an average sound level at the facade at night of 40 dB and higher.

The operation of the turbines also results in the alternating changes in light intensity that can occur at times when the rotating blades of wind turbines cast moving shadows on the ground or on structures. There have not been a strong linkage between concrete health effects and shadow flicker from wind farms. However, there are a few possible health effects mentioned in the literature such as nausea, dizziness, and disorientation. Yet, there are still limited research evidences to prove the link between shadow flickers of wind farms with those health hazards. The health impact to the community due to shadow flicker is detailed in Section 10.6-Shadow Flicker Impact Assessment and will not be repeated here.

12.12.2 Existing Controls

There is no existing control regarding this impact.

12.12.3 Significance of Impacts

The impact has negative and direct. It will be long-term as it would last during the operational phase. Noise modelling for the Project’s operational phase which performed in the worst-case scenario assess the magnitude impact of large (section 10.1). At the time of this ESIA, there is no validation survey of affected households within the safety zone. Therefore, the number and the situation of the households in the affected area is unknown. It is important that the Project should conduct a validation survey to identify the exact number and situation of the affected households to have details of their vulnerability.

The assessment of receptor vulnerability, at this point of time, is assessed at high assuming the worst scenario. The overall significance ranking is major.

Table 12.15 Impact of Health and Safety and General Disturbance to Local Community (Noise)

Impact Description	Health and Safety and General Disturbance to Local Community				
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Magnitude	Positive	Negligible	Small	Medium	**Large**
Receptor Sensitivity	Low	Medium	**High**		
Impact Significance	Negligible	Minor	Moderate	**Major**	

12.12.4 Additional Mitigation and Management Measures

The Project should follow additional mitigation and management measures for noise and vibration and shadow flicker impacts at operational phase suggested in Section 10.1 and 10.6.

12.12.5 Residual Impacts

As identified in section 10.1, residual impact is still considered as major and the Project's owner shall be responsible for applying the mitigation measures and re-assessing the implementation to ensure that the noise level at the potential affected receptors is met the permissible threshold of national and international standards.

12.12.6 Monitoring and Audit

Monitoring and audit plans and tools should follow recommendations in Noise Impact Assessment (section 10.1)

12.13 Operation – Relocation Impact Due to Health and Safety Reason

12.13.1 Potential Impacts

Potential relocation impact due to health and safety reason is assessed based on the assessment of impacts of noise and vibration, blade throw and shadow flicker. From the assessment of noise and vibration, any people living within the radius of 300m will be the receptors of the significant noise. Additionally, in accordance with national regulation (Circular 02/2019/TT-BCT), the households residing within a radius of 300m from the turbine ground may be exposed to health and safety risks. Additionally, the required setback distance for each turbine of the Project is 288m as required by IFC EHS Guideline for Wind Power. In this case, the more stringent requirements will be applied, hence the safety buffer zone will be defined as 300m. There are no specific requirements for what activities are allowed within the safety zone under Vietnam regulation and IFC guidelines. However, given the setback distance is required to maintain the public safety any activities required the local people to stay whole day long within the safety zone, such as living, which could increase the likelihood of the risk should be avoid.

From the satellite imagery based study, there are 103 receptors potentially impacted by the noise and blade throw when the Project is in operation phase. However, it is noted that these are identified based on satellite imagery only, further investigation with a validation survey should be conducted to confirm

the number of households, exact locations of the affected households, socio-economic situation of the affected households. The results from validation survey will confirm the likelihood and magnitude of the relocation impact.

Given that the project is already in the construction phase, and that the turbines have been site certified, as warranted by the manufacturer, significant modifications to the foundations and structures is not feasible and unlikely to be required. Therefore, either if any households are identified within the safety buffer zone as the result of the validation survey they should be subject to the relocation or the Project Owner to focus on increased inspection and monitoring activities, where relocation of affected households is not possible. It is noted that given the relocation of the affected households, if any, is not managed by the local authority nor governed by the Vietnamese regulations and laws, the relocation should be implemented based on a consultation and good faith negotiation between the affected households and the Project Owner.

12.13.2 Existing Controls

There are no existing controls for this impact.

12.13.3 Significance of Impacts

The nature of the impact is negative and direct as affected people may be exposed to health and safety risks. It will be permanent as it may happen during the operational phase. The impact is assessed at local level considering the number of households might be affected by the noise, shadow flicker and blade throw (Figure 12.6 shows possible receptors under AoI of noise, shadow flicker and blade throw). As the majority of the households in Project's site is ethnic minorities, the vulnerability profile among affected households can be said to be high as they are an ethnic minority and many of them have low illiteracy (with highest literacy of upper secondary school) with limited skills to change their job but still manage to gain enough income to pass the poverty income rate.

It is recommended that the Project conduct a validation survey to confirm the number and existing situation of affected households. Depending on the results of the survey, possible next steps will be proposed. The magnitude of the impact, in this case, might range from high to medium. It would be high if relocation is required as it will disturb the existing livelihood activities of the affected people. This disturbance could be temporally for those have surplus land and are able to be in-situ resettlement, or permanently for those have no either surplus land nearby or other place/house to relocate to. However, the relocation will not cause permanent agricultural land loss and physical displacement due to no land acquisition to occur. In summary, the overall significance of impact is likely to be within Moderate to Major and subject to be verified via a validation survey.

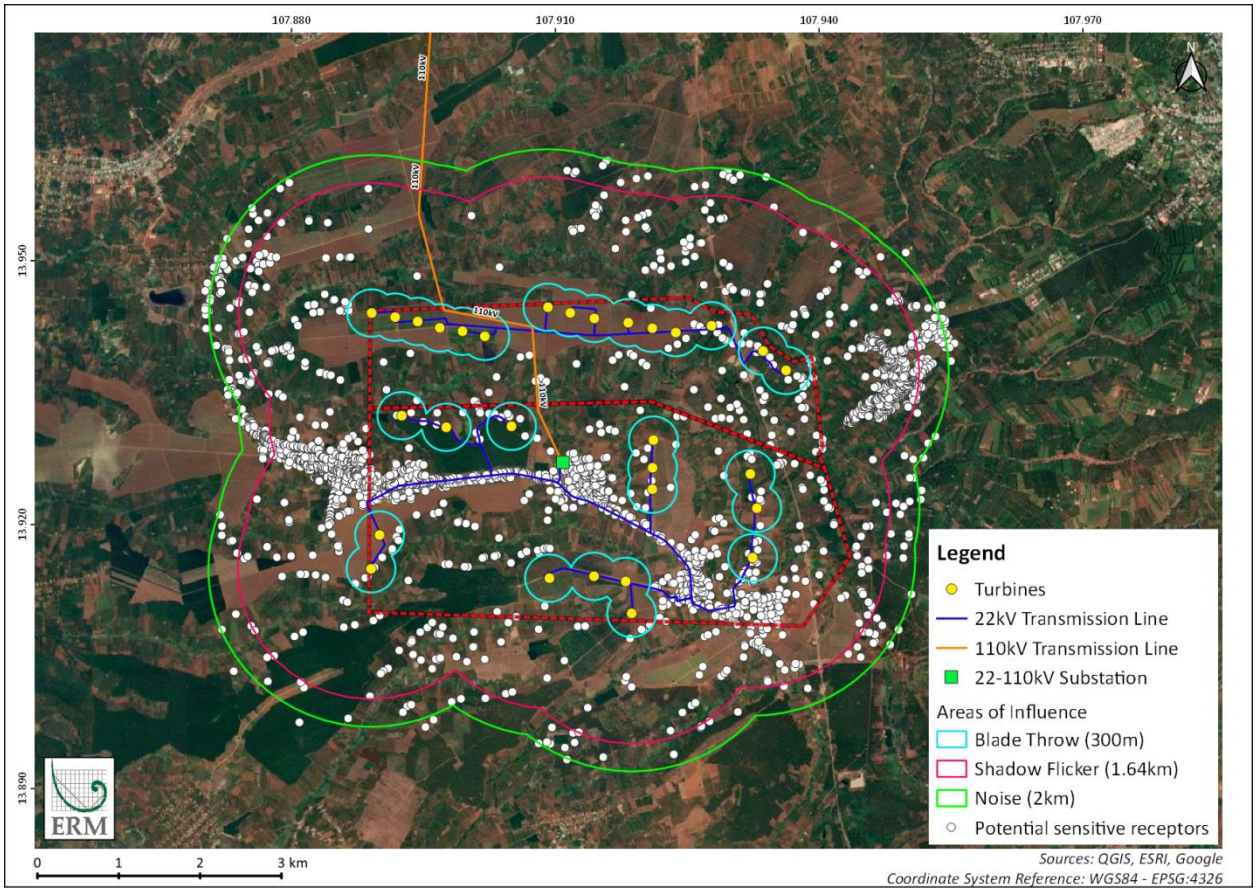


Figure 12.6 Possible Receptors in the AoI of Noise, Shadow Flicker and Blade Throw

Table 12.16 Impact of Relocation due to Health and Safety Reason

Impact Description	Relocation Due to Health and Safety Reason				
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	**Permanent**	
Impact Extent	**Local**	Regional	International		
Impact Magnitude	Positive	Negligible	Small	**Medium**	**Large**
Receptor Sensitivity	Low	Medium	**High**		
Impact Significance	Negligible	Minor	**Moderate**	**Major**	

12.13.4 Additional Mitigation and Management Measures

The following additional mitigation and management measures are recommended in order to meet international standards:

- A validation survey should be conducted to confirm the status of any people living in the safety zone and confirm the necessary of the relocation plan.

- If any dwellings are identified, the Project should develop a relocation plan in consultation with the impacted people and in which, the people identified residing within the safety zone will have to be relocated in accordance with this plan.

12.13.5 Residual Impacts

With mitigation measures in place, the project may reduce the impact to the negligible Minor significance along the year of project operation.

12.13.6 Monitoring and Audit

- Ensure the continuous monitoring on the concerns/feedback of people living within or nearby the safety buffer zone to address in a timely manner.
- Implement the monitoring and audit for the relocation plan if applicable.

12.14 Impact on Indigenous Peoples Way of Life

The IPs screening in Section 5 concludes that Gia Rai ethnic group fulfils all four characteristics of IPs against AIIB's ESS 3. As Gia Rai people form a large population in Ia Pech commune where all of the turbines are located and in other communes of Ia Grai District where the transmission line go through (Ia Kha Town, Ia Hrung and Ia Der communes), ERM would recommend that the Project consider Gia Rai people as IPs/Ethnic Minority and that AIIB's ESS 3 apply to them. Furthermore, according to the information available for review and the social situation of the project at the time of this assessment, FPICon is not applicable to the Project. The relevance of these special circumstances is assessed in following sections.

12.14.1 Potential Impacts

Requirement of Free, Prior, and Informed Consultation (FPICon) from Affected IPs Communities

In addition to the general requirements of AIIB ESS3, project proponents are required to obtain FPIC and FPICon of the affected communities of IPs in circumstances described in paragraphs 60-61 of ESS3 that is applicable to project design, implementation, and expected outcomes related to impacts affecting the communities of IPs. FPIC and FPICon[263] is required if projects are associated with any of the potentially adverse impacts identified below:

- Impacts on lands and natural resources subject to traditional ownership or under customary use;
- Relocation of Indigenous Peoples from lands and natural resources subject to traditional ownership or under customary use;
- Significant impacts on critical cultural heritage that is essential to the identity and/or cultural, ceremonial, or spiritual aspects of Indigenous Peoples lives, including natural areas with cultural and/or spiritual value such as sacred groves, sacred bodies of water and waterways, sacred trees, and sacred rocks; or
- Use of cultural heritage, including knowledge, innovations, or practices of Indigenous Peoples for commercial purposes.

According to the information available for review and the social situation of the project at the time of this assessment, FPIC and FPICon are not applicable to the Project.The relevance of these special circumstances is assessed in Table 12.17.

[263] It is noted that the criteria to identify if FPICon is applicable is similar to the one of FPIC

Table 12.17 FPIC and FPICon Identification

Circumstance	Observations	Applicability
Impact on lands and natural resources subject to traditional ownership or under customary use	Initial findings from discussion with local authorities revealed that the livelihoods of Gia Rai people highly rely on their private land. There is no physical displacement due to land acquisition foe the Project and the impacts is on individual households who belong to the Gia Rai ethnic minority. It is unlikely that the Project's main components (turbine foundations, 22-110kV sub-stations, 22kV transmission line, including foundations, 22kV transmission line, including foundations, and internal and access roads) will affect any land and/or natural resources that are under subject to traditional ownership or customary use of Gia Rai community in the affected communes. Based on the social baseline finding, drops of water (*giot nuoc*) and water whafts, which are invaluable assets given by the nature and preserved through the water offering ceremony organised annually in the locality, are not observed in the Project area.	Not Applicable
Relocation of IPs from laCunds and natural resources subject to traditional ownership or under customary use	All of Project affected households relate to economical displacement. There is no physical displacement due to land acquisition for the Project. In case of relocation due to the impacts within the safety zone of blade throw, noise exceedance, or shadow flickering, the impacts would be at the household level.	Not Applicable
Significant impact on critical cultural heritage	Based on current levels of project information, no significant impacts on Gia Rai critical cultural heritage are anticipated. There is no Gia Rai critical cultural heritage located within the Project areas.	Not Applicable
Commercial use of cultural heritage	The project will not make commercial use of Gia Rai cultural heritage or traditional knowledge and practices.	Not Applicable

Source: ERM Socio-economic baseline survey, August 2021

Land acquisition and Livelihood Impacts

As mentioned above, as Gia Rai people are identified as a land/natural resource dependant community, the loss of land will potentially lead to Loss of livelihood and/or income from the land-based livelihood, and thus a more vulnerable status to those households.

Social/cultural conflicts among the community might arise. Local people may lose trust in the local authority and Project Owner when they are not able to ensure equality in terms of compensation payment for land acquisition.

Communication Issues

Construction and operation of the Project will take place within the Gia Rai people's farmland. The Gia Rai people are found mostly live in the mountainous areas of the Central Highlands of Vietnam. The Gia Rai have their own language, which belongs to the Malayo - Polynesian language group (of the Austronesian language family) and their own writing system. As a result of their contacts with mainly Kinh people, the Gia Rai are bilingual or multi-lingual. However, elderly people are still recognised as not able to communicate in Vietnamese (Kinh language). Construction and operation of the Project may

bring more people to the Project location from other locations in the district or even from other provinces. However, the total number of onsite workers during both phase is not expected to exceed 322. This is considered small compared to the number of Gia Rai people in Ia Grai district which recorded as many as 48,000 people. Interaction misunderstanding between EPC workers and Gia Rai people may be expected.

Culture differences

The value and daily culture of Gia Rai people may also experience acculturation to new culture brought by the migrant workers from other locations. It is expected that construction and operation, including establishment of a worker camp will provide the opportunity for interactions between people from outside the affected commune and Gia Rai people. Both non-local people and Gia Rai People may have high expectations of having a job from Project, but only a limited number of people may secure employment. The interaction process may bring changes and conflicts between Gia Rai people and workers themselves. As such, social conflict/project opposition may be triggered due to social jealousies.

The traditional practice of Gia Rai people, which has a more matriarchal culture, might be different from the majority culture, which has a patriarchal culture. It is expected that the worker will come from patriarchal culture. It means that more women will interact in the consultation or discussion with the project. Other practices like marriage ceremony, religious, and medication treatment might be different from other majority culture in Vietnam. So other Vietnamese workers from other provinces might need to learn to respect Gia Rai People's culture in the project location.

Positive Impacts on Gia Rai People

The Gia Rai community in the Project area will likely benefit from the upgrade of infrastructure and job opportunities as well as ethnic minority development activities during the Project construction and operation.

12.14.2 Existing Controls

- A Stakeholder Engagement Plan (SEP) including a Community Grievance Mechanism (CGM) has been developed within this ESIA package.

12.14.3 Significance of Impacts

Given FPIC/FPICon is not required, a wide range of impacts from the Project, livelihoods, to health and security, are predicted in all affected villages where Gia Rai people live. Social and cultural conflict issues might if such potential impacts are not properly communicated and managed. As such, the impact magnitude is Medium

The receptors' sensitivity is assessed to be Medium in terms of high poverty rate, low educational attainment, high dependency on land-based livelihoods, and emerging challenges for community development. Eventually, the Project impacts on Gia Rai livelihoods, way of life, cultural values during the land clearance of construction phase and during the operation phase of the Project are assessed as Moderate significance.

Table 12.18 Impact on Indigenous People Way of Life

Impact Description	Impact on Indigenous People Way of Life			
Impact Nature	**Negative**	Positive	Neutral	
Impact Type	**Direct**	Indirect	Induced	
Impact Duration	Temporary	Short-term	**Long-term**	Permanent

Impact Description	Impact on Indigenous People Way of Life				
Impact Extent	**Local**		Regional		International
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low		**Medium**		High
Impact Significance	Negligible		Minor	**Moderate**	Major

12.14.4 Additional Mitigation and Management Measures

The following additional mitigation and management measures are recommended in order for the Project to meet international standards:

- An Indigenous Peoples Plan (IPP) with the training for workers about Gia Rai people's culture to reduce misunderstanding among them and support programs to assist people who not compensated adequately is suggested.
- A grievance redress mechanism should be established during construction and operation to capture any issues between the Project and local people. The Project Owner will establish a grievance mechanism that is explained to and accessible for, all villagers including Gia Rai people. The mechanism will be simple and easy for Gia Rai people to access and have specific provisions for IP groups.
- Community consultation should be designed to accommodate the Gia Rai people's communication necessity and those who speak the general Vietnamese language to reduce miscommunication and be inclusive.
- Information related to job or business opportunity should be disclosed as clear as possible, especially about hiring priorities and selection criteria. So that, community discontent due to high recruitment expectations can be reduced.

12.14.5 Residual Impacts

After successfully implement all of the mitigation measures above, it is expected that the impact significance can be reduced to minor.

12.14.6 Monitoring and Audit

- Number of disclosure and coordination record report during construction and operation;
- Evidence on education/awareness program for EPC workers to interact with Gia Rai People;
- Every 3 months report on grievance mechanism on community – worker conflicts if any exist.

12.15 Gender Impact Assessment

12.15.1 Potential Gender Impacts

Review of project activities, resource requirement, socio-economic features of the AOI, and gender landscape and local context has provided potential areas where the project may lead to adverse impact on women and/or girls or widen gender inequality.

After assessing the potential sources of social and environment risks, as well as gender baseline, the impact screening of gender finds positive and negative impacts.

The positive gender impacts are as follow:

- Impact on local economic dynamics because of construction activities with employment opportunities for supply chain opportunities for local suppliers and local workers including women
- Capacity building - skills strengthening, and exposure to different standards of development
- Compensatory benefits and long term change in the whole community due to the presence of such a project for a considerable period of time, and
- Community development projects that alleviate poverty and increases choices for women.

The negative gender impacts are as follow:

- Minimal engagement of women, poor and the excluded resulting in no or nominal engagement in the project processes leading to frustration and disenchantment
- Employment opportunities for a select few only, excluding women to a large extent, thus increasing women dependency on men as household income providers
- Reduce women access to productive agriculture land
- Post-construction frustration due to inability to continue with an improved lifestyle experienced during the construction period
- Community stakeholder consultation and local development plans made without the voice of women. Women may be excluded because they are out collecting water or in the fields or doing other domestic chores
- Add burden for women to engage with capacity building, economic activities, decision making process beside their daily activity
- Increase in sexual harassment/gender based violence around construction sites as well as human trafficking, and
- Increase in sexually transmitted disease such as HIV/AIDS

Women limited access to economic activities

As most of the population in the project's location is from Gia Rai ethnic group. Women in the project location are mainly dealing with domestic chores at home, working in agriculture activities and day labour. It is mentioned that women are responsible for fetching water and collecting firewood in a radius of approximately 200 meters away from their house or from their farm land. They collect these items by using motorbike or walking. They also collects natural food source for household consumption or for selling. For Gia Rai group, women have big role in farming and family expenditure. Therefore, the loss of productive land where it cannot be avoided, is a significant loss for Gia Rai women who maintain their family agriculture land as their assets.

Women employment opportunity in project location is less common compared to those available to men, and as such, they mainly work in agriculture activities. In the agriculture activities, men also dominate agriculture production activities. Workforce skill for women is mentioned to be limited to housework activities and light work in agriculture activities. Women can use simple agriculture equipment, while tractors are operated by men. Women limited skill also gives women lower income compared to men income when they work for as day labourer.

The project employment opportunity is going to be for limited group of women and will mostly be available during construction activities. While the working opportunity for men in the project's location is expected to be higher than women. As such, the project may support the general economic activities where women will depend on men in the households as the main breadwinner.

The possibility for women to work on other aspects of economic activities may come by using their skill in doing household activities. As there will be more and more migrant workers moving in around the project area, they might need accommodation service such as food, cleaning, and laundry. However,

the amount of work might only be available for short time through worker camp/ boarding house so only limited number of women might benefit from this type of work and income.

Women limited access to decision-making activities, capacity building, and information

Women in the project location have equal opportunity in decision-making process at household level. However, the political decision making activities such as public consultation for development might not involve equal number of men and women. For Kinh People with Patriarchy social structure, women are generally confined to carrying out housework and more time consuming agricultural activities. Men have more various working opportunities and activities besides working in the agriculture field. In Gia Rai ethnic minority group, women play a prominent role in the family as they maintain matriarchy culture in family but in community, Gia Rai men still take significant positions related to decision making process for community affairs matters.

Women FGD and women union have mentioned the time that women have to access information would be after they finish their daily activities caring for their family, around 9 pm every day. With the current project consultation activities conducted during the day, the project might have limited feedback or participation from women's group. This timeline of community engagement might also limit women from obtaining the information that they should receive during consultation sessions. The capacity building for women is also limited in term of agricultural production or any technical skill, because women are very busy during daytime with household task and work. Adding capacity building will help women to improve their skills and potentially their income but then it will take their time from their activity.

Women limited access to health and safety

Gender based violence (GBV), prostitution, unsafe sexual behaviour that may cause STD/AIDS are women's health and safety issues that might happen during construction activities surrounding the workers' camp. An influx of male migrant workers during construction from different cultural background might increase the case of health and safety issues relevant to local women group as well as Gia Rai women group. Even though, there is health service available in the community, there is not enough information for women to look for assistance when GBV happened without any judgement on such sensitive issues. If they have problem, women in the project location will usually talk to family member first before going to the women's union and local authority.

12.15.2 Significance of Impacts

Based on the above discussions, the Project's gender impacts will mostly relate to the women's livelihoods, empowerment, health and safety. Such impacts will be most significant during the construction phase, and its consequence will last for long-term. The impact magnitude is therefore Medium.

However, based on the social survey results, local women found that there is a low possibility of increasing women's workload or dependency on men and destabilising their current livelihoods due to the impacts of the Project. Eventually, it could be concluded that the Project will pose negative impacts on women's livelihoods, health and safety condition during the project's land clearance and construction phase and the operation phase in the locality. The impact significance is assessed as Minor.

Table 12.19 Gender Impacts

Impact Description	Gender Impact Assessment			
Impact Nature	**Negative**	**Positive**	Neutral	
Impact Type	**Direct**	Indirect	**Induced**	
Impact Duration	Temporary	Short-term	**Long-term**	Permanent
Impact Extent	**Local**	Regional	International	

Impact Description	Gender Impact Assessment				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	**Low**		Medium		High
Impact Significance	Negligible	**Minor**		Moderate	Major

12.15.3 Management and Mitigation Measure

Impact	Mitigation
Women limited access to economic activities	■ Provide women access to be able to gather water, firewood, natural food source and agriculture land whenever their productive land is impacted by land acquisition process ■ Provide equal recruitment opportunities for all positions, allocate selected positions such as catering and other domestic roles to women, and require application of this policy to the project's subcontractor
Women limited access to decision-making activities, capacity building, and information	■ Develop stakeholder engagement plan with priority to ensure equal participation from men and women ■ Provide flexible time capacity building through Community Development Plan or Livelihood Restoration Program for women so that they can increase their income in the long term and improve their living condition ■ Provide information disclosure material about the project that is accessible for men and women at all ages as well as to vulnerable people. Arrange engagement activities on a schedule that allows women to participate, informing ahead of the proposed engagement activities about the purpose of the meetings and benefits from participation ■ Include gender specific examples in training material and communication material ■ Hire a woman or women in the Community Relations' Team.
Women limited access to health and safety	■ Provide worker code of conduct that strictly prohibits workers' engagement with gender based violence, unsafe sexual behavior, and prostitution ■ Provide training for workers about prevention of gender based violence, unsafe sexual behavior, and prostitution in local context ■ Provide and disclose grievance channels that are safe to report any gender-based violence experienced by the affected community and workers. Where possible, the project must support if any remediation or compensation is needed concerning gender-based violence

12.15.4 Monitoring and Audit

After implemented the above mitigation measures, the project should continue to monitor the mitigation measures in place:

- Identified community access to water and fire wood or any other natural food source that may restrict because of project activities
- Identified number of local women recruited as worker during project construction and operation
- Record number of participant that attending stakeholder engagement activities, segregated the participant by gender and worker origin local/migrant worker (for stakeholder engagement involving workers)

- Record the number CDP and LRP implemented which targets women as beneficiaries
- Monitor the income level of women involved in LRP and CDP
- Record the number of training conducted for workers about prevention of gender based violence, unsafe sexual behavior, and prostitution in local context
- Available information disclosure material on grievance channel, CDP, LRP, and workers training related to gender based violence, unsafe sexual behavior, and prostitution in local context
- Available worker code of conduct that has gender sensitive approach and covers the project commitment in human right issues.

12.16 Human Right Impact Assessment

12.16.1 Human Right Impacts and Mitigation Measures

No	Thematic Areas	Source of Potential Human Rights Violation – Project Activity	Salient Human Right at Risk	Rights holders	Key Human Right Potential Risk	Description of Potential Impact	Management and Mitigation Measure
1	Labour Working Condition	■ Project Construction and operations ■ Deployment of workers ■ Setting up of labour accommodation ■ Procurement of materials	■ Right of Life and Personal Liberty ■ Right to Equality, and Non-discrimination ■ Freedom of Speech and Expression ■ Freedom of Assembly; ■ Freedom of form Associations and Trade union rights; ■ Right Against Exploitation such as child, forced or compulsory labour	■ Workers (local and migrant) ■ Women workers ■ Unskilled workers	■ Occupational Health and Safety risks during construction and operations leading to serious injuries and fatalities ■ Discrimination of workers in wages, working conditions and facilities, and differential access to remedy to complaints/grievances ■ Sexual Harassment at workplace ■ Workers forming association or unions for collective bargaining ■ Engagement of child ad forced labour may lead to cases of exploitation,	■ Construction stage will require 322 workers. Main activities will include site preparation, foundation laying, fencing, cleaning, pilling and erection of WTG and commissioning of mounting structures. Some of these activities can also construed as high risk activities such as working at height, working in confined spaces, electrical hazards, suspended loads etc. Improper and inadequate occupational safety controls may lead to worker injures and in worst cases, fatalities. ■ The project will engage local workers for unskilled and semi-skilled work in construction and operations stage. The engagement with worker during construction is expected under EPC. The EPC for the project is mainly	■ Implementation of the project's ESMS including Occupational Health and Safety Policy and Procedure, to include development of job hazard analysis, hazard identification and risk assessment, provisions of adequate PPEs, accident-incident reporting etc. Key recommendations should be implemented at site including but not limited to: ■ Use of Personal Protective Equipment (PPEs); ■ Daily monitoring and inspections of contractors, subcontractors and labourers to ensure they are compliant to the ESMP; ■ Accident/incident register to track any issues that may arise during the construction/operation and communicate the same to the respective stakeholders;

No	Thematic Areas	Source of Potential Human Rights Violation – Project Activity	Salient Human Right at Risk	Rights holders	Key Human Right Potential Risk	Description of Potential Impact	Management and Mitigation Measure
			■ Right to health		trafficking, or modern slavery ■ Risks of procuring materials from vendors engaged in forced labour and child labour or from conflict prone areas	migrant worker (Chinese nationality), Power Construction of China and China Energy Engineering Group Anhui No.1 Electric Power Construction Co.Ltd. For skilled workforce, migrant workers will be engaged (with unskilled and semi-skilled work as well depending upon the availability of local workers). All these workers will be engaged on a contractual basis, and thus may not have documented terms of employment, and are susceptible to unequal pay (between migrant and local workers, or between male and female workers). In addition, contract workers may face discrimination in terms of different working conditions as compared to permanent workers such as toilet and sanitation facilities, accommodation etc. ■ Discrimination can also occur due to unfair treatment of migrant and local workers	■ Permit to work or key activity risk identification process for higher risk activities such as working at height, working with rotating machinery, working with electromagnetic fields and working in confined spaces; ■ Project specific HIRA should be in place prior to start of construction activities and continue to be implemented during operation at site; and ■ Project specific Occupational health and safety plan also should be developed and implemented. ■ Implementation of the Project HR Policies and Procedures ■ Payment of wages as per the minimum wages norms of Vietnam for unskilled, semi-skilled and skilled workforce with no disparity between local migrant workers and male and female workers ■ Implementation and trainings on Prevention of Sexual Harassment at Workplace Policy

No	Thematic Areas	Source of Potential Human Rights Violation – Project Activity	Salient Human Right at Risk	Rights holders	Key Human Right Potential Risk	Description of Potential Impact	Management and Mitigation Measure
						based on their ethnicity or region they belong to. This is pertinent not only for the employee-worker relation, but migrant workers may face discrimination by local community during interactions in market, or by local workers engaged by the company. ■ There can also be cases of sexual harassment against women workers. Currently, number of local workers during construction to be deployed is 67 women workers and 146 men workers. While migrant worker number is recorded 109 workers from other districts or commune in Gia Lai Province, no gender segregated data on this record. The operation phase workers are expected to be 1 woman worker and 9 men workers. ■ The project will engage workers from local areas, and migrant workers from other countries. The project does not have any trade union, or	■ Implementation of IFC/EBRD Worker Accommodation Guidelines for worker accommodation to ensure a basic minimum standard of living and access to facilities ■ Appointment of a designated labour compliance officer to ensure compliance to applicable labour laws, rules and regulations ■ Contractor to carry out formal briefing of contractors and contract workers and explain the terms and conditions of employment, social security etc ■ Contractor to provide proper ID cards, employment terms on document, and salary slips indicating deductions. In case the same is being done indirectly by the contractor, review the performance periodically as a principal employer ■ The project should allow workers to form associations or other means of collective bargaining if the workers are willing to and not

No	Thematic Areas	Source of Potential Human Rights Violation – Project Activity	Salient Human Right at Risk	Rights holders	Key Human Right Potential Risk	Description of Potential Impact	Management and Mitigation Measure
						workers association. However, during the construction stage, there will be deployment of workforce, which may also entail opportunities for workers to unionise or form associations for collective bargaining, or get affiliated to local worker unions. ■ Any efforts to discourage or inhibit workers from forming means of collective bargaining may impinge on the workers right to peaceful assembly and form associations. ■ There can also be cases of forced labour, especially when migrant workers are hired through agents. Forced labour can manifest in different forms such as advance payment and deductions thereon leading to non-payment of regular wages; retention of identity documents; prohibition of right to leave employment etc. ■ Along the supply chain and under contractor hiring process, there will be potential	discourage or deter such activities ■ The project should ensure that no workers below 18 years of age should be deployed either directly or through contractors as well as local suppliers. This includes close monitoring of transport vendors, housekeeping service, and supply chain ■ The project should ensure that regular monitoring of contract workers, migrant workers is undertaken by Labour Compliance Officer on aspects related to forced labour ■ The HR Policy of Project and any contractors should include company's commitment towards prohibition of child/ forced labour at corporate and project sites, directly or indirectly ■ A Contractor Selection and Management mechanism to include: ■ Specific EHS & S clauses to be included in the contract agreement;

No	Thematic Areas	Source of Potential Human Rights Violation – Project Activity	Salient Human Right at Risk	Rights holders	Key Human Right Potential Risk	Description of Potential Impact	Management and Mitigation Measure
						of child labour, forced labour, and procurement of materials from conflict prone area. In Vietnam, non-formal worker that works in supplying gravel or sand material might involve child under 18 years old. ■ Opportunity to be included under workforce recruitment for ethnic minority is expected to be limited, as Gia Rai ethnic minority skills and education level might fall under unskilled worker. Other local community people might also expect to join the workforce either in construction and operation.	■ An Internal audit protocol to be established to monitor the compliance of labour laws and regulations and periodic audits should be undertaken ■ Procurement of materials from conflict prone areas is not to be undertaken by the project ■ Compliance to applicable laws to be monitored
2	Loss of land and Livelihood, and Access to resources	Land Procurement of private and government land on permanent and temporary basis	■ Right to own land and right to livelihood ■ Right to standard of living ■ Right to access common resources	■ Local community especially land users ■ Ethnic Minority	■ Loss of livelihoods of the land owners/users households, triggering migration of household members or shift to other sources of livelihood	■ The land occupied for the Project includes permanent and temporary land with a total area of 30.94 hectares and 28.85 hectares, respectively. In which, the permanent land acquisition will be used for WTG foundation, transformer foundation, 220 kV substation and maintenance road, while the temporary land used for construction laydown site,	■ The project should ensure that all land procured is through good faith negotiations, rates to be provided are aligned with market rates, land users and agricultural labourers and other vulnerable households are identified, and adequate allowances and other livelihood restoration support are provided ■ Where possible, land for land compensation is suggested

No	Thematic Areas	Source of Potential Human Rights Violation – Project Activity	Salient Human Right at Risk	Rights holders	Key Human Right Potential Risk	Description of Potential Impact	Management and Mitigation Measure
			■ Freedom of Movement			construction and production facilities, cable trench, and construction road. All of the land area for the Project has been identified as agriculture land. ■ To date, when this assessment is conducted, the project lead to economic displacement of 160 households (both long-term and short-term) with approximately 4 to 5 people in the household. ■ The construction and operation of the project is expected to impact Gia Rai ethnic minority farm land.	instead of cash compensation especially for ethnic minority agriculture land. This compensation approach will ensure the ethnic minority household will have access to agriculture livelihood to maintain their tradition and income ■ The project should develop livelihood development measures and community development measures for land owners/users affected by the project
3	Community Health and Safety and security	■ Deployment of security personnel ■ Transport of project components ■ Project construction and operations	■ Right of Life and Personal Liberty ■ Right to access common resources	■ Local community ■ Ethnic Minority	■ Community Health and Safety risks due to use of force, deployment of armed personnel ■ Community Health and Safety risks due to movement of vehicles through local	■ Project has reported that armed security guards will not be deployed. However, unarmed security personnel still may use force (and use non-explosive weapons such as batons, sticks) which may excessive, inappropriate and disproportionate, in cases of local conflict such as community agitations, worker	■ Trainings to security guards on community engagement, judicious use of force only if needed, and human rights ■ Development and implementation of traffic management plan ■ Road safety awareness as part of CDP/CSR activities in local community

No	Thematic Areas	Source of Potential Human Rights Violation – Project Activity	Salient Human Right at Risk	Rights holders	Key Human Right Potential Risk	Description of Potential Impact	Management and Mitigation Measure
		■ Site construction and related access controls and restrictions			roads leading to road accidents ■ Access Restrictions – project site fencing, guarding. Communities may demand to be allowed to pass through fenced areas in order to save time or reduce distance ■ Community health and safety risks linked to vector borne, and communicable diseases, potential conflict and violence between migrant workers and local community, and potential cases of gender based violence	strikes, and in worst cases violent protests/riots which is a threat to right to life. The project is suggested to hire security services contractor, or hire some local community members as security guards. ■ The project will require transport of project components such as wind turbines, electrical equipment etc. The project improve local roads to enable movement of heavy vehicles. However, there will be increased road traffic in the local area, especially during construction stage, more than what the local community has experienced before, which may lead to road accidents leading serious injuries and fatalities posing a threat to right to life and liberty. ■ Project land procurement may lead to disruption of local access routes to private land, common resources or infrastructure, increasing the time/distance to access. It is	■ The project should engage with local community and understand any access related concerns. The project should manage these issues through the stakeholder engagement plan and grievance mechanism ■ Security guards to be trained on aspects of unauthorised access in a rights compatible and sensitive manner ■ Implementation of IFC/EBRD Worker Accommodation Guidelines for worker accommodation to ensure avoiding setting up of labour accommodation in close proximity to local community, separate and dedicated resource supply such as domestic and drinking water, means of transportation, electricity, etc. and training on gender based violence, sexual harassment, human rights and laws linked to women safety and security

No	Thematic Areas	Source of Potential Human Rights Violation – Project Activity	Salient Human Right at Risk	Rights holders	Key Human Right Potential Risk	Description of Potential Impact	Management and Mitigation Measure
						reported that WTG locations will not be fenced hence allowing for continued access to local community ■ Setting up of labour accommodation may increase risk of vector borne diseases, communicable diseases due to improper accommodation and related water management leading to risk to local community ■ Labour accommodation and influx of workforce may also lead to conflict with local community, pressure on local resources, and cases of gender based violence.	
4	Informed Consultation and Participation	■ Land procurement ■ Project construction and operations	■ Right to access common resources ■ Freedom of Movement ■ Right to on-discrimination	■ Land users ■ Contract workers including migrant workers ■ Local community	■ Discrimination of workers access to remedy to complaints/grievances ■ Unfair means of negotiations for land procurement leading to different principles of rate finalisation	■ Contract workers including migrant workers may also be danger of being provided unequal/inadequate access to remedy through partial or lack of grievance redress; ■ Some land users may be vulnerable due to their identity (belonging to ethnic minority group, or low-income	■ Development of project specific stakeholder engagement plan including identification of vulnerable groups, and development of external grievance redressed mechanism ■ Extension of grievance mechanism for contract (local and migrant) workers and local community

No	Thematic Areas	Source of Potential Human Rights Violation – Project Activity	Salient Human Right at Risk	Rights holders	Key Human Right Potential Risk	Description of Potential Impact	Management and Mitigation Measure
				■ Ethnic Minority	■ Lack of identification of land users on private or government land required for the project ■ Local community may assemble for demonstrations to raise demands, grievances	households) and hence may be met with unfair means of negotiations for land rates. There are also chances of agricultural labourers and land users being left out of the negotiation process and hence receiving less, or no compensation during land procurement. ■ Local community may also want to demonstrate against the project in a peaceful manner to raise demands or communicate concerns and grievances. Concerns can emanate out of land procurement, displacement of livelihoods, water supply demands, worker behaviour, road accidents, worker accidents, etc. Such demonstrations may turn violent if not managed appropriately	■ Identification of land users/ non-titleholders of impacted private and government land such as woman headed ■ Households, ethnic minority households, landless households, land users, agricultural labourers etc. ■ Good faith negotiations with all land sellers with meaningful consultation, disclosure, and absence of threat/force ■ In cases of demonstrations, or assemblies, the project should liaise with local community or workers and manage the situation in a human rights sensitive manner. Use of excessive, inappropriate or disproportionate force to disrupt such incidents should not be undertaken

12.16.2 Significance of Impacts

Based on the above discussions, human rights impacts involved several salient human rights at risk for affected communities, workers, and other stakeholders. Such impacts will be most significant during the construction phase, and its consequence will last for long-term. For this reason, the magnitude of the impact is considered medium.

The project affected areas include the presence of Gia Rai ethnic community and other vulnerable groups. Also, the project will recruit a foreign workers in its workforce. As such, there are knowledge, social and cultural barriers for the two groups to fully understand and practice human rights in the local context of the Project area. For this reason, the receptor sensitivity is assessed as Medium and the overall impact significance is Moderate.

Table 12.20 Human Rights Impacts

Impact Description	Human Rights Impact Assessment				
Impact Nature	**Negative**		Positive		Neutral
Impact Type	**Direct**		Indirect		Induced
Impact Duration	Temporary		Short-term	**Long-term**	Permanent
Impact Extent	**Local**		Regional		International
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low		**Medium**		High
Impact Significance	Negligible		Minor	**Moderate**	Major

12.16.3 Monitoring and Audit

Ongoing monitoring of the stakeholder engagement program should be undertaken. Particular attention should be given to ensure that differentiated measures are effectively engaging vulnerable groups, including women, ethnic minority, the elderly, the poor, and the disabled.

Additionally, it will be important to monitor and documented allegations of human rights violations, and where necessary investigate and take disciplinary action.

13. UNPLANNED EVENTS

13.2 Overview

This chapter presents the evaluation of risks of unplanned events associated with the construction and operation phase of the Project. The unplanned events could potentially arise from technical failure, human error, or result from natural phenomena.

The assessment of potential impacts of unplanned events is based on the project description section (Chapter 2), environmental baseline section (Chapter 7), and judgements based on ERM's professional knowledge and previous experience on similar projects. The risk assessment of unplanned events considers the probability of events occurring and an estimate of the severity of consequences. The severity assessment is determined based on the worst-case scenario. The worse-case is assumed that safety devices and associated measures fail to operate properly resulting in the incidents.

Probable unplanned events relevant to the Project, in order of potential occurrence, which are accessed in this chapter include but not limited to:

- Spillage of fuel, oil, and hazardous materials
- Traffic accidents
- Fire and explosion, including brushfire and Unexploded Ordnance (UXOs)
- Occupational health and safety accident
- Blade throw, and
- Transmission line snapping, and transmission pylon/tower collapse.

This chapter covers an impact assessment of the above-listed unplanned events examining the potential and significance of the impacts. Mitigation measures based on best practice (as recommended by IFC EHS guidelines) and relevant national regulations are proposed. Afterwards, a qualitative classification is resolved for each impact with regards to its significance following the implementation of the proposed mitigation measures. Finally, a protocol for monitoring and auditing is recommended when applicable.

13.1 Relevant Guidelines and Regulatory Requirements

13.1.1 Local Regulations

- Related to oil spills:
  - Decision No. 02/2013/QD-TTG dated 14 January 2013 promulgating the regulation on oil spill response, and
  - Decision No. 63/2014/QD-TTg dated 11 November 2014 on amendments to some articles of the regulation on oil spill response according to the Decision No. 02/2013/QD-TTg dated 14 January 2013.
- Related to fire, explosion, and toxic release:
  - Decree No. 113/2017/ND-CP dated 9 October 2017 specifying and providing guidelines for implementation of certain articles of the Law on Chemicals, and
  - Circular No. 32/2017/TT-BCT dated 28 December 2017 specifying and providing guidelines for implementation of certain articles of the Law on Chemicals and Decree No. 113/2017/ND-CP specifying and providing guidelines for implementation of certain articles of the Law on Chemicals.

- Related to setback distance and the right-of-way widths
  - Decree No. 14/2014/ND-CP dated 26 February 2014 on stipulating in detail the implementation of electricity law regarding electricity safety, and
  - Circular 02/2019/TT-BCT of the Ministry of Industry and Trade dated 15 January 2019 on regulations on implementation of wind power project development and standard power purchase agreement for projects wind power projects.

13.1.2 International Standards and Requirements

IFC Performance Standards is presented in Table 13.1.

Table 13.1 Applicable IFC Performance Standards for Unplanned Events

Performance Standard	Requirements
PS1: Assessment and Management of Environmental and Social Risks and Impacts	Emergency Preparedness and Response Where the project involves specifically identified physical elements, aspects and facilities that are likely to generate impacts, the ESMS will establish and maintain an emergency preparedness and response system so that the client, in collaboration with appropriate and relevant third parties, will be prepared to respond to accidental and emergency situations associated to prevent and mitigate any harm to people and/or the environment. The preparation will include the identification of area where accidents and emergency situations may occur, communities and individuals that may be impacted, response procedures, provision of equipment and resources, designation of responsibilities, communication, including that with potentially Affected communities and periodic training to ensure effective response. The emergency preparedness and response activities will be periodically reviewed and revised, as necessary, to reflect changing condition.
PS4: Community Health, Safety, and Security	Emergency Preparedness and Response The client will also assist and collaborate with the affected communities, local government agencies, and other relevant parties, in their preparations to respond effectively to emergency situations especially when their participation and collaboration are necessary to respond to such emergency situations. If local government agencies have little or no capacity to respond effectively, the client will play an active role in preparing for and responding to emergencies associated with the project. The client will document its emergency preparedness and response activities, resources, and responsibilities, and will disclose appropriate information to affected communities, relevant government agencies, or other relevant parties.

13.2 Risk Assessment Methodology

To assess unplanned events, a risk-based approach is used. The impact significance for unplanned events is determined by evaluating the combination of the scale of the consequence and the likelihood of occurring event. It should be noted that this methodology is different than that applied to potential impacts from planned activities, as the assessment of these impacts from unplanned events must consider likelihood as well.

13.2.1 Step 1: Assess the Scale of Consequence

Indicative levels of consequence for potential impacts from unplanned events can be defined for the physical, biological and social environment as provided in Table 13.2.

Table 13.2 Indicative Level of Consequence for Potential Impacts from Unplanned Events

	Incidental (A)	Minor (B)	Moderate (C)	Major (D)	Severe (E)
Physical Environment	Impacts such as localised or short term effects or environmental media, meeting all environmental standards	Impacts such as widespread, short-term impacts to environmental media, meeting all environmental standards	Impacts such as widespread, long-term effects on environmental media, meeting all environmental standards	Impacts such as significant, widespread and persistent changes in environmental media OR Exceedance of environmental standards	Exceedance of environmental standards and fine/ prosecution
Biological Environment	Impacts such as localised or short term effects on habitat or species	Impacts such as localised, long term degradation of sensitive habitat or widespread, short-term impacts to habitat or species	Impacts such as localised but irreversible habitat loss or widespread, long-term effects on habitat or species	Impacts such as significant, widespread and persistent changes in habitat or species	Impacts such as persistent reduction in ecosystem function on a landscape scale or significant disruption of a sensitive species.
Social Environment	Slight, temporary, adverse impact on a few individuals	Temporary (<1 year), adverse impacts on community which are within international health standards	Adverse specific impacts on multiple individuals that can be restored in <1 year OR One or more injuries, not severe.	Adverse long-term, multiple impacts at a community level, but restoration possible. OR One or more severe injuries to a member of the public including permanently disabling injuries.	Adverse long-term, varied and diverse impacts at a community level or higher – restoration unlikely. OR Fatalities of public.

13.2.2 Step 2: Assess the Likelihood

For the purposes of assessment, the likelihood of an unplanned event occurring can be classified as five levels shown in Table 13.3 follows:

Table 13.3 Classification of Likelihood

Level	Description
Remote (1)	Not known in the industry
Very unlikely (2)	Known but unlikely to happen
Unlikely (3)	May occur one or more time in the Project's lifetime
Likely (4)	May occur once or twice per year
Expected (5)	May occur more than twice per year

13.2.3 Step 3: Assess the Risk Rating

The consequences and likelihood of potential unplanned events are combined to determine the overall risk rating using the risk matrix shown in Table 13.4.

Table 13.4 Risk Matrix for Potential Unplanned Events

		Likelihood of Occurrence				
		1 Remote	2 Very unlikely	3 Unlikely	4 Likely	5 Expected
Consequence	Incidental (A)	Negligible	Negligible	Negligible	Negligible	Negligible
	Minor (B)	Negligible	Minor	Minor	Minor	Moderate
	Moderate (C)	Minor	Minor	Moderate	Moderate	Major
	Major (D)	Moderate	Moderate	Major	Major	Major
	Severe (E)	Major	Major	Major	Major	Major

13.3 Impact Assessment

Based on the Project activities, the potential unplanned events, their causes and consequences during all phases are shown in Table 13.5. It should be noted that for the commissioning and operational phases, only indicative project activities are listed. A more comprehensive evaluation of potential impacts would be conducted once sufficient detailed design information is available.

Table 13.5 Causes and Consequences of Potential Unplanned Events

No.	Unplanned Events	Phase	Cause	Consequence
1	Leakage and spillage incidents	Construction phase	■ Storage of fuel, oil, chemicals and hazardous materials ■ Usage of machinery and transport vehicle, and ■ Construction activities like painting, building.	■ Affecting soil and ground water ■ Affecting terrestrial ecosystems (fauna and flora) ■ Affecting community health and safety.
		Operation phase	■ Operation and maintenance activities ■ Usage of chemicals, oils at transformer area.	
2	Traffic accidents	Construction phase	■ Transportation of wind turbines, heavy equipment, and construction materials ■ Transportation of personnel during the construction works	■ Property damage ■ Injuries, and ■ Fatality.
3	Fire and explosion	Construction phase	■ Electrical arcs or flashovers ■ Lightning strike ■ Bushfire ■ Facility and equipment failure ■ Storage of combustion materials, and ■ Uncleared UXOs.	■ Affect health and wellbeing of plant's workers and local residents ■ Affect local houses, crops, and vegetation

No.	Unplanned Events	Phase	Cause	Consequence
		Operation phase	■ Damage of the Wind Turbine Generator (WTGs), transmission lines, insulators, or other supporting parts ■ Fuel storage ■ Worker's living activities (cooking or smoking) ■ Electrical incidents during the operation ■ Damage of the WTGs and their ancillary components, transmission lines due to lightning strikes, electrical arcs or flashovers and malfunctioned equipment, and ■ Lighting.	■ Affect plants' operation, and ■ Affect local houses, crops, and vegetation.
4	Occupational Health and Safety	Construction phase	■ Working with heavy equipment ■ Heavy handing, and ■ Working at height.	■ Impact on worker's health and safety ■ Injuries, and ■ Fatality.
		Operation phase	■ Exposure to EMF, and ■ Working at height.	
5	Blade ejection failure / Blade throw	Operation phase	■ Root connection failure ■ Catastrophic structural buckling or separation ■ Leading edge, trailing edge, or other bond separation ■ Lightning damage ■ Erosion ■ Failure at outboard aerodynamic device ■ Reduction in stiffness of blades (up to 10%) ■ Superficial structural or delamination/ laminate wrinkling that eventually becomes permanent, leading to damage, and ■ Over speeding due to failure of supervisory control and data acquisition (SCADA) to rectify the failure or high wind/ cyclonic/ meteorological conditions.	■ Affect people living near by
6	Transmission line snapping and tower swaying/collapsing	Operation phase	■ Foundation failure; ■ Tower component theft ■ Damaged fitting, and ■ Natural hazards.	■ Affect community health and safety ■ Affect crop activity, and

No.	Unplanned Events	Phase	Cause	Consequence
				■ Loss/reduction of community livelihood.

Potential risks from these events are described in detail in the following section. These potential risks are classified using the methodology included in Section 13.2.

The risk assessment of each activity during each phase will be analysed with the following contents:

- Potential Risks
- Existing controls (if proposed by the Project Owner)
- Significance of Risks
- Additional preventive and mitigation measures
- Residual risk, and
- Monitoring and auditing.

13.3.1 Leakage and Spillage of Fuel, Oil, Chemicals, and Hazardous Materials

13.3.1.1 Potential Risk

According to Project information, approximately 58 mobile construction equipment and vehicles such as bulldozers, excavators, cranes, heavy good vehicles, and fuel trucks, etc. use diesel oil will be operating in the construction phase (Table 13.6). These also would contain relatively small reservoirs of lube oil and hydraulic oil. In addition, there might be bulk storage of fuel at the construction site. An accidental release of diesel oil from machinery has the potential to result in oil seeping into the ground causing soil and groundwater contamination if the release is not immediately responded. Improper management and control of oil has also the potential to result in leakage and spill into the surrounding environment and its vicinity either from storage areas or throughout the equipment and machinery usage.

There would be widespread use of chemicals, including hydrocarbons, across the site during both construction and operation phases of the Project for operation & maintenance (O&M) services. As a result, there would be a risk that small volumes of chemicals could be spilled on-site.

Table 13.6 List of Construction Equipment during the Construction Phase

Equipment - capacity	Quantity	Equipment - capacity	Quantity
Internal road construction			
Excavator (1m^3)	3	Vibratory roller (20 T)	3
Excavator (2m^3)	3	Dump Truck (10 m^3)	6
Bulldozer (3 m^3)	3	Compactor	3
110 kV and 22 kV construction			
Excavator	1	Mixer truck	3
Dump Truck	1	Compactor	7

Equipment - capacity	Quantity	Equipment - capacity	Quantity
Mixer truck	3	Crawler crane (80 T)	2
Substation Construction			
Crane (3.5T)	1	Crawler crane (5 T)	1
Forklift (3T)	2	Hydraulic Press (100T)	1
Administration Building Construction			
Excavator	3	Compactor	10
Diesel generators	1	Dump Truck	1
Total	**58**		

Source: Construction plan by Dien Xanh Gia Lai investment energy JSC

13.3.1.2 Existing Controls

Regarding the Feasibility Report, only building the oil tank at the 110V substation is an existing control related to unplanned oil spill for the operation phase. This tank has a total volume of 40 m^3 which could contain the total volume of oil contained in the substation in case of having an unplanned event. No mitigation measures have been proposed to deal with unexpected spillage of fuel, oil, chemicals, and hazardous waste at other areas of the Project.

13.3.1.3 Significance of Risk (Before Mitigation)

Construction phase

Upon normal construction activities, small, localized spillages are “Likely” (class 4, refer to Table 13.3) to occur during the operation of vehicles and general construction activities, maintenance of machinery, improper storage of hazardous materials.

Information on the positions of the vehicles and equipment in the construction phase is unknown. They are likely near the turbines and internal roads (9.8km-length in Ia Pech, 8.3 km-length in Ia Pech 2) located close to several residential areas and water bodies. Moreover, no existing controls were recommended by the Project owner for leakage and spill incidents during the construction phase. However, the leakage amount is likely to be small in the Project area. Therefore, the consequence of loss of containment event during the preparation and construction phase is more likely Minor (class B) which involves localised and long term impacts on physical, ecological, and social receptors. Based on the nature of the Project, this significance of the impact is assessed risk rankings of **4B Minor**.

Operation phase

Similar to the construction phase, small, localized spillages are Likely (class 4, refer to Table 13.3) to occur during the operation & maintenance (O&M) services.

In terms of consequence, the leakage amount was likely to be small in the Project area. The positions that could have this risk include substations, turbines, and other auxiliary works where are unlikely near the existing resident area and water bodies. The risk of these spills reaching the environment would be minimal in paved areas. As most chemical usage would be in paved areas, the potential environmental and social impact of releases of oils during the operation was likely to be low. The Project Owner also build an unplanned oil tank at the substation where is likely to happen unplanned event. Therefore, the consequence of spillage risk is more likely of Incidental nature (class A, refer to Table 13.2). The significance of the risk is **4A Negligible**.

Table 13.7 Risk Impact of Leakage and Spillage of Fuel, Oil, Chemicals and Hazardous Materials

Phase	Cause	Consequence	Risk Ranking
Construction phase	■ Storage of fuel, oil, chemicals and hazardous materials ■ Usage of machinery and transport vehicle, and ■ Construction activities like painting, building.	■ Affecting soil and ground water ■ Affecting terrestrial ecosystems (fauna and flora), and ■ Affecting community health and safety.	4B Minor
Operation phase	■ Operation and maintenance activities, and ■ Usage of chemicals, oils at transformer area.		4A Negligible

13.3.1.4 Additional Preventive and Mitigation Measures

The following additional preventive and mitigation measures proposed to reduce the likelihood of occurrences of spillage events of fuel, oil, chemical, and hazardous wastes, which can be applied to both construction and operation phase:

- Maintaining an inventory of the use of hazardous substances on site during construction and operation phases
- Maintaining good housekeeping including containment, cleaning up and disposal of contaminated soil as hazardous waste
- Storing hazardous materials securely in closed containers, inside a roofed, impermeable dedicated storage area equipped with a secondary containment system for spills, in compliance with applicable regulations
- Setting up protective barriers as applicable
- Developing procedures for loading/uploading hazardous chemicals to minimise the risk of incidents during operations
- Conducting routine inspections of the areas that involve the use and storage of hazardous materials and preventive maintenance for all vehicles and equipment on a regular basis to detect possible spills, leaks, and the potential for such occurrences
- Refuelling of equipment and vehicles will be carried out in designated areas on hard standing ground to prevent seepage of any spillages to the ground
- Train the involved personnel in the use (management and storage) of hazardous chemicals on site, and
- Maintaining spill kits in the relevant locations where hazardous substances are used in the Project area.

13.3.1.5 Residual Risk

Proper implementation of mitigation measures might maintain the impacts from spillage of fuel, oil, chemicals, and hazardous materials at **3B Minor** and **3A Negligible** for construction and operation phase, respectively by reducing the likelihood of occurrence to Unlikely (class 3, refer to Table 13.3). Table 13.8 presents the pre and post risk ranking of leakage and spillage incidents during both construction and operation phases.

Table 13.8 Pre and Post Risk Ranking of Leakage and Spillage Incidents

Impact Significance / Phase	Pre risk ranking (Without Mitigation Measures)	Post risk ranking (With mitigation measures)
Construction phase	**4B Minor**	**3B Minor**
Operation phase	**4A Negligible**	**3A Negligible**

13.3.1.6 Monitoring and Auditing

- Monthly monitoring the implementation of all proposed mitigation measures specified in Emergency Preparedness and Response Plan should be conducted properly, and
- Daily inspection of any secondary containment of oil/chemical on site and ensure good maintenance procedures to minimize small leaks and spills.

13.3.2 Traffic Accidents

13.3.2.1 Potential Risk

Traffic accidents have more potential to happen during the construction than the operation phase due to heavy traffic and long distanced transportation of turbines, ancillary equipment, and construction materials as well as daily personnel transportation.

During the planning and construction phase, the project components including wind turbines blades, nacelles and hubs, towers, etc. will be imported from overseas. This type of equipment will be transported from Cam Ranh ports located in Khanh Hoa province through a long journey via National Highway QL1A, TL8, QL26, QL29, and QL14 to the project site, which is located 350 km from the port.

In addition, other construction materials such as concrete, sand, gravel, iron, and steel will be purchased in the best possible, from local vendors in Gia Lai or adjacent provinces. Based on the estimation of transportation period, the number of moving equipment, and the amount of materials need to be delivered to the project site, the average number of vehicles movements is predicted around 20 trips per day. In addition, a number of personal movements of workers also added in the construction phase. These increased traffic volumes have the potential to increase the likelihood of accidents or collisions. In case this unexpected event is improperly planned and managed, the heavy-load long-haul project components may damage the existing roads, highways, bridges, and utility lines (e.g. electricity and cable lines) and could become a potential public safety concern to other vehicles on the road. Moreover, the transportation of huge components on-road may induce injury to people and damage to materials.

13.3.2.2 Significance of Risk (Before Mitigation)

According to the portal of the Ministry of Transportation, a total of five serious traffic accidents happened from 2017 to 2019 at two black spots in Gia Lai Province. The first spot (located on QL14) is at Yen The ward, 15 km north of the Project site whilst the other (located on QL19) is located at An Phu commune, 15 km east of the Project. The accidents could be caused by the diver's behaviours, the high traffic density, and limited visibility[264]. The additional vehicle transported materials and project components (with about 20 trips per day) could be considered the small portion of the total traffic volume. The number of personal movement was unknown at the time to prepare this assessment; however, most of workers are local people who likely live nearby the project site. Therefore, the potential for traffic accidents to happen during the construction phase could be reduced. With the existing rate in the local province and

[264]Portal of Ministration of Transportation (2019) Available at: http://mt.gov.vn/moitruong/quy-chuan-chat-luong/59768/thanh-pho-pleiku--gia-lai--no-luc-xoa--diem-den--tai-nan-giao-thong.aspx, Access date: 05 September 2021.

the nature of the Project, the traffic accidents related to the project could be assessed as Unlikely (class 3 – can happen once or twice during the project's lifetime, refer to Table 13.3).

As discussed above, in case of an accident happening in the Project area, traffic accidents in this area would likely result in injury or fatality. In addition, there are no existing controls recommended by the Project owner for traffic accidents. The consequence of traffic accidents is classified as Severe (Class E, refer to Table 13.2). As the result, the significance of the impact in the worst case is assessed risk rankings of **3E Major** with regards to the risk significance and mitigation measures are strongly required.

Table 13.9 Risk Assessment for Traffic Accidents

Phase	Cause	Consequence	Risk Ranking
Construction phase	■ Transportation of wind turbines, heavy equipment, and construction materials.	■ Property damage ■ Injuries, and ■ Fatality.	**3E Major**

13.3.2.3 Additional Preventive and Mitigation Measures

The following additional preventive and mitigation measures proposed to further control the impacts from unplanned traffic accidents:

- Developing and implementing a Traffic Management Plan which sets out a plan for transport activities personnel in charge, actions to be taken in case of emergency, vehicle inspection timeline, etc. All drivers must be aware of this. This should include measures such as:
  - Installing signs, signals, and sufficient lighting especially during construction, to support vehicle operation at night
  - Ensure speed limits are always respected by all drivers, provide training if needed
  - Planning the transport routes carefully to avoid the potential of collision and roads crossing housing areas
- Coordinating with the People's Committees at provincial levels (Khanh Hoa, Dak Lac, and Gia Lai provinces) to support the transportation of turbine foundations and blades from the Cam Ranh port to the project site
- Coordinating with Communal People's Committee to organize the traffic in and near project site when necessary
- Building the internal access road system to support the transportation of equipment and materials in the construction phase, as well as to support the operation and maintenance activities in the operation phase
- The straight road will be built to connect the main gate and the control house and the transformer station. The road will be asphalted and designed for expected types of vehicles
- Inspecting vehicles regularly for quality and safety aspects, and
- In case the transportation activities of the project cause damage to the local roads, the Project Owner shall make compensation and restore the road condition to its original state.

13.3.2.4 Residual Risk

The mitigation measures, if implemented effectively, can diminish the likelihood of the unplanned event from occurring and the consequence in case the accident happens. On this basis, the risk significant can be reduced to **2C Minor**.

Table 13.10 Pre and Post Risk Ranking of Traffic Accident

Impact Significance / Phase	Pre risk ranking (Without Mitigation Measures)	Post risk ranking (With mitigation measures)
Construction phase	**3E Major**	**2C Minor**

13.2.1.1 Monitoring and Auditing

- During construction, monthly monitoring the implementation of all proposed mitigation measures specified in the Traffic Management Plan (TMP) should be conducted, and
- Regular road condition monitoring along the transportation route to understand road quality during the construction phase.

13.3.3 Fire and Explosion, including Unexploded Ordnance (UXO)

13.3.3.1 Potential Risk

Given the nature of construction work, large volumes of hazardous chemicals for machinery and equipment could be used. Many of them use hydrocarbons (e.g. crude oil and refining products) that are also highly flammable. Improper handling and storing fuel can create a risk of loss of containment (i.e. large-scale spill), fires, or in some situations, explosions.

Unexploded Ordnance (UXO) is defined as military ammunition or explosive ordnance which has failed to function as intended. Some examples of UXO are unexploded bombs, grenades, and artillery shells, mortars used by the Army or the Air Force. Explosions of UXOs left behind from the war require to be detected and cleared at the project sites before the construction phase.

The potential sources of risks associated with fire and explosion would occur as a result of the following events:

- Lightning strike
- Bushfire
- Facility and equipment failure
- Storage of combustion materials
- Explosion of UXOs left behind from the war
- Fuel storage
- Worker's living activities (cooking or smoking)
- Electrical incidents, and
- Damage of the WTGs and their ancillary components, transmission lines due to lightning strikes, electrical arcs or flashovers and malfunctioned equipment.

Large-scale fires, or worst-case explosions, could potentially release smoke and fumes in the broader area. These fumes could impact environmental and social components including biodiversity, community safety, and welfare (for example, sensitive habitats, local community assets, and the health of local community residents). In more severe cases, combustion and explosion can lead to major injuries and possible fatality of human receptors, i.e. construction and nearby residents, especially in cases involving bushfires or UXO explosions.

13.3.3.2 Existing Controls

During the construction phase

According to the Feasibility Report, only mine detection and clearance activities as an existing control related to fire and explosion were conducted during the preparation phase. A total of 53 ha in the Ia Pech commune of the Project was cleared for UXOs within a depth range of 0.3 to 5 m.

During the operation phase

Acoording to the Feasibility Report, there are several existing controls recommended by the Project's owners to minimise the impact caused by fire and explosion events during the operation phase as stated below:

- Fully comply with regulations on firefighting and prevention
- Regularly train on fire fighting and prevention for the whole staffs and workers
- The design of the Project must be approved and certified to ensure fire safety by the Police Department of Fire Prevention and Fighting and Rescue. Project items, including equipment and fire protection systems, must be constructed and accepted according to the approved design
- Fire Prevention and Fighting and Rescue Plan needs to be prepared and submitted for approval following the regulation
- Fully provide protection equipment and fire extinguishers, especially at locations with high risks of fire and explosion (e.g. chemical warehouse, substation, etc.) and other different areas of the Project
- Set up fire alarm systems, evacuation lights, and diagrams in different areas of the project, and
- Regular train, certify and drill on fire and explosion response for emergency rescues team and other staff following the regulation.

13.3.3.3 Significance of Risk (Before Mitigation)

During the construction phase

Fire and explosion are considered Unlikely (class 3, refer to Table 13.3) to occur during the construction phase because only UXO clearance was proposed as an existing control in the construction phase. Without other existing controls could increase the possibility to happen fire and explosion. The lack of existing controls during the construction phase also might result in a slow response in case the fire and explosion occurred. Therefore, the consequence of fire and explosion events during the preparation and construction phase could be Severe (class E, refer to Table 13.2) in worse-case of fatality. Overall, the risk significance is considered **3E Major**.

During the construction phase

Based on statistical data, only 0.3 – 0.5 fire incidents happened per 1000 power stations[265] (for both onshore and offshore industries per year). However, besides happening at the turbine, fire and explosion could happen in other places in the operation phase such as the working camp, the operation house, etc. Therefore, the likelihood of the occurrence is considered very Unlikely (class 2, refer to Table 13.3) to occur with a number of existing controls proposed by the Project Owner for fire and explosion. The existing controls also include some mitigation measures that could minimise the consequence if any accident happens. Therefore, the consequence of fire and explosion events during

[265] https://www.firesafetysearch.com/fire-risk-in-wind-turbines/

the operation phase could be Major (Class D, refer to Table 13.2) in worse-case of injuries. Generally, the risk of fire and explosion events is ranked **2D Moderate**.

Table 13.11 Risk Assessment for Fire and Explosion

Phase	Cause	Consequence	Risk Ranking
Construction phase	■ Electrical arcs or flashovers ■ Lightning strike ■ Bushfire ■ Facility and equipment failure ■ Storage of combustion materials, and ■ Uncleared UXOs.	■ Affect health and wellbeing of plant's workers and local residents ■ Affect local houses, crops, and vegetation, and ■ Affect plants' operation.	**3E Major**
Operation phase	■ Damage of the Wind Turbine Generator (WTGs), transmission lines, insulators, or other supporting parts ■ Fuel storage ■ Worker's living activities (cooking or smoking) ■ Electrical incidents during the operation ■ Damage of the WTGs and their ancillary components, transmission lines due to lightning strikes, electrical arcs or flashovers and malfunctioned equipment, and ■ Lighting.		**2D Moderate**

13.3.3.4 Additional Preventive and Mitigation Measures

All preventive and mitigation measures proposed to reduce the likelihood and severity of accidental fire and explosion are summarised as below:

During the construction phase

- Install warning signs around the UXO-contained areas where clearing has not been undertaken, if any. Activities are forbidden in any areas that have not been cleared.
- Conduct induction training for new workers on UXO areas
- Install firefighting equipment (such as fire extinguishers, proper communication equipment), especially at areas with high risks of fire and explosion, such as warehouses of chemical and transformer stations
- Prepare the Fire prevention and Fighting Plan that ensure compliance with Decree No 79/2014/ND-CP guiding the Law on Fire Prevention and Fighting
- Conduct firefighting training to the emergency support team, contractors, and workers on site and camping areas
- Store flammable materials away from ignition sources and oxidising materials
- Develop an Emergency Response Plan and Emergency Management Plan and monitor contractors to ensure consistent implementation. The Emergency response plan should include:

- Immediately pull the nearest fire alarm if a fire occurs, report the event to shift supervisor or foreman immediately for emergency response
- When the emergency alarm sounds, all employees shall stop all activities and move to emergency assembly places immediately
- Limit the fire areas by utilizing the appropriate firefighting equipment, if the fire is small and controllable, and
- Follow the procedure included in the Emergency Response and Evacuation Plan to take actions.

During the construction phase

- The Project will implement the SEP and a robust stakeholder engagement program on emergency response
- Implement routine inspection and maintenance procedures (in line with international best practice) for any Unplanned Events substances' storage vessels and WTGs, and
- Implement Emergency Preparedness and Response Plan with forest fire protection and monitor contractors to ensure consistent implementation.

13.3.3.5 Residual Risk

In regards to the unintentional event of fire and explosion, if both existing controls and additional recommended mitigation measures are implemented correctly and diligently, the residual risk is minimised to **2C Minor** for construction and operation phases which is shown in Table 13.12 below.

Table 13.12 Pre and Post Risk Ranking of Fire and Explosion

Impact Significance / Phase	Pre risk ranking (Without Mitigation Measures)	Post risk ranking (With mitigation measures)
Construction	**3E Major**	**2D Moderate**
Operation	**2D Major**	**2C Minor**

13.3.4 Occupational Accidents

13.3.4.1 Potential Risk

During the construction phase

The nature of the construction phase presents occupational health and safety risks, which can result in direct impacts on worker's health and safety. This phase will involve a range of activities that could cause injury or even fatality if occupational health and safety regulations are not implemented correctly and diligently. These risks could include, but are not limited to, the misuse of large mobile equipment, wrong handling of construction machinery, working at heights or confined spaces, falling objects, crushing, slip, trip and fall (slippery road during the rainy season), occupational stress, and severe working conditions (hot weather during dry season).

During the construction phase

The operation and maintenance activities that could contribute to or present an occupational health and safety risk, resulting in an accident, injury, or even fatality, including:

- Exposure of workers to electromagnetic field (EMF) while working in proximity to charged electric power lines,
- Safety risks due to working at heights, and
- Electric shock incidents can occur due to the use of damaged equipment or improper operation of electric equipment, substation, and transformers without protective devices and non-compliance with electric safety policy.

13.3.4.2 Existing Controls

During the construction phase

According to the Feasibility Report, there are some existing controls recommended by the Project's owners to minimise the impact caused by occupational accidents during the construction phases as below:

- Conduct periodic medical examination and supply medicine cabinets at the construction site
- Notify and coordinate with local authorities for administrative management of construction workers
- Strictly comply with company's safety and labor equipment regulations (wearing hats, gloves, etc.) and other national safety regulations, and
- Carefully check the ropes and hooks before lifting heavy objects.

During the construction phase

According to the Feasibility Study Report, there are four existing controls suggested to minimise the impact of occupational health and safety accidents:

- Install the safety and warning signs at the necessary areas
- Assign a competent safety officer to supervise the implementation of the safety regulations
- Periodically check and perform maintenance of the turbine and transmission line systems, and
- Staff and workers must strictly comply with the company's occupational safety and health regulations.

13.3.4.3 Significance of Risk (Before Mitigation)

Occupational accidents are considered Likely to happen (class 4 - may happen once or twice a year, refer to Table 13.3) during both construction and operation phase. The consequence can be Severe (class E, refer to Table 13.2) in case of major injury and fatality of workers. Several existing controls were proposed by the Project Owner, therefore, the overall significance is considered **4E Major** and strategic management and mitigation measures are strongly required.

Table 13.13 Risk Assessment for Occupational Accidents

Phase	Cause	Consequence	Risk Ranking
Construction phase	■ Working with heavy equipment ■ Heavy handing, and ■ Working at height.	■ Impact on worker's health and safety ■ Injuries, and ■ Fatality.	**4E Major**
Operation phase	■ Exposure to EMF, and ■ Working at height.		**4E Major**

13.3.4.4 Additional Preventive and Mitigation Measures

The following additional preventive and mitigation measures proposed to further control the impacts from unplanned occupational accidents:

- All workers (including any subcontractor) should be trained on the Health and Safety policy, be provided PPE and first-aid kits, and be informed of Emergency Response Plans
- Establish an on-site grievance redressed mechanism to allow the employees and workers to report any concern or grievance related to work activities
- Assign supervisors to ensure all safety regulations and practices are followed
- Appropriate equipment/methods must be used in case of working at height, hot areas, work in confined spaces, etc.
- Workers (including contractors) need to complete a Job Hazard Analysis (JHA) before undertaking construction activities. Daily toolbox discussions also need to conduct to ensure hazards are identified and management measures are implemented
- Suitable exclusion zones should be established and maintained underneath any working at height activities, where possible, to protect workers from falling objects
- Avoid conducting tower installation or maintenance during poor weather conditions, especially at the place with a risk of lightning strikes, and
- An emergency rescue plan detailing the methods should be in place to rescue workers who are stranded or incapacitated while working at height.

13.3.4.5 Residual Risk

Based on the effective and diligent application of existing controls and mitigation measures, both the likelihood of occurrence of occupational accidents and the severity of consequence could be minimised. On that basis, the impact significance can be reduced to **2C Minor.** The residual risk is presented in Table 13.14.

Table 13.14 Pre and Post Risk Ranking of Occupational Accident

Impact Significance / Phase	Pre risk ranking (Without Mitigation Measures)	Post risk ranking (With mitigation measures)
Construction	**4E Major**	**2C Minor**
Operation	**4E Major**	**2C Minor**

13.2.1.2 Monitoring and Auditing

Random audits to the project areas with high risk activities will be conducted on a monthly basis to ensure proper implementation of the mitigation measures and other internal safety procedures. Any found deviations will be followed up until resolved.

13.3.5 Blade Ejection Failure / Blade Throw

13.3.5.1 Potential Risk

A failure of the rotor blade could result in the “throwing” of a rotor blade, which is an emerging safety concern. That unintentional event can endanger people living/working or just crossing by close to the

wind farm. Assessment of reports and case studies in the open domain had revealed an increasing trend to determine the distance at which a rotor blade could be thrown.

The most severe failure of the “blade throw” generated from splintering of motor blades and detachment of debris from blade fragments could travel over long distances and damage people and properties. It could result in rapid spread of fire and projectile in some cases or spread of debris given the heights of wind turbines. This could result in injuries or even fatalities in surrounding communities and damage to local flora and fauna.

Therefore, it became strictly necessary to define setback distances and/or buffer zones to minimise the risk of damage or injury from components failure.

13.3.5.1.1 National and International Existing Standards

Blade throw/ ejection incidents have been classified as the following modelling studies conducted by various research groups and blade test practices 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) Lightning damage;

(e) Erosion;

(f) Failure at outboard aerodynamic device;

(g) Reduction in stiffness of blades (up to 10%);

(h) Superficial structural or delamination/ laminate wrinkling that eventually becomes permanent, leading to damage; and

(h) Over speeding due to failure of supervisory control and data acquisition (SCADA) to rectify the failure or high wind/ cyclonic/ meteorological conditions.

Considering all the above, it is difficult to attribute blade throw failure to a single attribute or a combination of attributes that result in these incidents occurring. Therefore, national regulations or recommendations are in place in some countries to define setback distances and/or buffer zones surrounding WTGs to minimise the risk of damage or injury from component failure.

IFC EHS Guidelines

The IFC EHS Guidelines on Wind Energy, 2015 has recommended a setback distance, based on a review of existing literature in this domain, (encompassing the rationale that WTG models have varying dimensions) which is 1.5 × turbine height (tower + rotor radius, refer Figure 13.1), 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.

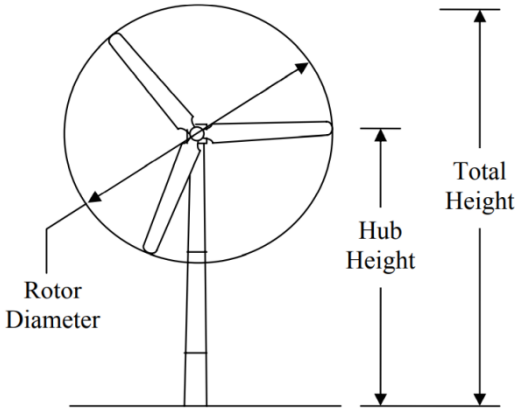


Figure 13.1 Wind Turbine Dimensions

The qualitative blade failure (BF) assessment encompassed the rationale that had been proposed by the IFC pertaining to setback distances which is 1.5 × turbine height (tower + rotor radius).

The Gia Lai Project comprises 30 wind turbines (WD164-3.3 MW). The number of each turbine type, the theoretical setback distances, and impact zone of theoretical blade throw of the WTGs as per IFC wind guidelines have been presented in Table 13.15.

Table 13.15 Setback Distances Adopted for Gia Lai Wind Turbines as per IFC Wind EHS Guidelines

WTG Model	Quantity	Tower height/ Hub height (m)	Rotor Radius (m)	Calculated setback distances as per IFC Wind EHS guidelines (m)
WD164-3.3 MW	30	110	82	288

Setback distances = 1.5 × (hub height + rotor radius)

(Source: EHS guidelines for wind energy, IFC, August 7, 2015)

National Regulation

Vietnam has established a regulation regarding setback distances required to ensure safety of nearby settlements in Circular 02/2019/TT-BCT of the Ministry of Industry and Trade dated 15 January 2019 on regulations on implementation of wind power project development and standard power purchase agreement for projects wind power project. The proposed setback distances required to ensure safety of nearby settlements in Circular 02/2019/TT-BCT are 300m.

Standards Applicable to the Project

In accordance with the IFC EHS Guidelines, the most stringent distance is applicable to the Project. Accordingly, the applicable safety buffer zone of blade throw is 300 m and presented in Figure 13.2.

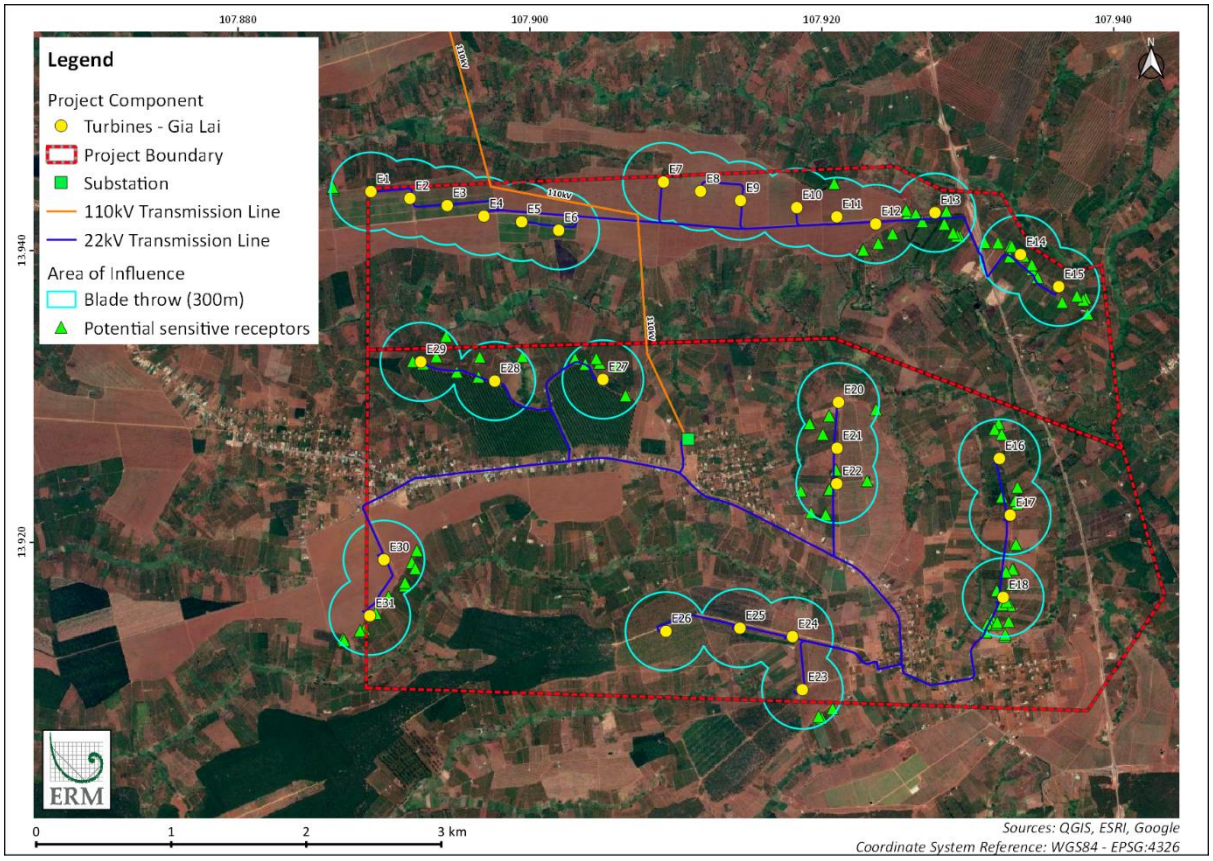


Figure 13.2 Impact Zone of Theoretical Blade Throw

13.3.5.2 Existing Controls

According to Scott (2005), some of the causes of blade failures include: *(a)* Unforeseen environmental events outside the design envelope, *(b)* Failure of turbine control/safety system, *(c)* Human error, *(d)* Incorrect design for ultimate loads, *(e)* Incorrect design for fatigue loads, and *(f)* Poor manufacturing quality. Human error could defeat safety systems during maintenance, resulting in the rotor over speed. Therefore, the plan for system maintenance/safety check-up in the FS is considered an existing control proposed by the Project Owner. This plan is designed as below:

- Periodically implement routine inspection and maintenance procedures in line with manufactory guidelines (both the content and the schedule)
- Maintenance must be conducted by skilled technical employees who know the Project and are trained by the manufacturer. All accessories and equipment involved in the electricity transmission must be checked by experts 2 or 4 times per year.
- Besides the main maintenance schedule following the manufacturer, other two support maintenances including lubricant and bolt tests
    - Equipment used for bolt torque testing must be calibrated. All bolts must be checked in the first maintenance (after one month of operation). For the next time, the bolts will be checked six months/time. The bolts checked in the previous time should be marked to ensure that others will be tested the next time
    - Types and the amount of lubricant should be checked with all related equipment. The use of different types without the manufacturer's approval is unauthorized.

- Regular maintenance shall describe measures and/or limit values or correction range of the parameters. The regular maintenance is conducted six months/time and should be included:
  - General check: visual inspection of corrosion, faults, structure damage, water leakage and penetration; abnormal noise, lightning protection system, ground wire, etc.
  - Rotor blade check: check the dirt on the surface of the wing, lightning path, etc.
  - Wing bearing check: check lubricant leakage, transmission gear system
  - Wing tilt adjustment system check (if any)
  - Rotor bearing check
  - Gearbox check (if any): check lubricant leakage, transmission gear system, etc.
  - Safety brake system check: check the surface of the brake disc, the slit, etc.
  - Generator check
  - Hydraulic system check
  - Wind monitoring equipment check: wind speed and direction sensors
  - Power cable check
  - Tower check
  - Control system, power conversion check, and
  - Fire protection system, safety equipment, and sanitary condition check.

13.3.5.3 Significance of Risk (Before Mitigation)

Based on statistical data, the likelihood of occurrence of the unexpected event “blade throw” is relatively rare. The available documentation in the literature shows blade failure probability in the 1-in-100 to 1-in-1000 per turbine per year range[266]. Moreover, a detailed maintenance procedure has been proposed by the Project Owner. Therefore, the likelihood has been classified as very Unlikely (class 2, refer to Table 13.3). As shown in Figure 13.2, a number of structures were observed during the scoping site visit and via aerial in the safety zone buffer of the blade throw. Solely based on satellite images and not yet verified with further investigation on site, within the 300m radius safety zone of eight WTGs including E1 (3), E12 to E23 (75), E27 to E31 (25) there might be households residing (the number of potentially affected households corresponding with the WTGs following in the brackets), the consequence was considered in Severe (class E, refer to Table 13.2) consequence at worst in case blade throw can cause juries and fatalities. Therefore, the significance of this risk could be classified as **2E Major.**

Table 13.16 Risk Assessment for Blade Throw

Phase	Cause	Consequence	Risk Ranking
Operation phase	■ Root connection failure ■ Catastrophic structural buckling or separation ■ Leading edge, trailing edge, or other bond separation ■ Lightening damage	■ Affect people living near by	**2E Major**

[266] Scott Larwood (2005) Permitting Setbacks for Wind Turbines in California and the Blade Throw Hazard, California Wind Energy Collaborative University of California, Davis Available at: https://docs.wind-watch.org/Larwood-bladethrow-paper.pdf, Access date: 22 July 2021

Phase	Cause	Consequence	Risk Ranking
	■ Erosion ■ Failure at outboard aerodynamic device ■ Reduction in stiffness of blades (up to 10%) ■ Superficial structural or delamination/ laminate wrinkling that eventually becomes permanent, leading to damage, and ■ Over speeding due to failure of supervisory control and data acquisition (SCADA) to rectify the failure or high wind/ cyclonic/ meteorological conditions.		

13.3.5.4 Additional Preventive and Mitigation Measures

All preventive and mitigation measures proposed to reduce the likelihood and severity of accidental blade throw are summarised below:

- Strengthening the foundation of all WTGs
- Providing anchors to all WTGs to delay the impacts
- Establish safety zones at least 288 m away from the WTGs with fences if possible. It was 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
- Additional fieldwork is required to assess more precisely the presence of any households within the safety buffer area. Relocation need to be implemented if any households is determined
- Implement periodic routine inspection and maintenance procedures (in line with international best practice)
- Install warning system, signal boards, lighting prevention system around the 288 m radius of the danger zone where the WTGs located. Equip WTGs with vibration sensors as a warning system for any imbalances in rotor blades
- Creating awareness amongst the residents if any about any potential impacts and bringing to immediate notice of the client any abnormal sound/changes notices by the residents regarding the operation of the turbines
- Communicating risks in the proximity of wind turbines to the neighbouring community, and
- Monitoring any development close to the turbines within the impact zone.

13.3.5.5 Residual Risk

The primary goal of preventative measures is to reduce the likelihood of the unplanned event from occurring. However, given the likelihood of the event have been occurring sporadically, hence, the possibility of such an incident still remains the same. In these cases, the mitigation measures described in the previous section would be applied to minimise the severity of communities and the surrounding environment. The risk of the “blade throw” event minimise to **2D Moderate**.

Table 13.17 Pre and Post Risk Ranking of Blade Throw

Phase \ Impact Significance	Pre risk ranking (Without Mitigation Measures)	Post risk ranking (With mitigation measures)
Operation	2E Major	2D Moderate

13.2.1.3 Monitoring and Auditing

A quarterly audit program shall be established to check the implementation of regular technical inspection of the WTGs and blades' safety. Any identify gaps or areas of opportunity will be followed up after the inspection until resolved. The auditing records will be kept onsite for future review and supervision.

13.3.6 Transmission Line Snapping and Transmission Pylon/Tower Collapse

13.3.6.1 Potential Risk

During operation, there is a possibility of lines or transmission towers/parts snapping/swaying due to the tower falling and resulting in injuries and/or fatalities. The risk is mainly triggered by unexpected extreme wind load levels combined with human errors such as poor quality control, faulty construction, erroneous operation, and improper maintenance[267]. Additionally, any contacts (both intentional and unintentional) with the exposing snapped transmission line can result in electrocution. The causes are mainly poor foundation quality, tower component theft, material corrosion due to poor coating, and poor quality of damaged fitting exposing the system to fail. Other natural hazards can also result in snapping incidents of transmission lines such as strong wind, flash floods, landslides, etc.

Considering the risks from transmission lines, electricity projects require rights-of-way to protect the system from windfall, contact with trees and branches, and other potential hazards that may result in damage to the system, power failures, or forest fires.

IFC EHS Guidelines

According to IFC EHS Guidelines for Electric Power Transmission and Distribution, right-of-ways width for transmission lines range from 15 to 100m depending on voltage and proximity to other rights-of-way (typically range from 15 to 30 m). Particularly, Duke Energy prescribes 21-meter minimum rights-of-way for voltages between 44 and 100 kV, 46-meter minimum rights-of-way for voltages of 230 kV, and 61-meter minimum rights-of-way for voltages of 525 kV)[268].

National Regulation

Vietnam has established a regulation regarding setback distances required to ensure safety of nearby settlements in Decree No.14/2014/ND-CP dated 26 February 2014 on stipulating in detail the implementation of electricity law regarding electricity safety. The proposed right-of-way width and height required to ensure safety of nearby settlements for 110 kV are 6 m and 4m, respectively.

[267] Yang Ma, Pedro Martinez-Vazquez, Charalampos Baniotopoulos (2018) Wind turbine tower collapse cases: a historical overview, A Historical Overview, ICE Proceedings Structures and Buildings 172(8).

[268] The EHS Guidelines for Electric Power Transmission and Distribution (2007) Available at: https://www.ifc.org/wps/wcm/connect/7b65ce6b-129d-4634-99dc-12f85c0674b3/Final%2B-%2BElectric%2BTransmission%2Band%2BDistribution.pdf?MOD=AJPERES&CVID=jqeI4Rs&id=1323162154847, Access date: 22 July 2021

Standards Applicable to the Project

In accordance with the IFC EHS Guidelines, the most stringent distance is applicable to the Project. Accordingly, the 50-m safety buffer zone of right-of-way widths is chosen for conservative and presented in Figure 13.3.

13.3.6.2 Significance of Risk (Before Mitigation)

According to literature (Yang Ma et al, 2018), blade throw, fire, and structural failure share the largest number of wind turbine accidents accounting for 17.9, 14.5, and 9.2%, respectively. However, the possibility of blade throw and fire is very rare as presented in Section 13.3.3 and 13.3.5. As the result, tower collapse and turbine damage with the lower sharing than blade throw and fire will have the lower possibility. Therefore the likelihood of transmission line snapping and transmission pylon/tower collapse has been ranked as very unlikely (class 2, refer to Table 13.3). As shown in Figure 13.3, few structures are found in the 50m buffer. Therefore, the consequence is considered Major (class D, refer to Table 13.2) at worst in case transmission line snapping and transmission pylon/tower collapse may cause severe injuries to a member of the public. Overall, the risk to the local community of this event during the commissioning and operation phase is assessed to be **2D Moderate.**

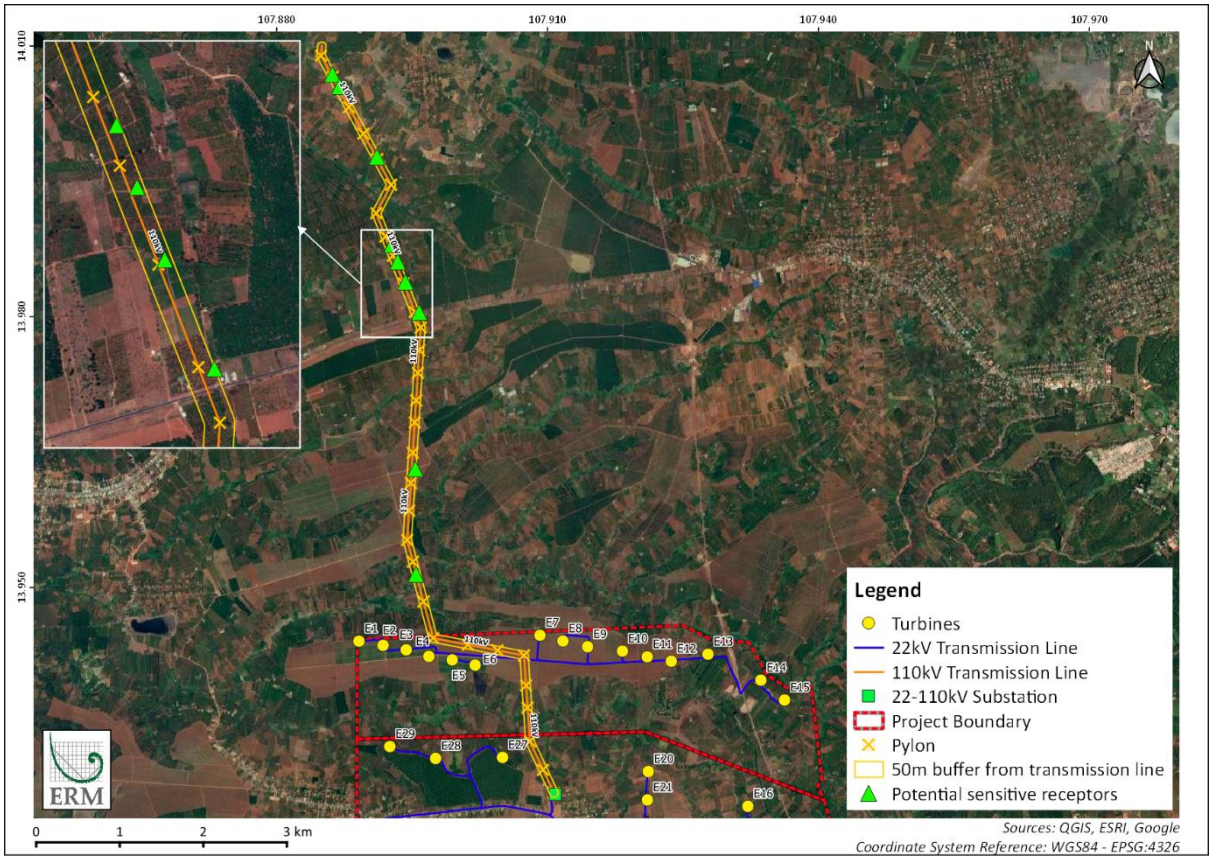


Figure 13.3 Impact Zone of Transmission Line

Table 13.18 Risk Assessment for Transmission Line Snapping and Transmission Pylon/Tower Collapse

Phase	Cause	Consequence	Risk Ranking
Operation phase	■ Foundation failure ■ Tower component theft	■ Affect community health and safety ■ Affect crop activity, and	**2D Moderate**

Phase	Cause	Consequence	Risk Ranking
	■ Damaged fitting, and ■ Natural hazards such as floods, landslides, etc.	■ Loss/reduction of community livelihood.	

13.3.6.3 Additional Preventive and Mitigation Measures

The following preventive and mitigation measures proposed to reduce the likelihood of occurrences of transmission line snapping:

- Conducting sufficient geological surface prior to the construction
- Aligning the turbine foundations and towers design with the geological conditions of the area
- Supervising closely the construction of the turbine foundation and tower to make sure the foundation/tower structure follow the technical design
- Inspecting quality of the structure regularly to promptly detect and respond to issues
- Installing on-off switch to automatically cut off the electrical connection in case of transmission line failure
- Installing warning system, signal boards, lighting prevention system, and anti-climbing devices on the tower
- Preparing an action plan to set out the actions to take in case of transmission line failure, and
- Conducting training to operation staff of the action plan.

13.3.6.4 Residual Risk

Upon effective implementation of mitigation measures, the risk ranking of transmission line snapping and transmission pylon collapse can be diminished to **2C Minor**. The evaluation of pre and post risk ranking of this unplanned event is detailed in Table 13.19.

Table 13.19 Pre and Post Risk Ranking of Transmission Line Snapping and Transmission Pylon/Tower Collapse

Impact Significance / Phase	Pre risk ranking (Without Mitigation Measures)	Post risk ranking (With mitigation measures)
Operation phase	**2D Moderate**	**2C Minor**

13.2.1.4 Monitoring and Auditing

A quarterly audit program shall be established to check the implementation of regular technical inspection of the transmission lines and transmission pylons' safety.

13.3.7 Natural Hazards

13.2.1.5 Potential Risk

As presented in the Environmental Baseline Chapter (Chapter 7), some natural hazards were identified in Gia Lai province such as storms, floods, and thunderstorms. These natural events can cause damage to the Project's facilities and people. Strong wind and flooding may lead to the collapse of structures including turbines, transmission lines, and transmission pylons whilst lightning may be one of causes to lead blade throw.

13.2.1.6 Significance of Risk (Before Mitigation)

According to the environmental baseline, the Project area is unlikely to be affected by storms and floods but has a high probability of thunderstorms compared to the national average. Therefore, in general, the likelihood of natural hazard occurrence in the Project site is considered to be very unlikely (class 2, refer to Table 13.2) and unlikely (class 3, refer to Table 13.3) for the construction and operation phase, respectively. Without any existing controls recommended by the Project owner for natural hazards, the consequence of this unplanned event remains Severe (class E, refer to Table 13.2) that may lead to injury or fatalities at worst. The significance of the risk is considered **2E Major** and **3E Major** for the construction and operation phase, respectively.

13.2.1.7 Additional Preventive and Mitigation Measures

- Safety engineering criteria need to be incorporated to prevent failures due to natural disasters
- Strengthen the weather forecasting system to notify the potential storms, floods, and thunderstorm
- Install warning system, signal boards, flood prevention systems
- Install lightning protection solutions, and
- Prepare an emergency response plan including facility shutdown and personnel evacuation.

13.2.1.8 Residual Risk

Upon effective implementation of mitigation measures are implemented, the risk ranking of natural hazards can be diminished to **2C Minor and 3C Moderated** for construction and operation phase, respectively. The evaluation of pre and post risk ranking of this unplanned event is detailed in Table 13.20.

Table 13.20 Pre and Post Risk Ranking of Natural Hazards

Impact Significance / Phase	Pre risk ranking (Without Mitigation Measures)	Post risk ranking (With mitigation measures)
Operation phase	**2E Major**	**2C Minor**
Construction phase	**3E Major**	**3C Moderate**

13.2.1.9 Monitoring and Auditing

Monthly monitoring of the implementation of all proposed mitigation measures specified in the Emergency Preparedness and Response Plan should be conducted properly.

13.2.2 Summary

In summary, a range of unplanned events can create minor to detrimental unexpected impacts during the project's lifetime. This chapter examines the potential impacts of those events, proposes additional mitigation measures, and evaluated the risk significant prior and after implementing the mitigation measures. The key findings of this chapter are summarised in Table 13.21.

Table 13.21 Summary of the Risk Ranking of the Potential Unplanned Events during Preparation and Construction and Commissioning and Operation Phases

No.	Unplanned Events	Phase	Impact significance					
			Pre-mitigation			Post-Mitigation		
			Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating
1	Leakage and spillage incidents	Construction phase	Likely (4)	Minor (B)	4B Minor	Unlikely (3)	Minor (B)	3B Minor
		Operation phase	Likely (4)	Incidental (A)	4A Negligible	Unlikely (3)	Incidental (A)	3A Negligible
2	Traffic accidents	Construction phase	Unlikely (3)	Severe (E)	3E Major	Very unlikely (2)	Moderate (C)	2C Minor
3	Fire and explosion	Construction phase	Unlikely (3)	Severe (E)	3E Major	Very unlikely (2)	Major (D)	2D Moderate
		Operation phase	Very unlikely (2)	Major (D)	2D Moderate	Very unlikely (2)	Moderate (C)	2C Minor
4	Occupational Health and Safety	Construction phase	Likely (4)	Severe (E)	4E Major	Very unlikely (2)	Moderate (C)	2C Minor
		Operation phase	Likely (4)	Severe (E)	4E Major	Very unlikely (2)	Moderate (C)	2C Minor
5	Blade ejection failure / Blade throw	Operation phase	Very unlikely (2)	Severe (E)	2E Major	Very unlikely (2)	Major (D)	2D Moderate
6	Transmission line snapping and tower swaying/collapsing	Operation phase	Very unlikely (2)	Major (D)	2D Moderate	Very unlikely (2)	Moderate (C)	2C Minor
7	Natura Hazards	Construction phase	Very unlikely (2)	Severe (E)	2E Major	Very unlikely (2)	Moderate (C)	2C Minor
		Operation phase	Unlikely (3)	Severe (E)	3E Major	Unlikely (3)	Moderate (C)	3C Moderate

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APPENDIX A EXISTING NON-GOVERNMENTAL ORGANIZATIONS IN GIA LAI PROVINCE[269]

[269] This information referred to https://www.ngocentre.org.vn/ingodirectory?field_ingo=&title=&field_projectsvietnam_value=&tid_1=275

Accessed date: 14 July 2021

No.	Short name	Organization name	Email Address	Phone	Mission
1	CEEVN	Center for Educational Exchange with Vietnam of the American Council of Learned	edex@ceevn.org	+84-4-3723 6825	Since 1988, CEEVN has assisted Vietnamese institutions and individuals obtain access to educational opportunities throughout the world. In this work, CEEVN is especially concerned to strengthen linkages between Vietnamese institutions and the international academy and to work with those institutions to provide disadvantaged individuals and communities with opportunities for learning and cultural expression.
2	VCF	VinaCapital Foundation	info@vinacapitalfoundation.org	+84 8 3827 8787	The VinaCapital Foundation's (VCF) mission is to empower the children and youth of Vietnam by providing opportunities for growth through health and education programs. Our vision at VCF is a Vietnam where all children, regardless of health complications or a lack of access to education, can take advantage of the opportunities available so that they may contribute to society and achieve their dreams.
3	WSPA	World Society for the Protection of Animals	N/A	+84 4 62764027	A world where animal welfare matters and animal cruelty has ended. The World Society for the Protection of Animals exists to tackle animal cruelty across the globe. We work directly with animals and with the people and organisations that can ensure animals are treated with respect and compassion. With your support, we campaign effectively to combat the world's most intense and large-scale animal welfare issues. We bring about lasting change by: • helping people understand the critical importance of good animal welfare • encouraging nations to commit to animal-friendly practices • building the scientific case for the better treatment of animals.

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ERM Vietnam
3rd Floor, Saigon Finance Centre
09 Dinh Tien Hoang, Dakao Ward
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Vietnam

T: +84 28 3914 7800
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