Environmental and Social Impact Assessment Report (ESIA)

Project No.: 51209-001
November 2017

INO: Eastern Indonesia Renewable Energy Project

Prepared by ESC for PT Energi Bayu Jeneponto (EBK) (Republic of Indonesia)

Tolo I Wind Farm

Environmental and Social Impact Assessment (ESIA)

22.11
2017

ESC

EXECUTIVE SUMMARY

Some 39 million Indonesians still lack access to electricity, especially those in rural areas, a number predicted to increase with population growth. The Indonesian National Electricity Forecast predicts electricity demand increase of about 10% annually; at present, slightly over 36 Gigawatts of capacity exists, targeted to increase to 115 GW in 2025. The planned energy mix includes 25% renewable energy; The Government of Indonesia is committed to reduce 26% of greenhouse gas emissions (GHG) by prioritizing renewable energy as outlined in the *National Action Plan for Reduction of GHG*. Wind power produces little to no GHG emissions in operation; wind energy is renewable, clean, consumes no water, and uses little land. Net effects on the environment are far less problematic than use of fossil-fuel power sources.

Equis Asia Fund II, through its Indonesian platform PT Redaya Energi Indonesia (REI) and PT Energi Bayu Jeneponto (EBJ) (together, Equis), has signed a Power Purchase Agreement with National electric utility PT PLN (Persero) to develop the Tolo Wind Farm Project in Jeneponto, South Sulawesi, with objectives of contributing to the GoI's capacity growth program by producing 72 MW of wind energy, also helping achieve the renewable energy target and supporting the Sulawesi electrical grid, and thus contributing to development of the regional economy.

Equis is one of Asia's largest renewable energy developers and investors with 3.7 GW of renewable generation assets financed across Asia and some US$2.6 billion in equity raised. Equis has been a UN Principles for Responsible Investment (UNPRI) signatory since 2014.

The Project is considered Category B, as it entails limited environmental/social impacts, applies world-class engineering and proven technology, and adopts good international practices, including IFC Performance Standards and EHS Guidelines.

The Tolo I Project covers an area of approximately 50 hectares at the southern end of the Island of Sulawesi (turbine and transmission tower, building, and infrastructure foot prints). The Project includes 20 turbines (hub height 135m with 63.5m rotors blades), with tower hardstands sites of about 0.63 ha each, 14 km of roads, a Pooling Substation, O & M facilities, a 33 kV underground collector system connecting the turbines, and 150 kV, 3.5 km overhead transmission line to the PLN Jeneponto substation.

The planning phase for Tolo I (design, engineering, and site preparation) is expected to be completed by Q1 2017, followed by 15-18 months of construction (early works followed by 12 months post-NTP), with 3-6 months for commissioning. Construction will employ a maximum of 180 workers. Wind energy production is targeted to commence in Q2 2018, with a very small onsite operational control work force, and will continue for at least 30 years. Decommissioning may be undertaken in 2048, but the Project may continue to operate under other contractual arrangements, depending on economic and technological conditions at that time. Alternative sites and technologies have been considered, but offer no advantages over those selected. The expansion (Tolo II), if carried out, will be a stand-alone new project about 2-5 km to the north and east of Tolo I.

Indonesian EIA permitting (AMDAL) has been completed, with the Environmental Permit (Izin Lingkungan) obtained on 6 March 2017. A separate UKL-UPL permitting effort for the 150 kV transmission line has already been submitted and approved, with Izin Lingkungan obtained on 15 March 2017. The majority of project elements are sited on rain-fed rice fields, land that is relatively unproductive in that it lacks irrigation and produces only one crop per year. Land acquisition involved no physical relocation and only minor household economic impacts. Short-term, minor impacts of air quality deterioration, noise, water consumption, soil erosion and compaction, and increased traffic load are expected during construction, with some stimulation of local economic activity. In operation, minor noise, and shadow flicker effects can be expected to impact several adjacent residential settlements. Health and safety risks for nearby communities are considered minor. Based on the bird and bat survey study the CR and/or EN bird species are not included in the list of bird species that was recorded in the study area. This is to confirm that yellow crested cockatoo, Christmas frigate bird and Great Knots bird species have not been found in the project area and these bird species live in coastal areas. No coastal bird species have been noted during the field work at the project site. No protected or endangered bat or bird species have been identified in the Project area. The bird and bat survey study has also confirmed that the project location is not traversed by global migration route of bird species or other groups. Management of all these impacts is addressed by the Environmental and Social Management System and Plan. Additional/extended birds and bats survey will also be conducted to include more survey points and will cover two seasons. The terms of reference (TOR) for the extended bird and bat survey is presented in Appendix 17.

Conclusions

Examining the activities involved in planning, constructing, operating, and decommissioning the Tolo I Wind Power Project, the characteristics of the existing natural and social environment, and the predicted impacts and management/mitigation measures to be applied, it is concluded that the Project:

- Is environmentally and socially feasible, with no severe impacts on the population or environment;
- All significant impacts can be managed or at least mitigated;
- Will assist Indonesia in meeting the needs for electricity in the southern part of Sulawesi Island;
- By using wind, a renewable energy resource, assist Indonesia in meeting targets for reducing carbon emissions; and
- Will provide local residents with benefits during construction and operation.

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURE

LIST OF APPENDICES

ABBREVIATIONS

AAQS	Ambient Air Quality Standards
ADB	Asian Development Bank
Amdal/EIA	Environmental Impact Assessment
Andal	Environmental Impact Assessment Statement
APL	Other Land Uses
BPS	Central Statistics Bureau
BS	Base Saturation
CEC	Cation Exchange Capacity
CEHSMP	Construction Environmental Health and Safety Management Procedure
COD	Commercial Operation
DHF	Dengue Hemorrhagic Fever
DLH	*Dinas Lingkungan Hidup*
DS	Degree of Saturation
EBJ	PT Energi Bayu Jeneponto
EDC	Environmental Design Criteria
EHS	Environmental Health and Safety
EMF	Electric and magnetic fields
EMP	Environmental Management Plan
EP	Equator Principles
EPC	Engineering, Procurement, and Construction
EPC CM	EPC Contract Manager
EPC EM	EPC Contractor's Environmental Manager
EPFI	Equator Principles Financial Institutions
ESC	PT Greencap NAA Indonesia
ESG	Environmental, Social and Governance
ESHIA/AMDAL	Environmental Social Health Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ETT	EBJ Technical Team
GDP	Gross Domestic Product
GHG	Greenhouse gas
GIIP	Good International Industry Practices
GIS	Geographical Information System
GoI	Government of Indonesia
GM	Grievance Mechanism

GRDP	Gross Regional Domestic Product
GW	Gigawatt
IEA	International Energy Agency
IFC PS	International Finance Corporation Environmental and Social Performance Standards
IFI	International Financial Institutions
IFR	Instrument Flight Rules
IP	Indigenous Peoples
IPP	Indigenous Peoples Plan
ITB	Institut Teknologi Bandung
IVI	Importance Value Index
KA ANDAL	Terms of Reference of Environmental Impact Assessment
KK	Household
MCAs	Minimum Crossing Altitudes
MEAs	Minimum En-route Altitudes
MHAs	Minimum Holding Altitudes
MMT	Multi-Partite Monitoring Team
MoER	Ministry of Energy and Mineral Resources
O & M	Operations and Maintenance
OEM	Owner's Environmental Manager
OPM	Owner's Project Manager
PAD	Locally-Generated Revenue
Perpres	Presidential Decree
PI	Pollution Index
PLN	PT PLN (Persero) – National Electric Power Company
PLTB	Wind Electric Power Plant
PM	Project Manager
PNS	Civil Servant
PP	Government Regulation – *Peraturan Pemerintah*
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PUK	Working Age Population
REI	PT Redaya Energi Indonesia
RKL-RPL	Environmental Management and Environmental Monitoring Plan
RN	Renewable Energy
RTRW	Spatial Plan
S1	Bachelor Degree
SEP	Stakeholder Engagement Procedure

SLI	Service Level Index
SLTA	Senior High School
SOP	Standard Operating Procedures
TOR	Terms of Reference
SPAL	Wastewater Disposal System
UKL-UPL	Environmental Management Efforts-Environmental Monitoring Efforts
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNHAS	Universitas Hasanuddin
UNPRI	United Nations Principles for Responsible Investment
VFR	Visual Flight Rules
WHO	World Health Organization
WTG	Wind Turbine Generator

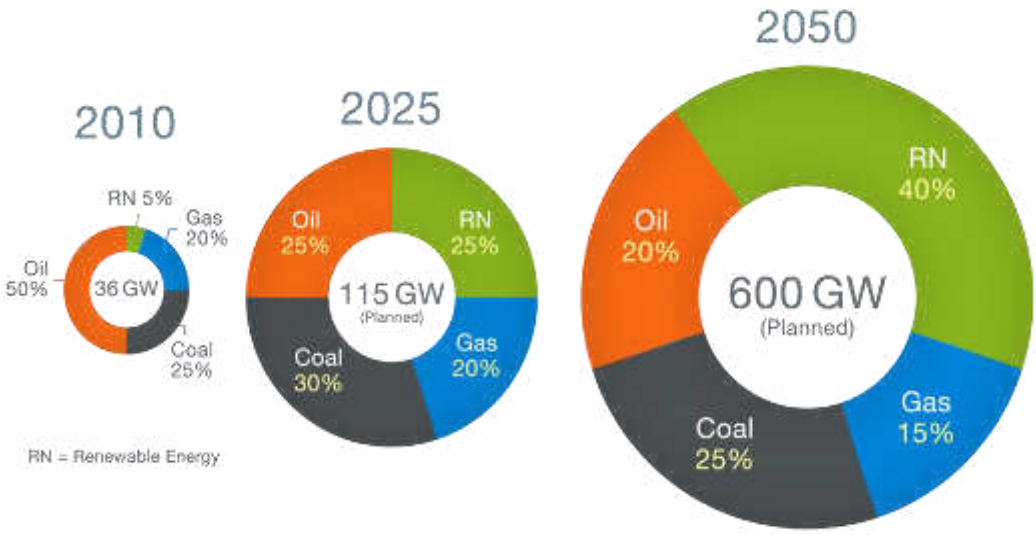
CHAPTER 1
PROJECT OVERVIEW

Chapter 1 provides an overview of the Project (objectives and benefits; project identity and location; project components and implementation phases) and of the content and structure of this ESIA document.

1.1 Project Objectives

With the fourth highest population in the world Indonesia has an ever increasing demand of electricity. In addition, based on World Bank data (World Bank Indonesia Country Profile 2015), about 39 million Indonesian still lack accesses to electricity, especially those live in rural areas. This number is predicted to increase due to future population growth.

The Indonesian National Electricity Forecast (*Rencana Ketenagalistrikan Nasional*) as published by the Indonesia Ministry of Energy and Mineral Resources (MoER) predicts an electricity demand increasing by about 10% annually in line with an Indonesian population growth rate of around 5 to 6 % per year. National electricity installed capacity totaled at 36 Gigawatt (GW) in 2010; to fulfill community needs and to support economic development, the government is targeting to increase the installed capacity to 115 GW in 2025 through an energy mix of oil (25%), gas (20%), coal (30%), and renewable energy (RN) (25%), for a total of 600 GW in 2050 as shown in Figure 1-1.



Source: RUPTL 2014

Figure 1-1 Indonesian Electricity Forecast

The Government of Indonesia (GoI) energy policy also includes increasing electricity generation by 35 GW in a fast-track program. At the same time the GoI is committed to reduce 26 % of greenhouse gas emission (GHG) by prioritizing the use of renewable energy as outlined in *Presidential Decree (Perpes) No 61 of 2001 on National Action Plan for Reduction of Greenhouse Gas Emission through Electricity Generation from Renewable Energy Sources*. This commitment to reduce GHG emission is also reflected in COP21 UNFCCC (21st Conference of Parties United

Nations Framework Convention on Climate Change) in Paris in 2015, when the GoI announced its commitment to reduce the GHG emission by 29 % in 2030 by its own efforts or by 41 % in 2030 with International support.

Wind energy, a form of renewable energy, describes the process by which wind is used to generate electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. A generator then converts mechanical power into electricity. Figure 1-2 illustrates that wind power produces little if any GHG emission: wind energy, as an alternative to burning fossil fuels, is plentiful, renewable, widely distributed, clean, produces no greenhouse gas emissions during operation, consumes no water, and uses little land. The net effects on the environment are far less problematic than those of non-renewable power sources.

PLN's Electricity Supply Business Plan of Indonesia (RUPTL 2016-2025) sets out a target to reach 535 MW of wind energy before 2025. Investing in wind energy is a winning strategy for the GoI to achieve its target to achieve its 25% RN target in 2025 and its commitment to reduce climate gas emissions by 29% in 2030.

It is estimated that wind power generation emits only 14 CO_2 t/GWh .The manufacture and installation stages together account for over 90% of the total carbon emission over project life (including GHG generation for concrete foundations, construction emissions, etc) while operation and maintenance activities contribute around 5% of total CO2 emissions. Decommissioning stage accounts for a further 5%.

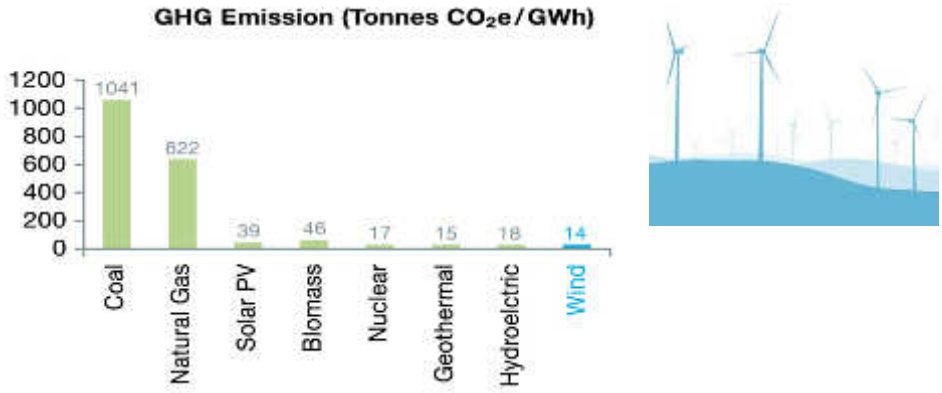


Figure 1-2 Lifecycle GHG Emissions of Various Electricity Generation Schemes

Against this background Equis Asia Fund II, through its Indonesian platform PT Energi Bayu Jeneponto (EBJ) (together 'Equis'), has signed a Power Purchase Agreement ('PPA') with PT PLN (Persero) ('PLN') to develop the Tolo I Wind Farm Project in Jeneponto, South Sulawesi, Indonesia (the 'Project'). The objectives of developing the Tolo I Wind Farm Project are to:

- contribute to the GoI's 35 GW additional capacity by 2019 program by producing 72 MW of wind energy;
- contribute to GoI's 23% renewable energy target;
- introduce new technologies for electricity generation to Indonesia;
- support the South Sulawesi electrical system; and by doing so to contribute to the development of the local economy.

1.2 Project Proponent

Equis is one of Asia's largest renewable energy developer and investor with about 3.7 GW of renewable energy generation assets financed across Asia and more than US$2,655 million in equity raised. Equis maintains 15 Asian offices, operating in Indonesia through PT Redaya Energi Indonesia and its Indonesian platform PT Energi Bayu Jeneponto, the Owner of the Project:

Company Name	:	PT Energi Bayu Jeneponto
President Director	:	Daniel Astbury
Address	:	The Plaza Office Tower 25th Floor Jalan MH. Thamrin Kav. 28-30 Jakarta 10340 Indonesia

1.3 Location and Spatial Characteristics

Section 1.3 details project location and access, and elaborates on the Project's conformance with regional spatial planning.

1.3.1 Project Location

EBJ intends to construct the Project in the Empoang and North Empoang Villages in Binamu District; the East Kayuloe, West Kayuloe, Bontomatene, Parasangan Beru Villages, Turatea District; the Maccini Baji village in Batang District; and the Kalumpangloe Village in Arungkeke District, all villages being part of the Jeneponto Kabupaten (Regency) (**Figure 1-3**). The Project obtained the Principle Permit from the Jeneponto Regency in form of Letter No 256 / IP / KPT / JP / X / 2016 on the Development of Wind Power Plant (PLTB) in Jeneponto (Extension of In-Principle Permit No 107 / IP / OPT / JP / X / 2015).

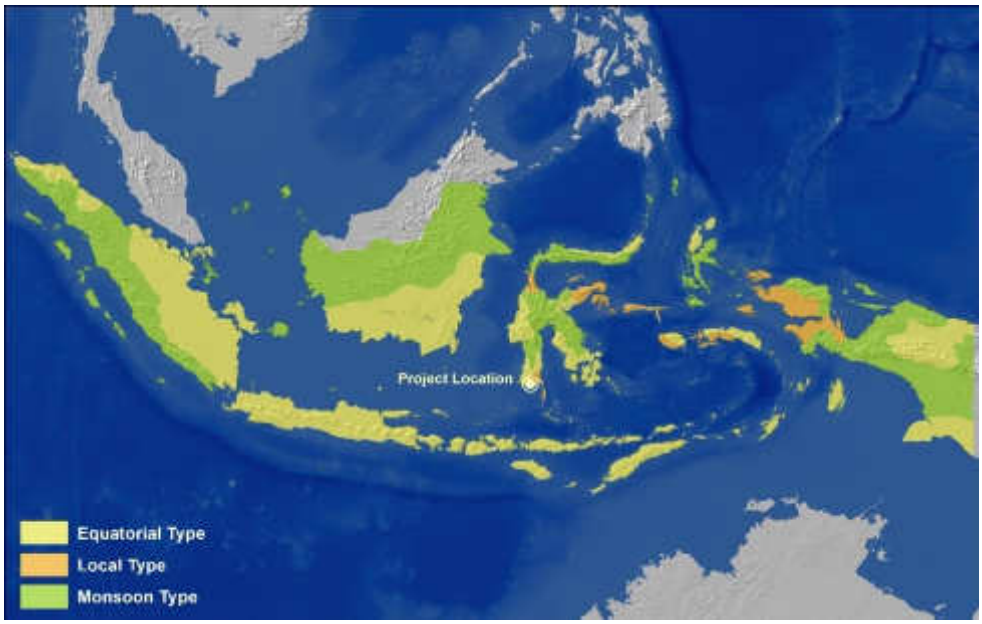


Figure 1-3 Project Location and Climate Zone

1.3.2 Project Access

The Project is accessible by land using the Jl. Poros and Tol Reformasi road at about the 98 km marker from Makassar Port in South Sulawesi (about 2 hrs by car). The flight from Jakarta to Makassar takes about 90 min. The Project covers a total area of about 50 ha, of which the tower foot prints account for about 13 ha.

1.3.3 Conformance with Spatial Planning

The Project has obtained the recommendation letter on Compliance with Spatial Plan of the Government of Jeneponto (Spatial Planning and Hygiene No 145 / DTRK / TR.1 / JP / XI / 2016). The recommendation letter confirms that the Project location is in compliance with the Jeneponto Spatial Plan (RTRW) as stipulated in Jeneponto Regency Local Regulation No 1 of 2012.

The Project location falls under the category 'other land use' (*Area Penggunaan Lain* or APL in short) (technical consideration and recommendation from Forest Area Consolidation Centers (BPKH – *Balai Pemantapan Kawasan Hutan*) Region VII Makassar No S.156 / BPKH /. VII-2 / 2016 dated 29 April 2009).

1.4 Project Components and Associated Facilities

Main Project components and associated facilities include turbine towers with generator and propeller; access roads; and local electric network together with the connection to the electricity grid (**Figure 1-4**). These components detail as follows (see Section 4 for more details):

- 20 Turbine towers with a height of 135 meters;
- Propeller rotor with a length of 63.5 meters;
- Turbine tower site with crane hardstand area (about 44 x 144 meters each);
- Permanent Project roads 14 km in length and about 5 to 8 meters in width (which includes road shoulders);
- Pooling Substation occupying an area of about 1.2 to 4 ha;
- Operations and Maintenance facilities (O & M Facilities) of about 2 ha;
- 33 kV underground collector system connecting the turbines; and
- 150 kV overhead transmission line to PLN Jeneponto substation with a length of about 3.5 km. [1]

[1] A separate UKL-UPL (Mini EIA) has been prepared in separate document and is presented in Appendix 16.

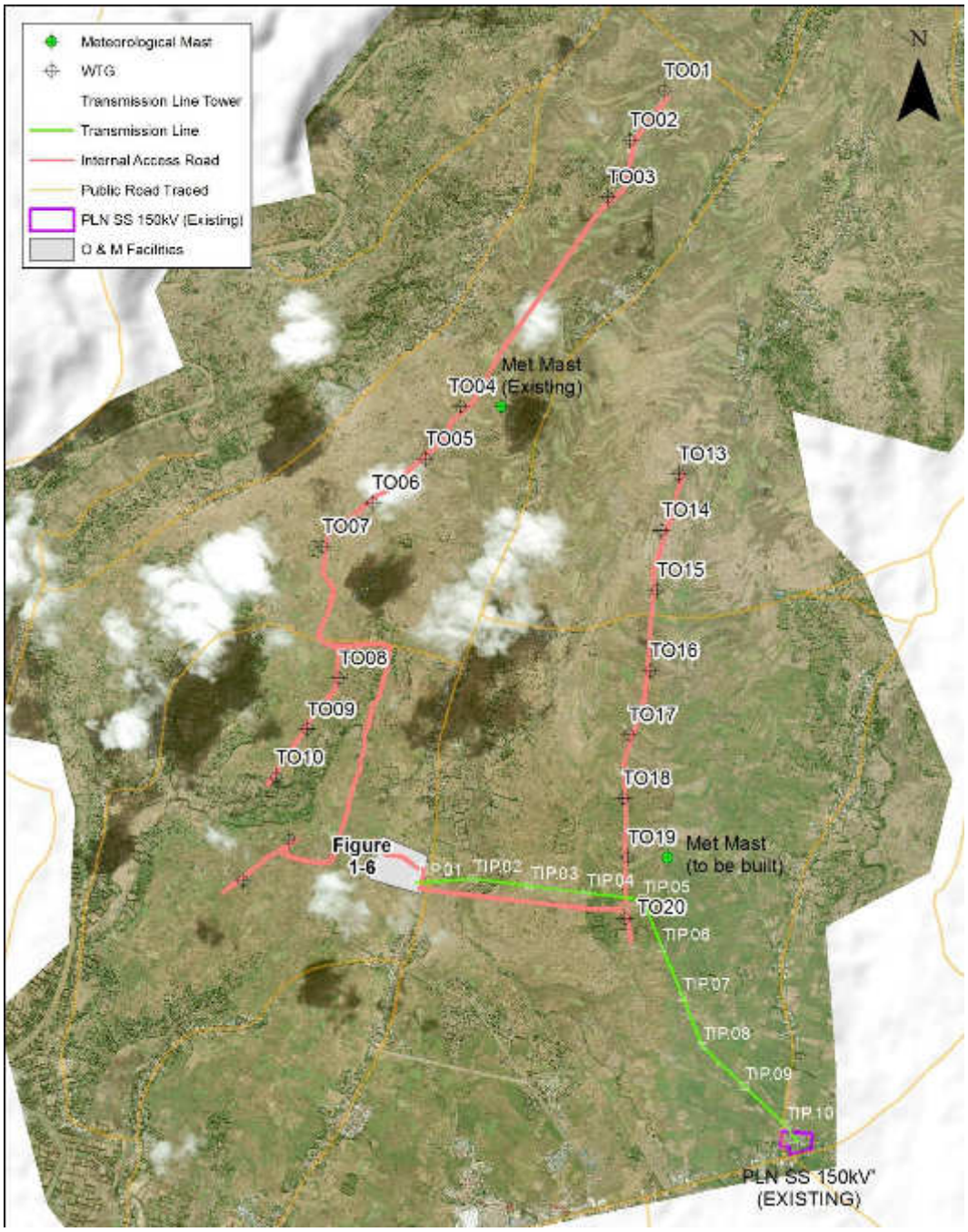


Figure 1-4 Project Layout

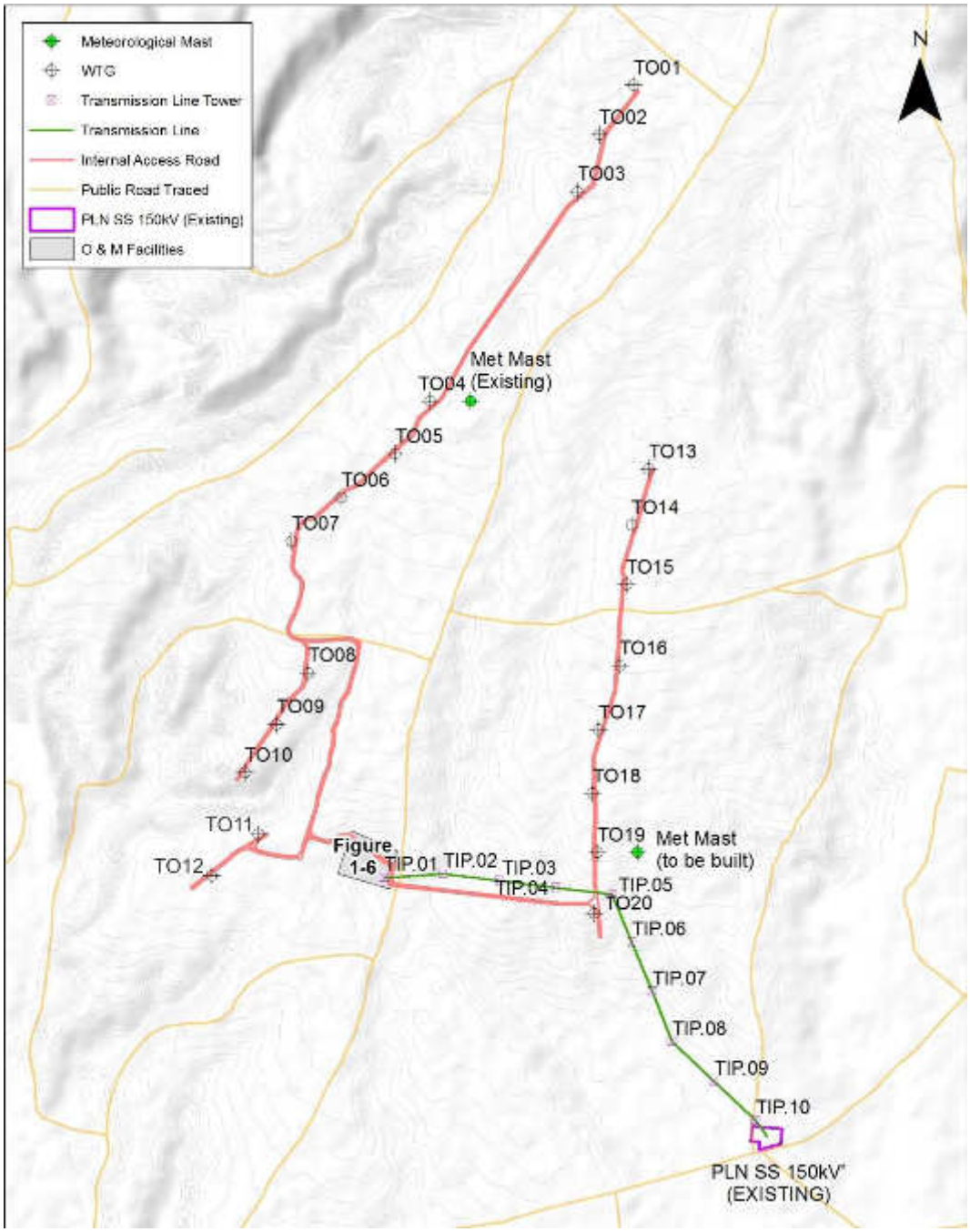


Figure 1-5 Project Layout (continued)

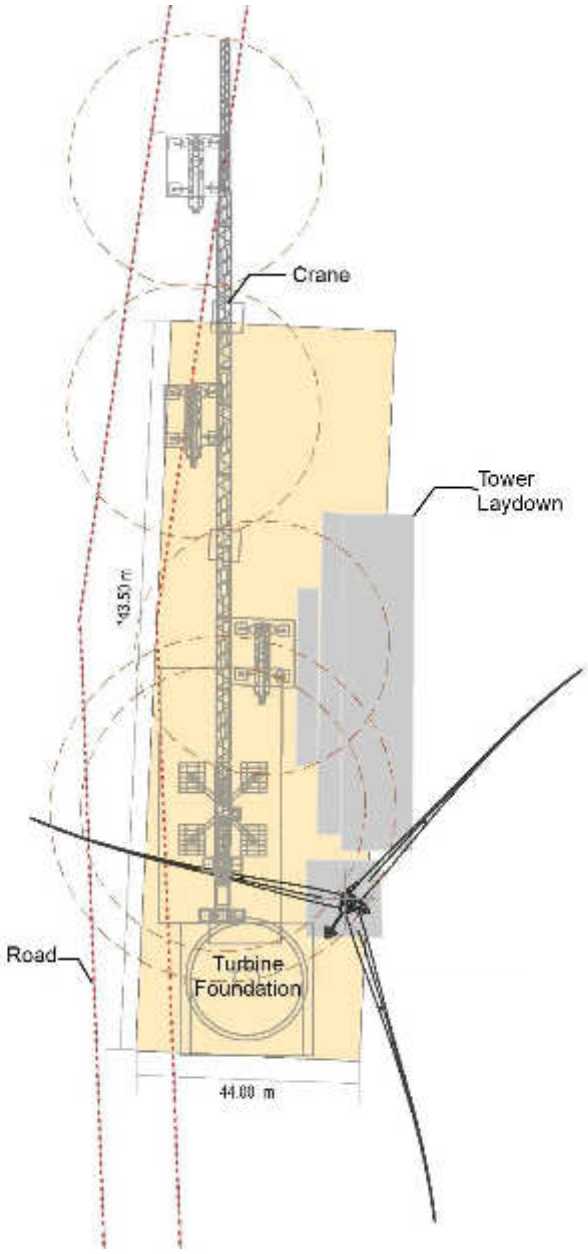


Figure 1-6 Project Layout (continued)

1.5 Project Phases

The pre-construction phase comprises project planning, engineering, and site preparation and is expected to be completed by mid of 2017. It will be followed by construction activities, which are scheduled to last about 15-18 months (early works followed by 12 months post-NTP), followed by an additional 3-6 months for commissioning (**Figure 1-7**).

Figure 1-7 Implementation Timeline

Production of wind energy is scheduled to commence by Q2 2018 and to last for 30 years. Decommissioning is expected to begin in 2048, but the Project may continue to operate beyond this time, depending on the economic conditions.

1.6 Project Workforce Requirements

The construction activities will employ a maximum of 180 workers. The workforce numbers will vary over time, depending on the activities such as site preparation, foundations, civil work, electrical work, etc. Most of the workforce will be blue collar workers recruited locally by the Engineering, Procurement, and Construction (EPC) contractors (**Table 1-1**). More highly skilled workers such as operators for heavy equipment and other specialized jobs may be hired from other regions in Indonesia. Few expatriate professionals will be required as the main technology comes from abroad.

Table 1-1 Estimated Construction Workforce Composition

Specification	Total	Skilled / unskilled
Site engineer	10	Skilled
Wind Power Specialist	10	Skilled
Supervisor/ Manager	5	Skilled
Administration	10	Skilled
Security Guard	25	Skilled and unskilled
Labour	120	Skilled and unskilled
Total	**180**	

The operational workforce will be much smaller than the construction workforce. Most operational workers will require specific competencies and certifications. The total operational workforce will be determined towards the end of the construction phase**.**

1.7 Project Alternatives

EBJ has extensively explored Project alternatives, in particular related to wind tower location and technology.

1.7.1 No Project

The no project scenario is that the wind farm is not built. In the event that the wind farm is not built there will be no negative impacts in terms of those that might be typical of wind farms (noise, visual impact, shadow flicker etc.). The Jeneponto Kabupaten, on which territory the wind farm is supposed to be built, and the host communities will in this scenario feel negative impact because they do not receive the financial and other rewards associated with the construction of the wind farm as a major private investment in this otherwise economically challenged area.

From a national perspective, there will be a negative impact in that South Sulawesi will be more reliant on fossil thermal power generation to meet increasing energy demand and also Indonesia will not be developing renewable energy sources in line with its international obligations. Without the Project, 72MW of electricity for the South Sulawesi electric grid has to be obtained from another source, the most likely source being diesel fuel. Diesel energy (or any other thermal energy) would create significant carbon emissions (see also Figure 1-2).

1.7.2 Alternative Siting

Selection of the Project location is guided by wind speed and wind power density observed at the area which control how much energy a potential wind farm could produce. While few alternative sites in South Sulawesi with similar wind energy potential exist, particularly near the coast, they don't offer significant economic or environmental advantages. Site selection is further limited given that similar projects are in planning stages in the larger Project area.

Impacts at the port and along the transportation road are temporary, and no cumulative impact assessment is expected. There is the possibility of a second windfarm development in the Project area (Tolo II) also to be developed by Equis. Cumulative impacts would preliminary relate to economic displacement, noise, shadow flicker, and visual impact. The preliminary project design suggests that the proposed Tolo II will be in sufficient distance to Tolo 1 (about 2 to 5 kilometers) to ensure that such cumulative impacts do not materialize.

1.7.3 Alternative Project Configuration

Early in the planning process, EBJ considered alternative scenarios associated with the wind farm at the proposed site. These considered the following:

- Number of installed wind turbine generators (WTGs);
- Increased spacing between turbines in order to minimize noise and shadow flicker cumulative impact; and
- Application of buffer zones to move away from settlements (potential noise and flicker impacts).

The early assessments undertaken by EBJ suggested a staged wind farm development limiting the number of WTGs to 20 in the first stage (Tolo I) and a buffer zone averaging to about 500 m from dwellings. Tolo II (second stage) will be a stand-alone new Project located about 2-5 km further north and east of Tolo I. Impacts related to Stage 2 will be the subject matter of a new ESIA.

1.7.4 Alternative Technology

The Project site has no particular advantages for any technology other than climatic conditions. A power plant using conventional fossil fuel including diesel would very likely be sited elsewhere. The Jeneponto region would not be impacted by any of the environmental and social impacts associated with the Project, but the region would forego all of the economic benefits.

1.7.5 Alternative Site Access

Practically, there are only two routes that could be used for the delivery of major plant items to the site.

The southern exit from the coast would provide the shortest distance but deliveries of the various wind farm components would require constructing a new port facility. Besides increasing project costs, port construction would introduce additional environmental impacts.

The use of the Makassar port facilities and road transportation along Jalan Poros and Tol Reformasi road means that the heavy vehicles will pass through various regencies, namely Makassar city, Gowa, Takalar and Jeneponto (Figure 1-8). This transportation route will require the Project to upgrade parts of the local road to meet the size and weight requirements for the delivery vehicles. It should be noted that zero community displacement is expected within the transportation route. It is hoped that this upgrade will help support the development of the Jeneponto Kabupaten.

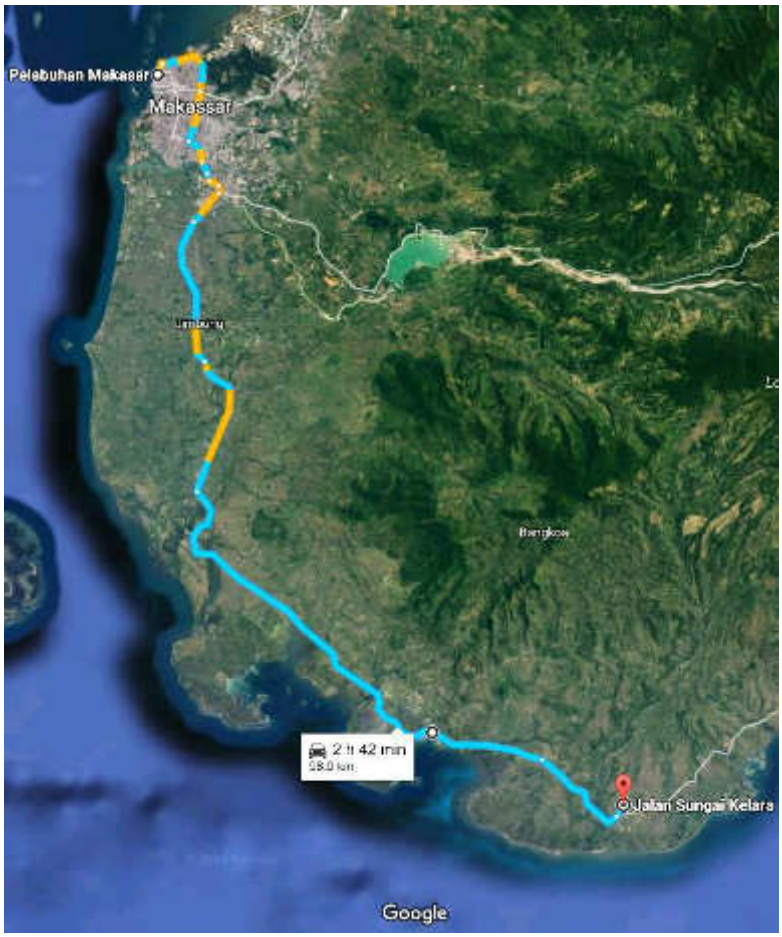


Figure 1-8 Ground Transport Route

1.8 Environmental and Social Impact Assessment and Management Plan Overview

Section 1.8 details the ESIA objectives, regulatory permitting requirements, ESIA scope and project categorization, and key Project impacts. Section 1.8 also identifies the ESIA Consultant and outlines the organization of the ESIA document.

1.8.1 Objectives

The ESIA is designed to meet the regulatory requirements and the requirements of the 2012 IFC Environmental and Social Performance Standards (IFC PS) to achieve the following environmental and social sustainability objectives:

- Identify and evaluate environmental and social risks and impacts of the Project;
- Adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected stakeholders, and the environment;
- Promote improved environmental and social performance through the effective use of management systems;
- Ensure that grievances from affected stakeholders are responded to and managed appropriately; and
- Promote and provide means for adequate engagement with affected stakeholders throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

1.8.2 Regulatory Permitting Requirements

Compliance with applicable Indonesian regulatory standards is mandatory, and regulatory compliance is well covered in the Project AMDAL (wind power plant) and UKL/UPL (transmission line) documents. Depending on Project size and associated impacts GoI Regulation No 27 of 2012 regarding Environmental Permit requires new developments to prepare an AMDAL or an UKL-UPL document. The document format is defined in Regulation of Ministry of Environment (MoE) No 16 of 2012 regarding Guidelines for Preparation of Environmental Documents. In case of this Project the responsible GoI approval authority is the South Sulawesi AMDAL Commission.

The Project AMDAL was approved on 20 January 2017 and Environmental Permit for the wind power plant was obtained on 6 March 2017. Table 1-2 presents a summary of the key AMDAL and UKL-UPL milestones for this Project.

Table 1-2 Key AMDAL and UKL-UPL Milestones

Milestone	Date
Project Amdal	
Amdal presentation meeting	31-10-2016
Submittal of Amdal revision	15-11-2017
Amdal clarification meeting	22-12-2017
Submittal of Amdal revision	29-12-2017
Amdal Approval	20–01-2017
Transmission Line UKL-UPL	
UKL-UPL consultation meeting	09-03-2017

Milestone	Date
Submittal of UKL-UPL revision	10-03-2017
Environmental Permit Issued	15-03-2017

Details on the national, local, and international regulatory setting are further provided in Section 3.1 on Policy, Legal, and Administrative Framework.

1.8.3 Scope of ESIA

This ESIA is concerned with environmental and social impacts associated throughout the Project Cycle with the wind power plant facilities and associated transmission line to the South Sulawesi electric grid (Stage 1 – Tolo I). It also includes the surrounding region that is affected and impacted by transportation, supply chain, visual impacts, noise and flicker, and other aspects of the Project.

1.8.4 Project Categorization

As part of the review of environmental and social risks and impacts of a proposed investment, IFC uses a process of environmental and social categorization to reflect the magnitude of risks and impacts. The resulting category determines the level of environmental assessment and disclosure requirements. IFC categorization follows:

- Category A: Projects expected to have significant adverse social and/or environmental impacts that are diverse, irreversible, or unprecedented;
- Category B: Projects expected to have limited adverse impacts that can be readily addressed through mitigation measures; and
- Category C: Projects expected to have minimal or no adverse impacts.

ESC as the appointed ESIA Consultant is of the opinion that the Project is an IFC Category B project because it:

- Has limited environmental social impacts;
- Uses world-class engineering and proven technology; and
- Adopts Good International Industry Practices (GIIP).

1.8.5 Summary of Main Impacts

Potential environmental and social issues were identified for study against established baseline conditions. Each is further discussed in the succeeding sections, and evaluates the Project's impact and possible mitigation/enhancement activities. All of these impacts are assessed, but not all these impacts are ultimately significant (requiring management).

Environmental Issues	Affected Phase
Land Use	
– Overlap in land use	Construction & Operations
Noise	
– Construction noise	Construction
– Increase in ambient noise	Operations
Biodiversity	

Environmental Issues	Affected Phase
– Vegetation removal	Construction
– Habitat and species fragmentation	Construction
– Species disturbance	Construction
Drainage and hydrology	
– Water sourcing	Construction
– Drainage morphology	Construction
Soil, Water Quality and Contamination	
– Soil loss	Construction
– Water Contamination	Construction & Operations
– Change in surface topography/landform	Planning, Construction
Air Quality	
– Dust generation	Construction
Traffic, access, safety	
– Traffic congestion	Construction
Landscape Visual Assessment	
– Presence of WTG	Construction & Operations
Social Issues	**Affected Phase (Construction & Operations)**
Socio-Economic Issues	
– Social acceptability	Construction & Operations
– Displacement	Construction
– Generation of benefits	Construction & Operations
– Public safety	Construction
– Noise, shadow flicker	Operations

1.8.6 ESIA Consultant

EBJ has retained ESC to provide independent expert advice and analysis:

Company Name	:	PT Greencap NAA Indonesia and EnviroSolutions&Consulting (together '**ESC**')
Office Address	:	Intiland Tower, 18th Floor Jl. Jend. Sudirman Kav. 32 Jakarta 10220, Indonesia Phone +62-21-57901344 Fax +62-21-57901348
Person in Charge	:	Dr Karlheinz Spitz MBA

ESC subject matter experts and international advisors have worked together to complete this impact assessment and management plan. **Table 1-3** illustrates the Team composition.

Table 1-3 ESIA Team

Expertise	Name	Subject Matter
ESIA Team Leader	Dr Karlheinz Spitz	Environmental modeling impact assessment
Project Technology	Dr Karlheinz Spitz	Civil work
Atmosphere	Barid Manna	Noise and Flicker
Lithosphere	Jonathan Gilbey	Geology
Hydrosphere	Nigel Landon	Surface water drainage, Agricultural water use
Biosphere	Baktiar Aji	Terrestrial fauna and flora
		Birds and Bats
Social Sphere	Dr Rachel Lorenzen	Social impact assessment
Impact Assessment and Management	Dr Karlheinz Spitz	Impact assessment
	Jonathan Gilbey	Visual Impact Assessment
	Prannoy Agarwala	Noise modelling
	Prannoy Agarwala	Shadown Flicker modelling

Organization of ESIA Document

Based on the stated objectives, **Table 1-4** describes the main sections of this ESIA.

Table 1-4 Main ESIA Sections

Section	Description
1	*Project Overview* explains objective, proponent information, project phase, etc.
2	*Environmental and Social Risks and Impacts Framework* explains the policies, procedures, and standards that govern the impact assessment and management plan.
3	*Environmental Design Criteria* presents detailed standards for environmental aspects, drawn from GoI and international requirements and guidelines.
4	*Project Description* provides detailed description of Project components focusing on their environmental and social impacts.
5	*Resource Efficiency and Pollution Prevention* sets the goals and strategies for efficiency and pollution prevention.
6	*Labor and Working Conditions* presents approach to labor and working conditions, in line with GoI and international standards.
7	*Environmental and Social Project Setting* outlines comprehensive environmental and social baseline.
8	*Identification of Environmental and Social Risks and Impacts* describes the impact assessment methodology and identifies potentially significant impacts based on comprehensive review of the Project and receptors.
9	*Information Disclosure, Consultation, and Participation* presents the approach to stakeholder engagement and building long-lasting community relationships.

Section	Description
10	*Assessment of Potentially Significant Environmental and Social Risks and Impacts* describes the analysis of potentially significant Project impacts that determines significant impacts that must be managed. This section also addresses key environmental and social performance requirements.
11	*Management of Environmental and Social Risks and Impacts* outlines strategy, tactics, and safeguards to manage and monitor significant impacts.

CHAPTER 2
ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS FRAMEWORK

Chapter 2 provides an overview of the Project's Environmental and Social Management System (ESMS), Environmental and Social Policy, organizational capacity and competence, and emergency preparedness and response. Given the Project implementation phase at the time of the ESIA compilation, Chapter 2 also summarizes the Project's environmental management during construction.

2.1 Environmental and Social Management System

Since inception, Equis has incorporated the management of Environmental, Social and Governance ('ESG') standards in its strategy and investment practices. These systems ensure that ESG considerations are a fundamental component of the investment decision process and remain a central focus during the development, construction and operation of all its investments.

Investment decisions and operational policies incorporate international development and sustainability best practices in accordance with the IFC Performance Standards, the World Bank Environmental and Social Standards, the United Nations Declaration of Human Rights, as well as the United Nations Principles for Responsible Investment ('UNPRI').

PT. Redaya Energi Indonesia benefits from these group ESG systems. The company has adopted these systems in an ESMS that addresses environmental and social risks and impacts based on the requirements of GoI and IFC Performance Standards (REI ESHS-MS January 2017, for Table of Contents see **Appendix 1**).

The ESMS manual applies to both, construction and operation. The ESMS includes findings of this ESIA and provides an overview of the environmental and social Project setting, summaries potential Project impacts, and sets out management measures to mitigate potential significant impacts. The ESMS includes project-related activities by sub-constractors. In short the primary focus of the ESMS is to describe management and monitoring measures required to implement during construction and operation.

2.2 Investment Code

Equis' Investment Code (2016 Sustainability Report) stipulates that all employees shall commit to the following key principles, which platforms are also required to adopt:

- Minimise adverse impacts and enhance positive effects on the environment, stakeholders and staff;
- Apply the relevant international best practice standards to investments;
- Commit to continuous improvements in managing ESG topics and issues;
- Make efficient use of natural resources and protect the environment;
- Support reduction of GHG emissions, contributors to climate change;
- Comply with all applicable laws;
- Promote social aspects of development impact from investments;
- Apply management systems which address ESG risks; and

- Realise ESG opportunities as an essential aspect of investment value.

2.3 Environmental and Social Policy

After becoming a UNPRI signatory in 2014, Equis incorporated the UNPRI Principles into the EBJ Environmental and Social Responsibility Policy (**Appendix 2**) which outlines actions required pre and post investment, including:

- Incorporating ESG considerations into investment analysis and decision making processes;
- Being active owners and incorporating ESG issues into our ownership policies and practices;
- Seeking appropriate disclosure on the ESG practices of target investments;
- Promoting the acceptance and implementation of the Principles within the investment industry;
- Working to enhance our effectiveness in implementing the Principles;
- Promoting ESG to the investment industry; and
- Monitoring and reporting platform investment ESG activities and progress on a quarterly and annual basis.

This policy will be communicated and understood by the workforce through clear roles and responsibilities, internal communications, and training.

Project EHS Policies

Our Commitment

PT Energi Bayu Jeneponto (EBJ) is committed to the effective implementation of our ESHS Policy and to the continual improvement of our ESHS performance.

Environment

We care for the environment. It is in the nature of our business as a renewable energy IPP that we are contributing to the reduction of Greenhouse Gas (GHG) emissions. The largest anthropogenic source of GHG has been from fossil fuel burning to generate electricity. We have strong commitment to sustainable development by providing electricity generated from renewable resources.

We are committed to comply with the following principles:

- Compliance with applicable environmental laws and regulations;
- Efficient use of resources, cleaner production principles in product design and production processes; and
- Prevention of pollution and minimizing the environmental impacts of our operations including the materials that we use.

Community and Stakeholder Engagement

We strive to be a valued corporate citizen to the communities in the vicinity of our operations.

We are committed to the following principles:

- We respect the values and cultural heritage of local communities;

- We aim to improve the livelihood of local community where possible and to minimize any impact on their living conditions;
- We are committed to developing strong, constructive, and responsive relationships with the affected communities and stakeholders including but not limited to government entities, non-governmental organizations (NGOs), shareholders, and other interested parties in carrying out our activities including planning, design, construction, and operation.

We will achieve this objective through stakeholder engagement, operating a robust grievance mechanism, and ongoing reporting to the affected communities.

Labor and Working Conditions

We and our contractors recognize our responsibility to respect and protect the rights of our workers.

We adopt the following principles:

- We obey and comply with local labor practices relating to term of employment, work hours, payment of wages, and maintaining good working relationships with our workers; and, **we demand the same from our contractors**;
- We will not employ or support the use of any form of child labor or forced/coerced labor, either **directly or through suppliers or contractors;**
- We respect our workers' right to associate and engage in the collective bargaining process pursuant to local labor practices;
- We guarantee our workers that they will be free from all forms of harassment and discrimination based on race, color, religion, national origin, gender (including pregnancy), age, disability, sexual orientation, gender identity, HIV status, marital status, or any other status protected by the laws and regulations in the locations where we operate; and
- We protect workers' rights by allowing each worker to deal directly with management on issues of importance to that worker. Thus, we provide a grievance mechanism to receive, analyze, and address workers' concerns.

Health and Safety

We do not compromise the health and safety of our workers and our contractors' workers. We will provide a safe and comfortable working environment to our workers and will ensure our contractors to do the same. We aspire to achieve a *Zero Harm* track record for all of our workers as well as the surrounding communities. It is our fundamental belief that all accidents can be prevented.

Our Actions

To meet our ESHS commitments, we will:

- Ensure that all activities undertaken by us, our contractors and consultants are complying with the applicable regulations of the Republic of Indonesia as well as international standard that we subscribe to;

- Continuously review, measure, and evaluate our environmental, social, health, and safety objectives;
- Perform Environmental, Social, Health, and Safety Management System (ESHS-MS) performance reviews, which will be reported to Senior Management to ensure the effectiveness of ESHS-MS implementation;
- Take any necessary and appropriate follow-up action to ensure the intent of the ESHS policy is met, that procedures and plans are being implemented, and are seen to be effective;
- Ensure that all workers, shareholders, and other stakeholders understand our ESHS Policy commitments; and
- Manage external interactions through an active stakeholder engagement program and a mechanism to receive, analyze, and address stakeholder grievances.

This policy will be communicated to all staff, contractors and stakeholders of the Company.

EBJ's ESHS Policy Statement is provided in bilingual (English and Bahasa Indonesia) and is presented in **Appendix 13**.

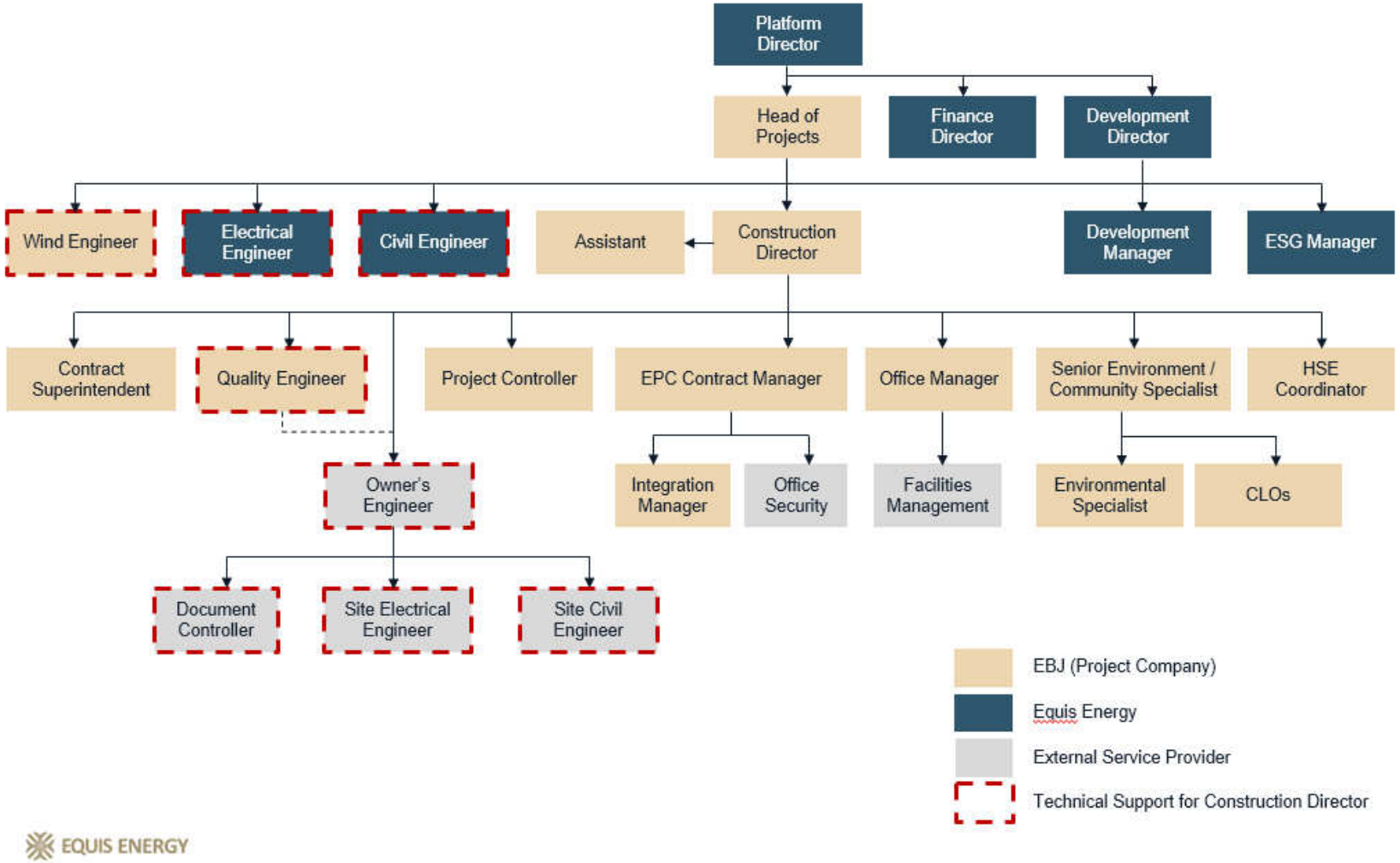
2.4 Organizational Capacity and Competence

EBJ will establish, maintain, and strengthen as necessary an organizational structure that defines roles, responsibilities, and authority to implement the Environmental and Social Management System (ESMS) (see **Table 2-1**). Specific personnel, including management representative(s) with clear lines of responsibility and authority, will be designated. Key environmental and social responsibilities will be defined, communicated, and understood by specific personnel and the entire Project organization. Sufficient management sponsorship and human and financial resources will be provided on an ongoing basis to achieve effective environmental and social performance and continual improvement.

Identification of environmental risks and impacts has been carried out in an appropriate, accurate, and objective manner, based on GoI requirements and GIIP. For potentially significant adverse impacts and technically complex issues, the Project involved external experts to assist in the risk and impact identification process.

Project personnel with direct responsibility for environmental and social performance have the knowledge, skills, and experience necessary to perform their work, including current knowledge of GoI regulatory requirements, GIIP, and the applicable requirements of IFC Performance Standards 1 through 8. Personnel also possess the knowledge, skills, and experience to implement the specific measures and actions required under the ESMS and the methods required performing the actions in a competent and efficient manner**. Table 2-1** below describes the roles and responsibilities for implementing the ESMS focusing on the functional leader. In each function, responsibilities are cascaded through the entire organization.

Two teams will be responsible to oversee compliance of the commitments set out in the Environmental Management Plan (EMP): the EBJ Environmental, Social and Health Safety Unit (ESHSU) (see **Table 2-1** for roles and responsibilities); and the EBJ Technical Team (ETT); (**Figure 2-1**). The latter team provide guidance to the Project's ESHSU and review the ESMS effectiveness.



Source: PT. Energy Bayu Jeneponto Environmental, Social, Health and Safety Management System Manual, August 2017

Figure 2-1 ESHS Management Organization Chart

Table 2-1 ESMS Roles and Responsibilities

Role	Responsibilities	Competencies
Equis ESG Manager	Coordinate the ESMP during project implementation Oversee the development of procedure and guideline to facilitate implementation of the ESMP Monitor the implementation and operation of the ESMP Responsible for all of the physic-chemical monitoring of inflow and outflow water quality and air quality as well as other environmental parameters such as ecological monitoring as required in the issued ECC Responsible for monitoring the performance of the EPC Contractor against statutory requirements and the agreed objectives and targets Review and approved the Contractor Environmental, Health and Safety Management Plan (CEHSMP), prepared by the EPC, and specialist procedures and identify any area for improvement Identify the environmental competence of all contractors and sub-contractors working on the project Act as a main contact between the contractor team on environmental and social issues	Understands the ESMS and how to build cross-functional support for the ESMS, especially with construction and operations staff and integrate ESMS requirements into overall management system. Experienced as an EHS professional, including impact assessments, social performance and human rights issues, and management plans. Understanding of local ESMS-related GoI regulations and policy issues, such as AMDAL. Leadership, project management, analytical and planning skills. Understands and undertakes continual improvement steps. Leverages lessons learned from inside and outside the Project and applies best practices
Environmental Officer (EO)	Explain to each employee the importance and needs of the ESMP Develop procedures and guidelines to facilitate implementation of the ESMP Monitor the implementation and operation of the ESMP Review, analyse and interpret data and records emanating from monitoring activities to assess their effectiveness and the overall ESMP for improvement Assist in the revision/updates of the Emergency Preparedness and Response Plan where appropriate	Hold the National and/or International standard training Course as an EO, such as ISO 14,001 training or SMK3L from GoI. Understands the ESMS and how to build cross-functional support for the ESMS, especially with construction and operations staff and integrate ESMS requirements into overall management system.

Role	Responsibilities	Competencies
	Review, analyze and interpret data and records emanating from monitoring activities to assess the effectiveness of the monitoring process and the overall ESMP for continual improvement Ensure adherence to associated monitoring protocols and program Maintain a repository of material safety data sheets Review and approved the Contractor Environmental, Health, and Safety Management Plan (CEHSMP), prepared by the EPC, and specialist procedures and identify any area for improvement Review method statements for environmental aspect and advise of any suggested improvements prior to the start of work Monitor construction activities to ensure the identified and appropriate control measures are effective and in compliance with the CEHSMP Coordination of hazardous material management and disposal Liaise closely with the Safety Officer with respect to areas of overlapping concern in the ESMP Contribute to training and capacity building in the area of Environmental Management Prepare and submit to DLH (Dinas Lingkungan Hidup – Environmental Office) of South Sulawesi province the six monthly monitoring Report among others as required in the regulations Take lead in the processing of the application and renewal of the required clearances/permits Maintain records of the analytical data	Experienced as an EHS professional, including impact assessments, social performance and human rights issues, and management plans. Understanding of local ESMS-related GoI regulations and policy issues, such as AMDAL. Leadership, project management, analytical and planning skills. Understands and undertakes continual improvement steps. Leverages lessons learned from inside and outside the Project and applies best practices
Safety Officer (SO)	Develop procedures and guidelines to facilitate implementation occupational and community Health and Safety aspects of the ESMP Monitor the implementation and operation of the occupational and communityHealth and Safety aspects of the ESMP Ensure adherence to associated monitoring protocols and programs Assists in the review, analysis and interpretation of data emanating from monitoring activities to assess their effectiveness and the overall ESMP for continual improvement	AK3 Qualified; AK3-Umum at the minimum

Role	Responsibilities	Competencies
	Assist in the revision/updating the Emergency Preparedness and Response Procedures where appropriate Liaise closely with the EO with respect to areas of overlapping concern in the ESMP Contribute to training and capacity building in the area of Occupational and Community Health and Safety Maintain occupational and community health and safety records	
Security Manager	Assure compliance with the ESMS, particularly relating to security aspects, to ensure that it is understood, meets commitments of the ESMS, and adds value. Lead the implementation, measurement, audit, and continual improvement (of effectiveness and efficiency) of security commitments of the ESMS. Benchmark Project against competitors and top performers in the region. Maintain and deliver training.	Understands the ESMS and how to build cross-functional support for the ESMS and integrate supply chain requirements into overall management system. Understands key stakeholders and their issues relating to security. Leadership, analytical, planning, and project management skills. Understands and undertakes continual improvement steps. Leverages lessons learned from inside and outside Project and applies best practices Has completed related training.
Community Liaison Officer (CLO)	Assure compliance with the ESMS, including leading, resourcing, and serving as advocate for the Stakeholder Engagement Procedure, the Stakeholder Engagement Procedure, and the Grievance Mechanism, to ensure that these are understood, meet commitments of the ESMS, and add value. (External stakeholder issues primarily relate to Performance Standards 1, 4, 5, 7, and 8.)	Understands the ESMS and how to build cross-functional support for the ESMS and integrate supply chain requirements into overall management system. Includes Stakeholder Engagement Procedure, the Stakeholder

Role	Responsibilities	Competencies
	Lead the implementation, measurement, audit, and continual improvement (of effectiveness and efficiency) of the procedures, plans, and Grievance Mechanism. Benchmark Project against competitors and top performers in the region. Maintain and deliver Stakeholder Engagement training Maintain a database of approved external stakeholder engagement consultants. Integrate and align relevant stakeholder information into business planning and decision making. Develop and maintain a Stakeholder Engagement Plan to document engagement and communications plans and activities. Carry out regular review of regulatory and other issues that may affect the Project and ensure related stakeholders are engaged. Ensures stakeholder issues are satisfactorily closed out (addressed) in timely manner. Develop, maintain, and implement the Project Community Development Plan/CSR.	Engagement Procedure, and the Grievance Mechanism. Understanding of the key stakeholders and their issues. Leadership, analytical, planning, and project management skills. Understands and undertakes continual improvement steps. Leverages lessons learned from inside and outside the Project and applies best practices Has completed related training. Understands community development principles and planning processes. Proficient in engaging stakeholders, per the Stakeholder Engagement Procedure.
Human Resources Manager	Assure compliance with the ESMS, particularly relating to PS 2 (Labor and Working Conditions), to ensure that it is understood, meets commitments of the ESMS, and adds value. Lead the implementation, measurement, audit, and continual improvement (of effectiveness and efficiency) for labor and working conditions commitments of the ESMS. Benchmark Project against competitors and top performers in the region. Maintain and deliver training.	Understands the ESMS and how to build cross-functional support for the ESMS and integrate human resources requirements into overall management system. Understands key stakeholders and their issues relating to human resources. Leadership, analytical, planning and project management skills.

Role	Responsibilities	Competencies
		Understands and undertakes continual improvement steps. Leverages lessons learned from inside and outside the Project and applies best practices Has completed related training.

2.5 Training and Review

EBJ will identify the knowledge and skills necessary for ESMS implementation and will design trainings programs for the organization's personnel as necessary. All person responsible for undertaking work during the life of the project will be trained on the contents of the ESMS Manual.

The site personnel will have basic level of environmental awareness which include the meaning and importance of environment; identification of potential impacts; potential mitigation measures; awareness on emergency spills and response; and social responsibility during the construction.

2.6 Emergency Preparedness and Response System

The Project has developed and maintained an emergency preparedness and response system to respond to accidental and emergency situations in a manner appropriate to prevent and mitigate any harm to people and/or the environment. The system includes identification of areas where accidents and emergency situations may occur, stakeholders that may be impacted, response procedures, provision of equipment and resources, designation of responsibilities, communication, including that with potentially affected stakeholders, and periodic training to ensure effective response. The emergency preparedness and response system will be periodically reviewed and revised, as necessary, to reflect changing conditions.

The Project will assist and will collaborate with affected stakeholders, local government agencies, and other relevant parties on emergency preparedness and response, planning, and implementation because their participation and collaboration are essential to effectively responding to an emergency. The Project will also work with the local government agencies to enhance local capacity through joint training and workshops. Appropriate information about emergency preparedness and response will be disclosed through external communications, stakeholder engagement with affected stakeholders, including government agencies.

The emergency preparedness and response procedure, including requirements and resources and responsibilities, are contained in an Emergency Preparedness and Response Plan document has been developed to also include operation stage. The Emergency Preparedness and Response Plan will at a minimum address the following aspects:

- Identification of the emergency scenarios and development of appropriate emergency response procedures for each scenario;
- Training of emergency response teams on the appropriate procedures and the use of emergency response equipment;
- Identification of emergency contacts and support devices and development of effective communication systems/protocols;
- Involvement of relevant government authorities including procedures for engagement, communication and reporting;
- Emergency equipment;
- Development of decontamination/clean-up procedures and identify critical remedial measures to contain, limit and reduce pollution (e.g. oil spill); and

- Identification of potential risks related to uncontrolled release of hazardous materials and preparation of pill prevention, control and response planning (e.g. training of operators on spill prevention; implementation of inspection programs to confirm the integrity of secondary containment structures and equipment; development of standard operating procedures (SOP) for filling containers or equipment and the transfer of hazardous materials; identification of location of hazardous materials and associated activities on an emergency plan site map; identification and availability of the appropriate Personal Protective Equipment (PPE); and clarification of roles and responsibilities of individual or group as well as decision process for assessing severity of the release and determining appropriate action.)

2.7 Environmental Management during Construction Phase

The Project will adopt the following Construction Environmental Health and Safety Management Procedure (CEHSMP), which provides the management framework needed for the planning and implementation of construction activities in accordance with environmental commitments identified within the UKL-UPL and ESIA and other necessary requirements such as compliance with the Equator Principles or EBJ's Environmental Health and Safety Policy. Its purpose is to reduce the risk of adverse construction impacts on sensitive environmental resources and to minimize disturbance to local villagers, and to transparently document the adopted management mechanisms to achieve this purpose.

The CEHSMP describes the human resources and management efforts that will be required, and the checking, monitoring, and audit processes that will be implemented, to ensure construction works are undertaken in accordance with these requirements, together with measures to ensure that appropriate corrective actions or mitigation measures are taken.

The CEHSMP will form part of the overall Project Management and as such, activities described will be integrated with other Quality, Sustainability, and Health and Safety management processes. In particular, the CEHSMP will make reference to the extensive EHS Construction Management Plan of the appointed EPC Contractor. The CEHSMP is not a substitute for the EPC EHS Construction Management Plan.

2.7.1 Fitness Test of EPC Contractor and Contractors

EBJ as the Owner will only select EPC Contractors and Contractors that have the capability and the commitment to comply with the requirements as outlined in this ESIA. To this end, EBJ will adopt a three-step fitness test: (1) pre-qualification, (2) contractor selection, and (3) final pre-award check.

Pre-qualification

Prequalification is a process used to investigate and assess the capabilities of candidate contractors to carry out a job if it is awarded to them. Prequalification will provide EBJ with a list of contractors that are invited to tender.

To evaluate the overall suitability of contractors, EBJ will assess each potential contractor on grounds of financial stability, managerial capability, organizational structure, technical expertise, and previous record of comparable construction. These criteria comprise the contractor's permanent place of business, adequacy of people and equipment to do the work properly and

expeditiously, financial capability to meet obligations required by the work, appropriateness of technical ability and experience, performance of work of the same general type and on a scale not less than 50% of the amount of the proposed contract, the frequency of previous failures to perform contracts properly or fail to complete them on time, the current capability of the contractor to perform the contract well, and the contractor's relationship with subcontractors and employees.

EBJ will inform potential contractors clearly on the Company's expectations in regard to environmental performance of any contractor working on the Project. EBJ will select potential contractors in an objective and systematic manner and will base its selected short-list upon consideration of set of environmentally relevant characteristics, including:

- Demonstrated ability to perform the required environmental tasks in a technically sound manner, and utilizing an appropriate EHS Management System;
- Commitment to dedicate qualified and experienced environmental, health and safety personnel in adequate numbers through completion of construction;
- Experience in communicating with government officials and the general public on sensitive environmental issues;
- Ability to devote sufficient financial resources to the accomplishment of the required environmental tasks; and
- Ability to perform the required tasks in a cost effective manner.

Contractor Selection

Based upon the qualification process, EBJ will invite contractors to bid for Project work. EBJ will interview contractors that have submitted proposals, and may request presentations from them as part of the interview process. Issuance of a contract shall be contingent upon satisfactory completion of a background investigation.

Environmental and social aspects form only one part of the bid/proposal evaluation, which is a multi-parameter process. Major parameters are the bid amount, time of execution, and quality of previous work. In addition to these major three parameters of cost, time, and quality, EBJ will incorporate secondary criteria in the evaluation: capability and commitment to agreed environmental and social performance measures is one of these.

Final Check

A final check and a pre-award meeting will be carried out to clarify the technical, safety, and environmental and social risks associated with selection of the contractor.

2.7.2 Environmental Design Criteria

Register of Environmental Impacts

This ESIA provides an initial Register of Environmental Impacts. This Register will be regularly updated to reflect any additional risks resulting from the contractor's selected methods of working, changing site conditions, etc. Environmental risks would be identified under of the following general headings:

- Community perception;

- Community health & safety;
- Noise, vibration, and dust;
- Surface water drainage and water quality;
- Terrestrial fauna and flora; and
- Waste management.

Register of Legislative and Regulatory Commitments

The ESIA provides an initial register of Legislative and Regulatory Commitments. This register will be regularly updated to reflect any changes in the regulatory setting.

IFC EHS Guidelines

In addition to regulatory requirements, including ESIA commitments, construction activities will be designed to conform to relevant IFC EHS Guidelines.

2.7.3 Environmental and Social Management Plans

The ESIA provides an initial program of Environmental and Social Management Plans. These action plans will be regularly updated to reflect any additional risks resulting from the contractors selected methods of working, changing site conditions, etc.

If necessary, the EPC Contractor is required to expand the Environmental and Social Management Plans contained in the ESIA to identify and sequence environmental activities needed to complete a specific construction activity without unacceptable risks to the environment and to the safety of workers and the community. The Environmental and Social Management Plan would typically identify reference documentation, the approval required to complete that activity, and the verification documentation to be produced as evidence of satisfactory completion. The Environmental and Social Management Plan would also identify where 'hold points' would be required. Hold Points are where continuation of a subsequent activity is prohibited unless a former activity has been signed-off.

Environmental and Social Management Plans would typically fall into the following headings:

- HSE site management;
- Construction environmental control;
- HSE environmental inspection and monitoring;
- Construction erosion and sedimentation control;
- Site fencing;
- Earthworks;
- Site drainage works;
- Construction waste management;
- Construction spill prevention and response; and
- Traffic management.

2.7.4 Site Environmental Standards

Site environmental standards would be agreed with the EBJ's Environmental, Social, Health and Safety Manager and Environmental Officer, detailing the minimum of control measures and safety and environmental procedures that should be applied to operations to cover the majority

of construction activities. These standards would cover issues such as general housekeeping, material storage, sanitary and hazardous waste management, use of Personal Protection Equipment, speed limits, and water pollution controls. The standards would be printed on A3 posters, placed on site notice boards, and used as a briefing tool on site.

2.7.5 Code of Conduct

Recognizing that the conduct of its employees, independent of rank, as well as of its contractors determines EBJ's standing in the host communities and the society, a Code of Conduct will be designed to serve as an enduring model of operating the business with the highest ethical standards and of consistently doing the right thing (see **Appendix 3**). The Code of Conduct reflects the principles, values, standards, and rules of behavior that guide the decisions, procedures, and systems of EBJ in ways that first, contribute to the welfare of key stakeholders, and second, respect the rights of all constituents affected by its operations.

2.7.6 Grievance Mechanism

Recognizing that complaints may arise during the Project development, EBJ recognizes the need to acknowledge such complaints or claims and to have an established grievance tracking and resolution mechanism to efficiently and transparently address issues as they arise. Accordingly, community members in the Project area, in particular villagers in the primary impact areas (e.g., transport), will have access to the grievance tracking and resolution mechanism (see **Appendix 4**). The Project has committed to ensuring that complainants can lodge and resolve complaints without cost and with the assurance of a timely response to the claim.

2.7.7 EHS Management Framework for Construction

The line of responsibility for environmental management during the construction phase is shown below in **Figure 2-2**. Descriptions of individual environmental management responsibilities are detailed in the following paragraphs. Environmental management is here taken to also include management of social and community health and safety issues.

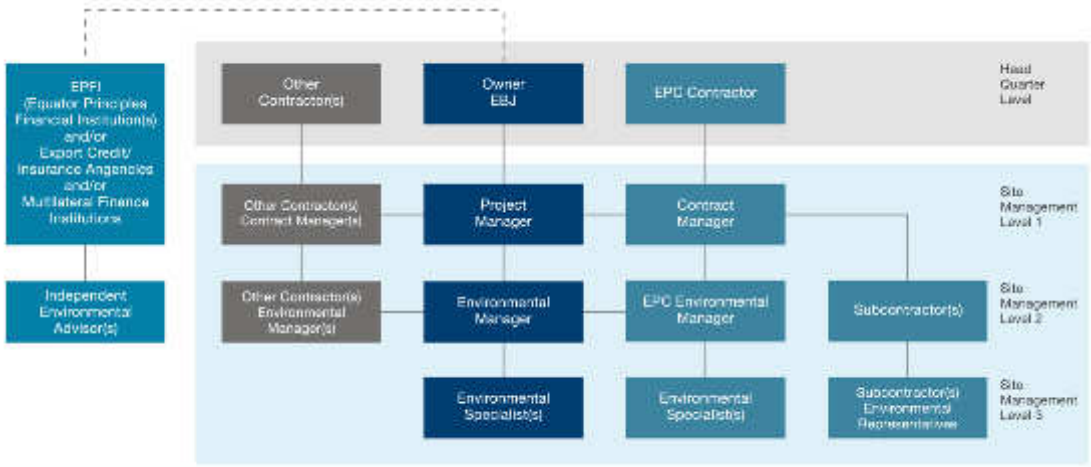


Figure 2-2 Lines of Responsibility for Environmental Management during Construction Phase

OPM (Owner's Project Manager) -The Project Manager (PM) acts on behalf of the EBJ (Owner), with responsibility for managing the Project within the agreed environmental constraints in conjunction with all other necessary management processes.

OEM (Owner's Environmental Manager) - The OEM reports to the Project Manager and is responsible for monitoring the performance of the Project against statutory requirements and the agreed environmental standards. Duties of the OEM typically include:

Act as the main point of contact between the regulatory authorities and the Project on environmental issues;

- Act as the first contact between villagers and the Project on environmental issues;
- Act as a main point of contact between the EPC Contractor and the EBJ Project Team on environmental issues;
- Verify the environmental competence of all contractors working on the Project and advise the Project Manager as to their suitability;
- Review method statements for environmental aspects and advise of any suggested improvements prior to work starting;
- Regularly review the CEHSMP and SOP and identify any areas for improvement; and
- Monitor construction activities to ensure that identified and appropriate control measures are effective and in compliance with the CEHSMP.

EPC CM (EPC Contract Manager) - The Contract Manager is a named individual from the EPC Contractor who has the overall responsibility for Health and Safety, Environmental, and Quality performance throughout construction. S/he ensures that appropriate resources are made available, and any necessary environmental controls or mitigation measures are implemented. The Contract Manager reports to the EPC Contractor's Senior Management.

EPC EM (EPC Contractor's Environmental Manager) - The EPC Contractor's Environmental Manager reports to the EPC Contract Manager and is responsible for day-to-day coordination and management of all environmental activities during the construction phase. The Environmental Manager's duties include but are not limited to the following:

- Develop and review the Construction EHS Plan and SOP;
- Identify environmental competence requirements for all staff working on the Project and ensure delivery of environmental training to personnel within the Project team;
- Review and approve method statements for environmental aspects prior to work starting;
- Monitor construction activities and performance to ensure that identified and appropriate control measures are being effectively applied, and to ensure compliance with the Construction EHS Plan (and consequently with the UKL-UPL and ESIA commitments);
- In conjunction with the environmental specialists, overall monitoring of the program for environmental compliance, and provision of status reports as necessary;
- Provision of advice and liaison with the construction teams to ensure that environmental risks are identified and appropriate controls are developed and included within method statements and risk assessments;
- Assistance in the development and delivery of environmental training for site personnel and subcontractors;
- Liaison with the Owner's Environmental Manager;

- Management of the environmental monitoring program, including noise, vibration and dust, and review routine reports; and
- Environmental audit of subcontractors and suppliers.

Sub-Contractors Environmental Representatives - Each Sub-contractor appointed by the EPC Contractor or Contractor appointed by the Owner is required to appoint an Environmental, Health and Safety Representative who is responsible for:

Ensuring that environmental considerations are included in risk assessments and all work at site;

- Carrying out weekly environmental, health and safety inspections of their areas of responsibility within the site, initiating actions as needed, and completing a weekly environmental inspection report; and
- Acting as a main point of contact between the Subcontractor and the EPC Contractor on environmental issues.

Environmental Specialists - The Owner, the EPC Contractor, and any subcontractors may employ Environmental Specialists to support the Project as required to provide the mitigation measures described in the CEHSMP or in support of particular construction activities that may otherwise present an environmental risk. Their role is to undertake the detailed mitigation design within their specialist field, oversee its implementation, and conduct maintenance and monitoring as needed throughout the construction period up to the end of the maintenance period.

Independent Environmental Advisor - EBJ may include Equator Principles Financial Institutions (EPFI) in the financing of the Project. Equator Principle (EP) 9 requires regular independent environmental audits of the Project to ensure EP compliance. Similarly, export credit or insurance agencies or multilateral financial institutions must comply with their internal environmental policies and standards. The Independent Environmental Advisor, appointed by involved EPFI, is responsible for:

- Regularly reviewing EP compliance of the Project implementation (e.g., bi-annually during construction and every three years during operation); and
- Review conformance with environmental covenants.

2.7.8 Environmental Review

The EPC Contractor will be required to demonstrate an appropriate method of auditing the CEHSMP implementation via an internal or external auditing procedure. Provision of evidence that the agreed auditing procedure has taken place will be a requirement of regular meetings between the Contract Manager and the Owner's Project Manager.

2.7.9 Workforce Accommodation

Temporary accommodation facilities will be established by the EPC contractor during the construction phase. Temporary and permanent accommodation facilities will meet minimum standards, as for example outlined in Workers' Accommodation and Standards - A Guidance Note by IFC and the EBRD, 2009.

Where accommodation services are required EBJ has policies on the quality and management of the accommodation and provision of basic services consistent with the IFC Performance Standards; in addition, they are provided in a manner consistent with the principles of non-

discrimination and equal opportunity. EBJ's worker accommodation arrangements do not restrict workers' freedom of movement or of association.

CHAPTER 3
ENVIRONMENTAL DESIGN CRITERIA

To minimize environmental impacts, drive resource efficiency, and limit waste, as well as assure compliance with Government of Indonesia regulations and meet GIIP, Environmental Design Criteria (EDC) set detailed binding and nonbinding environmental performance standards. Qualitative EDC cannot be measured and aim to prevent or lessen potential environmental impacts (i.e., Overarching Principles). Quantitative EDC represent defined allowable limit values, established in national and/or international regulations or guidelines for specific environmental aspects. Legally required (regulatory) limits are based on in-country limits stipulated in national and local regulations. Where no in-country limits are available for non-binding targets, values are based on IFC or other appropriate international guidelines, such as World Health Organization (WHO). Where levels and measures in regulations differ from those found in IFC guidelines, the most stringent value is used.

For the design and operation phases of the Project, the following criteria provide direction, standards, and guideline values for the:

- Emissions to air;
- Discharges to water; and
- Waste management.

3.1 Policy, Legal, and Administrative Framework

Section 3.1 lists applicable company policies, GoI laws and regulations, international conventions, and Good International Industry Practices, predominantly in form of the IFC EHS Guidelines.

3.1.1 Company Policies

The Project is subject to EBJ environmental and social policy framework outlined in Section 2.2.

3.1.2 Indonesian Laws and Regulations

The regulatory administrative framework comprises of Government of Indonesia regulations and commitments that govern social and environmental practices, including the environmental assessment of the Project, environmental regulations, social and land use regulations, and international treaties and agreements to which Indonesia is a signatory.

Indonesia is divided into administrative zones in five layers (**Figure 3-1**). At the top level is the nation, the Republic of Indonesia, which consists of 33 propinsi (provinces). Each province is headed by a *gubernur* (governor). The various *propinsi* (otherwise known as Level 1 regions) are further subdivided into *kabupaten* or regencies (Level 2 regions, headed by the *bupati* or district administrators), which are further subdivided into *kecamatan* (districts) and *desa* (villages). Within the provinces, there are municipalities or city governments, which enjoy the same status as regencies. These metropolitan regencies are referred to as Kota (or townships), not Kabupaten. Each Kota is headed by a walikotamadya (town administrator or mayor).

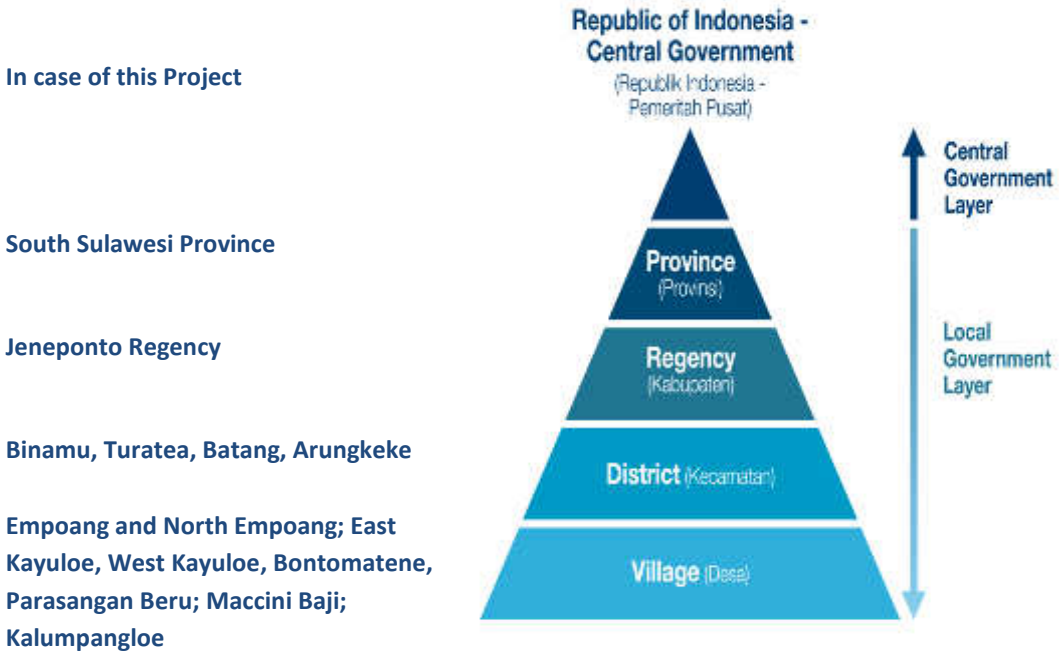


Figure 3-1 Five Layers of the Government of Indonesia

The Central Government issues laws and regulations relating to or directly governing environmental management and protection in Indonesia. These are complemented by environmental regulations at province and regency levels that at times directly contradict central national legislation or nationally-issued regulations. The Project has to comply with both national and local regulations.

Regulations Governing Air and Noise

National regulations governing air and noise are:

- Environmental Impact Management Agency Decree No 205 of 1996 (KEP-205/BAPEDAL/07/1996) on Air Pollution Control from Stationary Sources;
- Government Regulation No 41 of 1999 on Ambient Air Quality Standards;
- Minister of Environment Decree No 48/MENLH/11/1996 on Noise Standards;
- Minister of Environment Decree No 50/MENLH/11/1996 on Ambient Odors; and
- Minister of Environment Decree No KEP-49/MENLH/11/1996 on Vibration Level Standards.

Local regulations governing air emissions are:

- South Sulawesi Governor Regulation No 69 of 2010 on Quality Standards and Criteria for Environmental Damages

Regulations Governing Water

National regulations governing water include:

- Government Regulation No 82 of 2001 on Management of Water Quality and Control of Water Pollution;
- Government Regulation No 42 of 2008 on Water Resource Management;
- Minister of Health Decree No 49 of 2010 on Drinking Water Quality Standards;

- Minister of Health Regulation No. 528 of 1982 on Groundwater Quality Related to Health;
- Public Works and Community Housing Minister Regulation No 50 of 2015 on Water Resources Utilization Permits;
- Minister of Environment Regulation No 1 of 2010 on Water Pollution Control Procedures;
- Minister of Environment Regulation No 5 of 2014 on Wastewater Quality Standards; and
- Minister of Environment Decree No 112 of 2003 on Domestic Wastewater Quality Standards.

Local regulations governing water include:

- South Sulawesi Governor Regulation No 69 of 2010 on Quality Standards and Criteria for Environmental Damages

Regulations Governing Biosphere

- Minister of Forestry Regulation No 4 of 2011 on Guidelines on Forest Reclamation;
- Government Regulation No 24 of 2010; and 61 of 2012; and 105 of 2015 on Utilization of Forest Areas;
- Government Regulation No 1 of 2004 on Government Regulation replacing Law No 41 of 1999 on Forestry;
- Minister of Forestry Regulation No P.12/Menhut-II/2009 on Forest Fire Control; and
- Minister of Forestry Regulation No 16 of 2014 on Guidelines for Borrow-Use of Forest Areas.

Regulations Governing Waste Management

National regulations governing waste management include:

- Law No 18 of 2008 on Municipal Solid Waste Management;
- Minister of Environment Regulation No 13 of 2012 on Guidelines for Reduce, Reuse, and Recycle through Waste Banks;
- Government Regulation No 81 of 2012 on Management of Domestic Waste and Types Similar to Domestic Waste;
- Government Regulation No 101 of 2014 on Hazardous and Toxic Waste Management;
- Minister of Home Affairs Regulation No 33 of 2010 on Guidelines for Waste Management;
- Minister of Environment Regulation No 2 of 2008 on Hazardous Waste Utilization;
- Minister of Environment Regulation No 18 of 2009 on Permit Procedures for Hazardous Waste Management;
- Environmental Impact Management Agency Decree No 1/BAPEDAL/09 of 1995 on Procedures and Requirements for the Storage and Collection of Hazardous and Toxic Waste;
- Environmental Impact Management Agency Decree No 2/BAPEDAL/09 of 1995 on Hazardous and Toxic Waste Manifest;
- Environmental Impact Management Agency Decree No 3/BAPEDAL/09 of 1995 on Technical Requirement of Hazardous and Toxic Waste Treatment;
- Ministry of Environment Regulation No 14 of 2013 on Symbols and Labelling of Hazardous and Toxic Waste;

- Decree of Head of BAPEDAL Decree No KEP-255/BAPEDAL/08/1996 on Lubricating Oil Collection and Storage Procedures;
- Government Regulation No 74 of 2001 on Hazardous Materials Management;
- Minister of Environment Regulation No 3 of 2008 on Procedures for Providing Symbols and Labels for Hazardous and Toxic Materials; and
- Minister of Labour and Transmigration Regulation No 3 of 1985 on Occupational Health and Safety for Asbestos Use.

Regulations Governing Land Acquisition

- Head of National Land Agency Regulations No 5 of 2012; and 06 of 2015 on Technical Guidelines for Land Procurement;
- Presidential Decrees No 71 of 2012; No 40 of 2014; No 99 of 2014; No 30 of 2015; and No 148 of 2015 on Implementation of Land Procurement for Developments in Public Interest;
- Law No. 2 of 2012 on Land Procurements for Development in Public Interest;
- Government Regulation No 24 of 2010; No 61 of 2012; and No 105 of 2015 on Utilization of Forest Areas; and
- Government Regulation No.1 of 2004 on Government Regulation replacing Law No 41 of 1999 on Forestry.

Regulations Governing Labour

- Government Regulation No 45 of 2015 on Implementation of Pension Insurance Program;
- Government Regulation No 46 of 2015, and 60 of 2015 on Implementation of Pension Plan Program; and
- Government Regulation No 44 of 2015 on Implementation of Occupational Accident and Life Insurance Programs.

Regulations Governing Occupational Health and Safety

- Government Regulation No 50 of 2012 on Implementation of Safety and Occupational Health Management System;
- Minister of Labour Decree No. PER.08/MEN/VII/2010 on Personal Protective Equipment;
- Minister of Health Decree No 1405 of 2002 on Occupational Health Requirements in Office and Industry Work;
- Director General of Labour Decree No 40 of 1978 on Construction of Installations at Work Places;
- Minister of Labour and Transmigration Regulation No 13 of 2011 on Physical and Chemical Factor Thresholds in Work Places;
- Minister of Health Regulation No 28 of 2014 on National Health Insurance Program Implementation Guidelines;
- Minister of Health Regulation No 28 of 2011 on Clinics;
- Minister of Labour and Transmigration Regulation No 12 of 2015 on Electrical Safety and Health; and
- Minister of Labour and Transmigration Regulation No PER-02/MEN/1980 of 1980 on Worker Medical Examinations in Work Safety Implementation.

3.1.3 International Conventions

Applicable international treaties and conventions ratified to date by the Republic of Indonesia are summarized below.

International Convention/Treaty	Ratification by Indonesian Laws and Regulations
Air and Atmosphere	
United Nations Framework Convention on Climate Change	Law No. 6 of 1994
Paris Agreement to the United Nations Framework Convention on Climate Change	Law No. 16 of 2016
Kyoto Protocol to the United Nations Framework Convention on Climate Change	Law No. 17 of 2004
Biodiversity	
International Plant Protection Convention	Presidential Decree PP No. 2 of 1977
Convention on International Trade in Endangered Species of Wild Fauna and Flora	Presidential Decree PP No. 43 of 1978
ASEAN Agreement on the Conservation of Nature and Natural Resources	Presidential Decree PP No. 26 of 1986
Amendment 1979 to Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973	Presidential Decree PP No. 1 of 1987
Convention concerning the Protection of the World Cultural and Natural Heritage	Presidential Decree PP No. 17 of 1989
Cartagena Protocol on Biosafety to the Convention on Biological Diversity	Law No. 21 of 2004
Ramsar Convention on Wetlands	Presidential Decree PP No. 48 of 1991
United Nations Convention on Biological Diversity	Law No. 05 of 1994
International Tropical Timber Agreement, 1994	Presidential Decree No 04 of 1995
Convention concerning the Protection fo the World and Natural Heritage	Presidential Decree No 17 of 1989
Amendment 1979 on Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973	Presidential Decree No 01 of 1987
Asean Agreement on the Conservation of Nature and Natural Resources	Presidential Decree No 26 of 1986
Convention on International Trade in Endangered Species of Wild Fauna and Flora which had been Signed in Washington on March 3rd 1973	Presidential Decree No 43 of 1978
International Plant Protection Convention which had been Signed by the Delegation of the Government of the Republic of Indonesia in Rome	Presidential Decree No 02 of 1977
Forestry	
International Tropical Timber Agreement	Presidential Decree PP No. 4 of 1995
Labor / Children / Women	
ILO Conventions	Law No.19 of 1999, Law No.20 of 1999, Law No. 21 of 1999

International Convention/Treaty	Ratification by Indonesian Laws and Regulations
International Convention on the Protection of the Right of All Migrant Workers and Members of their Families	
Convention on the Right of Persons with Disabilities	Law No. 15 of 2016
Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, Supplementing the United nations Convention Against Transnational Organized Crime.	Law No. 06 of 2012
ILO Convention No. 81 concerning Labour Inspection in Industry and Commerce	Law No. 19 of 2011
Convention ILO No. 138 regarding Minimum Age of Labor	Law No. 14 of 2009
Convention on the Elimination of all Forms of Discrimination Against Women	Law No. 21 of 2003
Convention Concerning for Occupational Safety and Health/Convention 198, 2006	Law No. 20 of 1999
Instrument for the Amendment to the Constitution of the International Labor Organization 1997	Law No. 07 of 1984
ILO Convention No. 88 Concerning The Organization Of The Employment Service	Presidential Regulation No. 34 of 2015
Convention on the Rights of the Child	Presidential Decree No 36 of 1990
Convention 144 concerning Tripartite Consultations to Promote Implementation of International Labour Standard	Presidential Decree No 26 of 1990
Hazardouse Material and Waste	
Framework Agreement between the Government of Indonesia and the Secretariat of the Basel Convention on the Control of the Transboundary Movement of Hazardous Wastes and their Disposal on the Establishment of a Basel Convention Regional Centre for Training and Technology Transfer for Southeast Asia	Presidential Regulation No. 60 of 2005
Amendment to the Basel Convention on the Control of Transboundary Movement of Hazardous Waste and their Disposal	Presidential Regulation No. 47 of 2005
Protocol 9 Dangerous Goods	Presidential Decree No 21 of 2003
Basel Convention on the Control of Transboundary Movement of Hazardous Waste and their Disposal	Presidential Decree No 61 of 1993
Health	
United Nations Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances, 1988	Law No. 07 of 1997
Convention on Psychotropic Substances 1971	Law No. 08 of 1996
Social	
International Covenant on Economic, Social and Cultural Right	Law No. 11 of 2005

International Convention/Treaty	Ratification by Indonesian Laws and Regulations
Convention for the Safeguarding of the Intangible Cultural Heritage	Presidential Regulation No. 78 of 2007

3.1.4 Good International Industry Practices

The IFC EHS Guidelines are technical reference documents with general and industry-specific examples of GIIP, as defined in IFC Performance Standard 3: Resource Efficiency and Pollution Prevention. The IFC EHS Guidelines contain the performance levels and measures that are normally acceptable to IFC and that are generally considered to be achievable in new facilities at reasonable costs by existing technology. Compliance with IFC requirements is considered as GIIP, commonly acceptable to International Financial Institutions (IFI) involved in project financing. As such, this ESIA derives Good International Industry Practices from IFC guidelines, specifically the following:

- IFC Performance Standards;
- IFC's General EHS Guidelines;
- IFC's EHS Guidelines for Wind Energy; and
- IFC's EHS Guidelines for Electric Power Transmission and Distribution.

This assessment is carried out based on these guidelines. It must also be noted that the most extreme dimensions were utilised for the assessment to ensure that the 'worst case scenario' had been dealt with.

3.2 Emissions to Air

Ambient air quality standards (AAQS) are provided to ensure the community and protected areas around the Project are not adversely affected by emissions: predominantly dust (and potentially vehicle exhaust gases) during construction, and noise during operation.

Particulate Matters (PM)

Concentrations are measured and documented in milligrams per cubic meter of gas (mg/m^3) over specified averaging periods. AAQS include various thresholds for different averaging periods, all of which have to be met. The Indonesian regulation does not specify where limits apply: at Project boundary, at the receptor, or at the maximum point of impingement. The Project has selected the nearest receptors as compliance point. Approval on the monitoring locations and monitoring frequency is granted through the approved AMDAL document.

Table 3-1 shows the comparative limits of ambient air quality based on several references. These are Indonesian National Government Regulation No 41 of 1999 and the WHO which is also the IFC guideline.

IFC General EHS Guidelines require that projects with significant sources of air emissions and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines. Since the government has established ambient

quality guidelines and standards, limits as defined by the government serve as EDC. That said the Project makes also reference to WHO guidance values for ambient air quality.

Table 3-1 Project Ambient Air Quality Standards (µg/m^3)

Parameters	Averaging Time	Central Gov.(1)	WHO (IFC) (2)	Project
SO_2	1 Hour	900	N/A	**900**
	24 Hours	365	**20**	**20**
	1 Year	**60**	N/A	**60**
CO	1 Hour	**30,000**	N/A	**30,000**
	8 Hours	N/A	N/A	N/A
	24 Hours	**10,000**	N/A	**10,000**
NO_2	1 Hour	400	200	**400**
	24 Hours	150	N/A	**150**
	1 Year	100	**40**	**40**
O_3	1 Hour	235	N/A	**235**
	8 Hours	N/A	**100**	**100**
Particulates (PM_{10})	1 Year	**50**	N/A	**50**
	24 Hours	**150**	50	**150**
	1 Year	N/A	**20**	**20**
Particulates ($PM_{2.5}$)	24 Hours	65	**25**	**25**
	1 Year	15	25	**15**
Total Particulates	24 Hours	**230**	N/A	**230**
	1 Year	**90**	N/A	**90**
Pb	24 Hours	**2**	N/A	**2**
	1 Year	**1**	N/A	**1**
Dustfall	30 Days	**10 ton/km^2/mo (for Residential)** **20 ton/km^2/month (for Industrial)**	N/A	**10 ton/km^2/month (for Residential)** **20 ton/km^2/month (for Industrial)**

Note: 1 Indonesia National - Government Regulation No 41 of 1999
2 WHO standards refer to Interim Target-1, the maximum of all targets.

Noise

Minister of Environment Decree No 48/MENLH/11/1996 on Noise Standards defines national noise emission standards dependent on the area designation, with lower limits for residential and natural areas compared to industrial and commercial areas (**Table 3-2**). The IFC General EHS Guidelines on Noise presented in **Table 3-2** are from World Health Organization Guidelines for Community Noise, 1999.

In Indonesia, noise level measurements are taken off-site at specific times over the course of a day using a noise level meter. A 24-hour weighted average is calculated based on the

measurements, with greater weighting given to measurements taken at night. It is the 24-hour weighted average that is compared to the regulatory noise limits.

Table 3-2 Noise Level Standards in dB(A)

Receptor	MOE Decree No 48 of 1996	IFC[1]	Stringent Limit
Houses and residential areas	55	55 Daytime (7:00 to 22:00)	**55**
		45 Nighttime (22:00 to 07:00)	**45**
Trade and services	70	70 (commercial)	**70**
Offices and trade	65	70 (commercial)	**65**
Green open spaces	50	-	**50**
Industry	70	70 Daytime (07:00 to 22:00)	**70**
		70 Nighttime (22:00 to 07:00)	
Government and public facilities	60	-	**60**
Recreation	70	-	**70**
Seaport	70	-	**70**
Hospitals, schools, and religious buildings	55	55 Day time(07:00 to 22:00)	**55**
		45 Night time (22:00 to 07:00)	**45**

Note:

1. *IFC EHS Guidelines – General EHS Guidelines: Environmental*
2. *Maximum allowable log equivalent (hourly measurements) in dBA.*

In Indonesia, noise level measurements are taken off-site at specific times over the course of a day using a noise level meter. As stated above a 24-hour weighted average is calculated based on the measurements, with greater weighting given to measurements taken at night. It is the 24-hour weighted average that is compared to the regulatory noise limits.

In the PLN Power Purchase Agreement (PPA) Noise Regulations, the on-land limit for ground level noise from all generating capacity when operating in steady state conditions complies with the requirements of PLN Standards SPLN 46-1:1981 and SPLN 46-2-2:1982. Noise levels shall be the quieter of:

- No more than 70 dB (A) by day (6:00 to 22:00) and no more than 60dB (A) by night (22:00 to 06:00) at a distance of one meter from the base of each WTG tower, or
- At a distance of 300 meters from the base of the WTG tower, the noise levels shall be no more than 60 dB (A) by day (6:00 to 22:00) and no more than 55dB (A) by night (22:00 to 06:00).

Regardless of both points above, the noise levels at adjacent residences shall be no more than 55dB (A) by day (6:00 to 22:00) and no more than 50dB (A) by night (22:00 to 06:00).

3.3 Shadow Flicker

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 (IFC EHS Guideline for Wind Energy 2015).

At equatorial latitudes such as that in South Sulawesi, potential shadow flicker issues are less likely compared to 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.

If it is not possible to locate the wind energy facility/turbines such that during operation neighbouring receptors experience no shadow flicker effects, it is recommended that the predicted duration of shadow flicker effects experienced at a sensitive receptor not exceed 30 hours per year and 30 minutes per day on the worst affected day, based on a worst-case scenario. The outcome of this analysis, and proposed actions for implementing a more realistic scenario, are provided in the appropriate sections of this ESIA.

3.4 Landscape and Visual Impacts

IFC's EHS for Wind Energy (August 7, 2015, paragraphs 11 through 16) serves as reference and addresses Landscape and Visual Impacts as follows:

Depending on the location, a wind energy facility may have an impact on viewscapes, especially if visible from or located near residential areas or tourism sites. Visual impacts associated with wind energy projects typically concern the installed and operational turbines themselves (e.g., colour, height, and number of turbines).

Impacts may also arise in relation to operational wind facilities' interaction with the character of the surrounding landscape and/or seascape. Impacts on Legally Protected and Internationally Recognized Areas of importance to biodiversity and cultural heritage features are also a consideration. Preparing zone of visual influence maps and preparing wire-frame images and photomontages from key viewpoints is recommended to inform both the assessment and the consultation processes.

Avoidance and minimization measures to address landscape and visual impacts are largely associated with the siting and layout of wind turbines and associated infrastructure, such as meteorological towers, onshore access tracks, and substations.

Consideration should be given to turbine layout, size, and scale in relation to the surrounding landscape character and surrounding visual receptors (e.g., residential properties, users of recreational areas/routes). Consideration should also be given to the proximity of turbines to settlements, residential areas, and other visual receptors to minimize visual impacts and impacts on residential amenity, where possible. All relevant viewing angles should be considered when considering turbine locations, including viewpoints from nearby settlements.

Other factors can be considered in relation to minimizing visual impacts:

- Incorporate community input into wind energy facility layout and siting.
- Maintain a uniform size and design of turbines (e.g., type of turbine and tower, as well as height).
- Adhere to country-specific standards for marking turbines, including aviation/navigational and environmental requirements, where available as exist.
- Minimize presence of ancillary structures on the site by minimizing site infrastructure, including the number of roads, as well as by burying collector system power lines, avoiding stockpiling of excavated material or construction debris, and removing inoperative turbines.
- Erosion measures should be implemented and cleared land should be promptly re-vegetated with local seed stock of native species.

3.5 Electric and Magnetic Fields

Electric and magnetic fields (EMF) are invisible lines of force emitted by and surrounding any electrical device such as the power lines and other electrical equipment. Although there is public and scientific concern over the potential health effects associated with exposure to EMF), there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern. The IFC's EHS Guidelines for Electric Power Transmission and Distribution (April 30, 2007) recommend several management strategies for the EMF in accordance to the operation of electric transmission facilities such as consider the site siting which can avoid and/or minimize the exposure to the public; and modifies the design criteria such as shielding with the specific metal alloys; increasing height of transmission tower; and modification of size, spacing and configuration of conductor. EMF is applicable for overhead 150 kV transmission line and wind farm's 33 kV internal collector system.

3.6 Emissions to Water

Water impacts are largely confined to the construction phase. Installation of turbine foundations, underground cables, access roads, transmission pile foundation, and other ancillary infrastructure may result in increased erosion, soil compaction, increased run-off, and sedimentation of nearby surface waters. The construction, installation, and removal of structural components should be planned and managed to minimize the impact on water quality. The impact of the Project on water quality is similar to the other construction activities; no specific impact during the operation stage with the exception of potential oil spills.

Sewage

Construction activities are cause of increased sewage generation defined in this document as wastewater containing human excrement and/or household wastewater that originate from sanitary conveniences of a dwelling, business, building, or industrial facility.

Minister of Environment Decree (*Keputusan Menteri* LH) No 112 of 2003 on Domestic Wastewater Quality Standards defines domestic wastewater as wastewater originating from business and/or resident activity (real estate), restaurant, office complex, commerce, apartments, and dormitories. **Table 3-3** summarizes applicable domestic wastewater discharge limits.

Table 3-3 Domestic Wastewater Discharge Limits (mg/L or as indicated)

Parameter	Indonesia National – MOE Decree No 112 of 2003	IFC	Design Basis for Sewage Treatment (ICS Project)
pH	**6 ~ 9**	**6 ~ 9**	**6 ~ 9**
BOD	100	**30**	**30**
Total Suspended Solids (TSS)	100	**50**	**50**
Oil and Grease	10	**10**	**10**
COD	-	**125**	**125**
Total Nitrogen	-	**10**	**10**
Total Phosphorus	-	**2**	**2**
Total Coliform Bacteria (MPN10/100 ml)	-	**400**[6]	**400**

3.7 Hazardous Waste

Various hazardous materials may be used during the life of the Project: insulating oils / gases and fuels, in addition to chemicals or products for wood preservation for poles and associated wood construction material. Petroleum fuels for vehicles and other equipment may be used and stored at transmission and distribution projects. Recommendations for prevention and control of hazards associated with spill prevention, emergency response, clean-up, and contaminated soil remediation were considered as part of the mitigation measures of this Project. The hazardous waste impact were not considered as the specific impact of the wind project but it relates to general construction and operation activities.

3.8 Biodiversity

Onshore wind energy facilities have the potential for direct and indirect adverse impacts on the biodiversity almost in all of the activities stages during construction, operation and maintenance, and decommissioning. Impacts include bird and bat collision-related fatalities; bat fatalities due to the potential impact of pulmonary barotrauma; displacement of wildlife; and habitat conversion/degradation. The location of operational turbines may disrupt the daily movements of bats and birds (e.g., from feeding to roosting or breeding grounds), and may potentially represent a barrier to the migratory patterns of certain wildlife. Adverse impacts can also result from associated infrastructure, particularly overhead transmission lines, meteorological masts, substations, roads, and lighting.

The IFC's EHS Guidelines for Wind Energy (August 7, 2015) requires to collect appropriate site-specific baseline information as basis for the ESIA. The guideline further states that baseline biodiversity surveys, where required, should occur as early as possible and should consider seasonality. A tiered approach to biodiversity surveys could be useful in terms of designing a survey effort commensurate with the stage of project development, also considering the existing

biodiversity value of the area. This can result the careful site selection and layout considering the adverse impacts on biodiversity. Several mitigation measures could also be applied as applicable such as modifying the turbine design and layout; the active turbine managements in the wind turbine facilities nearby the key biodiversity areas; and avoidance of creating features and/or conditions which attract birds and bats to the wind project facilities.

3.9 Community Health and Safety

Specific Project impacts on the community health and safety may include the risk of the blade throw, aviation disturbance, electromagnetic interference, public access limitation to the wind turbine facilities and traffic accidents during construction.

The risk of blade throw may occur by the failure of the rotor blade which can result in the “throwing” of a rotor blade, or part thereof, which may affect public safety giving the condition in the project area. The overall risk of blade throw is considered very low given the climate condition. However, to minimize the risk of blade throw impact, turbines will be sited at an acceptable distance ("setback") between wind turbines and adjacent sensitive receptors to maintain public safety in the event of blade failure. The IFC EHS Guidelines for Wind Energy (August 7, 2015) recommends the minimum setback distance is 1.5 x turbine height (tower plus rotor radius), although modelling suggests that the theoretical blade throw distance can vary with the size, shape, weight, and speed of the blades, and the height of the turbine. It is therefore recommended that the minimum setback distances required to meet noise and shadow flicker limits be maintained with respect to sensitive residential receptors to provide further protection.

Wind turbine blade tips, at their highest point, can reach close to 200 meters and in the future may exceed this height as the technology evolves. If located near airports, military low-flying areas, or known flight paths, a wind energy facility (including anemometer mast) may impact aircraft safety directly through potential collision or alteration of flight paths. Mitigation measures include coordination with the relevant aviation authorities before the installation of the wind turbine in accordance with the air traffic safety regulations, and visual aids to avoid aviation accidents (e.g. red colour rings and/or lights painted/installed at wind towers).

Impact on electromagnetic interference can be minimized by placement of wind turbines to avoid the direct physical interference to the communication systems.

Public safety issues may arise as the public access to wind turbines, transmission line area and the substation. There are several mitigation measures that could be applied to limit the public access within the facilities such as fences and warning sign installation.

The IFC EHS Guidelines for Wind Energy (August 7, 2015) states that public safety impacts from wind turbines facilities are often related to increase of traffic and transportation of the oversized or heavy wind turbine components such as blades, turbines tower sections, nacelle and transformers and cranes to the site area. These issues are best addressed by a Traffic Management Plan which considers transportation outside of peak hours, utilization of approved access routes, provision of traffic management to stop public traffic as needed, and provision of police escorts as required.

Turbine Fire Risk

The majority of turbine fires are started by a lightning strike, brought about by their exposed and often high-altitude location and the height of the structure. Mechanical failure or electrical malfunction also account for a significant percentage of fires that can be fuelled by up to 500 liters of hydraulic fluid and lubricants in the nacelle, which itself is constructed from highly-flammable resin and glass fiber. Internal insulation in the nacelle, which can become contaminated by oil deposits, add to the fuel load. Electrical equipment is another high-risk area. Capacitors, transformers, generators, electrical controls, and transmission equipment all have the potential to catch fire, as do Supervisory Control and Data Acquisition (SCADA) systems. Braking systems pose a particularly high fire risk. Overheating can cause hot fragments of the disc brake material to break off, rupturing hydraulic hoses and resulting in highly combustible hydraulic fluid being expelled under pressure and coming into contact with the hot disk brake fragments. Hydraulic pumps and connections have also been known to fail, allowing the fluid to erupt into flames when it comes into contact with a hot surface.

The main risk of turbine fire is the loss of the entire nacelle with its expensive equipment parts. However, burning parts are likely to fall on the ground, potentially endanger bystanders and/or start a secondary fire on the ground.

The options for controlling fire risks that are often considered in modern WTG can be generally categorized as air sampling detection; water mist suppression; compressed-air foam suppression; fusible link detection and suppression; total flooding CO_2 (carbon dioxide)suppression; total flooding clean agent suppression; and linear pneumatic detection and suppression. Any of these options will significantly reduce if not eliminate the fire risk.

CHAPTER 4
PROJECT DESCRIPTION

Chapter 4 provides an overview of the Project detailing technology, main Project components, and Project phases.

4.1 Technology

4.1.1 Capacity

The design capacity of the Project is 72 MW produced by 20 wind turbine generators with an installed capacity of 3.6 MW each, (**Figure 4-1** for the main technical characteristics of the proposed wind turbines).

4.1.2 Technology Description

A wind turbine works on a simple principle: Energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity. Wind turbines are mounted on a tower to capture the most energy. At 30 meters or more above ground, wind turbines take advantage of faster and less turbulent wind. Electric power is collected at substation transformers and connected to an electricity grid for widespread electricity distribution **Figure 4-1.**

4.2 Main Project Components

A typical wind power project comprises the following components:

- Wind turbines mounted on towers;
- Electrical collection system;
- Meteorological masts; and
- Transmission/interconnection facilities.

Besides these components associated facilities include access roads and Operation & Maintenance facilities.

Technical Specification	
General	
Nominal power	3.6 MW
Number of WTG	20
Installed Capacity	72 MW
Average total height	200 m
Wind class	IIA
Concept	3-bladed; horizontal axis direct drive; pitch regulation with variable speed upwind clockwise rotation
Control System	Built-in computer control system coupled with remote access system (Supervisory Control and Data Acquisition or SCADA in short).

Tower	
Height	135 m
Material	Tubular Steel
Color	White (non-glossy) to light grey
Crane Hardstand	44m x 144 m
Rotor	
Diameter	130 m
Blade length	63.5 m
Swept area	13,300 m^2
Material	Glass reinforced epoxy fibre (GRE)
Speed	6.5 – 12.8 rpm
Operational Data	
Cut-in wind speed	3-5 m/s
Cut-out wind speed	25 m/s
Nominal power at approximate	11-12 m/s
Generator	
Type	Synchronous, Permanent Magnet Generator
Indicative Weight	
Blade	17 metric tons
Rotor	96 metric tons
Nacelle	103 metric tons
Tower	80 metric tons
Foundation*	
Shape	Octagonal
Horizontal dimension	About 20 m diameter
Thickness	Up to 4 m
Material	Up to 650 m^3 of reinforced concrete
Substation Complex	
Area	approximately 2 ha
Comprises	Distribution substation and switchgear with 33 kV ratings; 45 MVA Power transformers; Control/management facility and service; Parking,; Traffic acces; Landscape area; Internal infrastructure supply; Sewage Low voltage power supply 33/0.4 kV internal transformer
Transmission Line	
Voltage	150 kV
Length	3.5 km

** The final design of each foundation will depend on the result of geotechnical investigation at each site.*

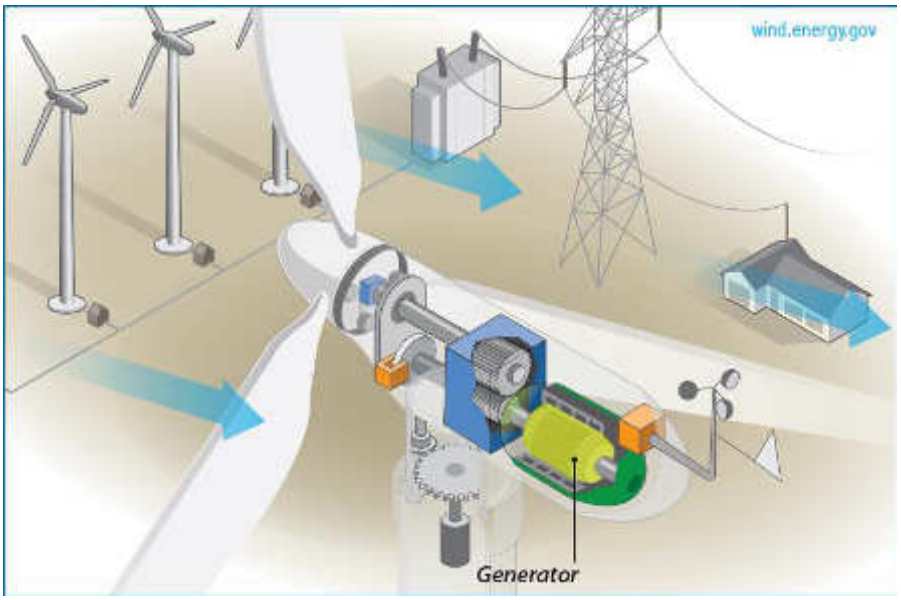


Figure 4-1 Power Gathering Scheme and Technical Specification (Illustration - US Department of Energy)

4.2.1 Wind Turbines Mounted on Towers

As stated above the wind turbines consist of a hollow steel tower with a nacelle to which the fibreglass rotor with three blades is attached. The nacelle houses the generator, cooling system, and control systems. A transformer is located in the base of each WTG tower. Each turbine tower site features a crane hardstand/working area of about 44 x 144 meters.

The wind turbines are large but are of a fairly standard size for on-shore designs wind farms. These larger units generate electricity more efficiently than smaller units.

Tolo I wind farm will consist of direct drive turbines with permanent magnet generators. The absence of gearbox in direct drive turbines results in the reduction of turbine component failures (i.e. requires less maintenance).

Source: Alternergy Pililla Rizal Wind Farm

Figure 4-2 Example of Windfarm in operation

Rotor

The three-blade propellers will have a length of about 63.5 meters rotating at a fairly slow spin speed between 6.5 and 12.8 rpm under normal operating condition. Blades are made of glass-reinforced epoxy polyester materials similar to those used in advanced powerboat racing.

Nacelle

The nacelle serves as housing of the wind turbine generator (WTG). The turbine rotor is mounted on a sliding roller bearing that allows it to spin and maximize energy. A wind vane and anemometer mounted at the rear of the nacelle provide signals to the computerized control system on wind speed and direction information. The computer system directs the nacelle toward the dominant wind direction, sets the propeller in motion, and sends information to the site control room. Through this system the wind power station can also be controlled remotely from the site control room. The communication system between the wind turbines and central control room station uses a fiber optic cable.

Wind turbine generators use engine coolant and hydraulic oils. Leak detection systems and reservoirs are used to minimize the potential for spills as a result of damage to the system.

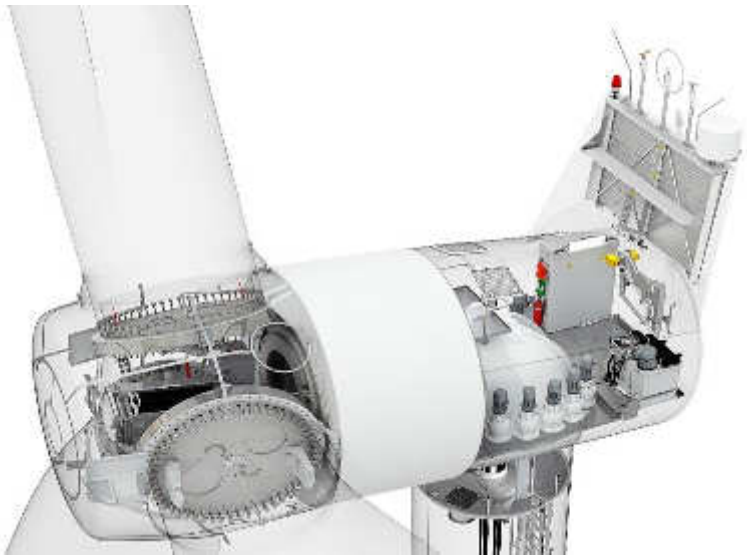


Figure 4-3 Nacelle Component Illustrated (Source: Siemens)

Tower

WTG towers are conical tubular steel structures delivered to the site in several sections depending on tower height. An internal staircase and lift extend the height of the tower to just below the nacelle. A staircase connects the bottom of the engine nacelle with the peak of the tower. Tower design will be certified by an experienced and qualified structural engineer with relevant experience.

Wind turbine foundation is embedded deep into the ground to securely place the wind turbine structure. The type of foundation is determined based on the load information provided by the manufacturer of the wind turbines and the geotechnical site conditions. **Figure 4-4** provides an example of a wind turbine foundation.

Source: Alternergy Pililla Rizal Wind Farm

Figure 4-4 Example of WTG foundation type

4.2.2 Wind Farm Electrical Network

When the wind reaches and maintains constant speeds of over 3 m/s (cut-in wind), the turbine rotor shaft rotates and directly drives the permanent magnet generator that converts rotor shaft energy (i.e. mechanical energy) into electrical energy through an electrical generator. The wind turbine will start generating electricity at a minimum constant wind speed of 3 m/s, with rotor spins in a clockwise direction and a corresponding output at that speed of approximately 40 kW. At 6 m/s the output is approximately 780 kW but then rises sharply to the maximum power output at 11-12 m/s, where the turbine will generate the maximum design output of approximately 3,600 kW. This will be held up to a constant speed of approximately 25 m/s (cut-off wind). At higher wind speeds the turbine blades are stopped/parked for safety reasons and to prevent excessive wear and tear on the mechanisms.

Most of the electricity produced by the wind farm will be transferred to the grid but a small amount of electricity will be used by the on-site control facilities and the wind turbines themselves may use electricity when wind speed is constantly in excess of 25 m/s and requires the activation of the hydraulic braking system of the turbine rotor.

The electricity produced by the turbine is transferred to the base of the turbine tower to a transformer unit where it is converted into electricity for transmission into the underground 33 kV wind farm network. The design of the transformer allows for leak detection and security systems. The potential for leakage due to damage or cracks in the transformer is low and leaked fluids will be collected.

4.2.3 Transformer Substation Complex

The transformer substation complex will measure about 2 hectares, and comprises the following elements: a distribution substation and switchgear with 33 kV and 45 MVA power transformers, a control/management facility and service, parking, traffic access and landscape areas. The internal infrastructure (such as water supply, sewage and low-voltage power supply provided by

a 33/0.4 kV internal transformer within the transformer substation) is provided to enable the operation of the transformer substation complex.

All major elements will be mounted on a concrete foundation designed for the soil conditions at the site substation. The transformer substation complex will be fenced and features an outdoor lighting system.

4.2.4 Grid Connection

Power will be injected to the grid via 3.5 km-long 150 kV transmission line from the wind farm's pooling substation to PLN Jeneponto substation. The transmission line will consist of ten (10) towers with 20 m x 20 m or 15 m x 15 m footprint. The grid connection is subject of separate environmental permitting process (UKL/UPL); the grid connection count as associated facility.

4.3 Wind Farm Infrastructure

4.3.1 Access Roads

Access to various turbines will be reached via access roads with a gravel surface (permanent Project roads 14 km in length and about 5 to 8 meters in width (which includes road shoulders). New roads are designed to allow heavy equipment to reach the sites of the wind turbines, main relay station, and weather monitoring tower. Access roads connecting these facilities will be designed in accordance with the National Standards of Indonesia and will be maintained by the proponent as long as these facilities are in use.

Road design is to optimize access and avoid the risk of erosion. If possible, the design will use roads to minimize the impact on surrounding land. The access road will be compacted and widened, so that it can be used to mobilize a large crane that will be used to erect the turbine towers.

4.3.2 Weather Station

Wind data are collected to determine the wind resources at the site using meteorological mast. Two new meteorological masts will be erected within the Project area during the construction phase for Project turbines power curve testing purposes.

The new masts will be 135 m tall (similar with turbine hub height) lattice masts consisting of first class IEC compliant measurement instruments. Two (2) met masts will be permanently installed at the site to provide accurate measurements.

4.3.3 Operation & Maintenance Facilities

Operations and Maintenance (O & M) Facility will occupy a fenced area of about 2 ha, including operation and maintenance buildings, parking area with gravel surface, and warehouse. O&M building is a concrete structure with minimum floor area of 150 m^2 and painted to blend harmoniously with the surrounding environment. Lighting outside the O&M building will be minimized with lighting directed downward. Electric power for the O & M building will be provided by PLN.

All sanitary waste from the O & M buildings will be collected and stored in a permanent septic system. Domestic water wells will be drilled for water supply to the O & M buildings. All permits

required for the construction of this facility will be obtained prior to construction in accordance with applicable regulations.

4.3.4 Laydown Area for Construction

When the contractor mobilizes to the Project site, safe material/equipment storage and laydown as well as a construction office will be prepared and temporary construction facilities including portable toilets and facilities for moving and storing material (among others turbine components and fuel for construction equipment). In addition, the area is also used to park construction vehicles and employees' personal vehicles, and other construction equipment.

The location proposed for this facility is a relatively flat spot, close to the access point to the site, adjacent to the proposed road access, and in a central location around where the turbines will be built. This will provide efficient access to material and equipment transportation to the locations where turbines will be built. The site surface layers of soil will be cleared and replaced with sand and gravel. All chemicals and fuel will be stored in the areas provided. The spill containment will meet the applicable environmental management requirements. The main part of this facility will be fitted with temporary fencing to provide security to the materials and the equipment in it. After construction, areas used for this facility will be restored as closely as possible to their previous state.

4.3.5 Concrete Batch Plant

The foundations that will support each of the turbines will be constructed in steel reinforced concrete. Each of the foundations is calculated to require about 650 m^3 of concrete, depending on the optimization of the design. This is a significant quantity of concrete and it would be impractical to transport ready mixed concrete from Makassar to the site (due to the transportation time and the number of vehicles that would be required).

The concrete will therefore be prepared on site using a concrete batching plant. The batch plant would be able to produce 700 to 800 m^3 of concrete per day, i.e. sufficient quantity for one foundation per working day (10 hours).

The batch plant will require a land area of 5,000 to 6,000 m^2 and will comprise:

- 2 or 3 cement silos (up to 100t capacity each);
- 2 or 3 shipping containers for equipment storage;
- 4 aggregate bunkers;
- water/ waste setting pit; and
- parking for truck mixers and pumps.

The cement and the aggregates needed for concrete manufacture will be delivered to site by road. In order to optimize gravel transport fleet, it may be necessary to have an additional area of 3,000 m^2 to 4,000 m^2 for a gravel aggregates stock. Aggregate will be sourced from existing quarries at Bili-bili.

The batch plant must have a stable supply of good quality water for concrete production. It is currently expected that water would be obtained from a dedicated groundwater well. Hydrogeological studies indicate that sufficient groundwater is available. A preliminary hydrogeological study of the area was completed by Ground Risk Management as a “Broad Level Water Assessment, Tolo Wind Farm Project, South Sulawesi in March 2017. This included

geological mapping, review of existing sources in terms of depth and water level, collection of groundwater samples for analysis by an internationally certified laboratory, and pump testing of two selected wells.

In summary the area is underlain by volcanoclastic sediments derived from Mount Bawakaran volcano. Such sediments, from experience with similar sediments throughout Indonesia are moderately to highly permeable and in such a high rainfall area the annual recharge is commensurately high. The GRM survey showed that groundwater is available throughout the Tolo area. Samples collected were analysed by Intertek, an international laboratory, including comparison of results against reference samples. The analyses confirmed that the groundwater quality is typically slightly alkaline pH (ie non-corrosive) and moderate salinity. The wells sampled returned coliform bacteria as is common in shallow community supplies but in all other respects the groundwater meets WHO and Indonesian drinking water standards.

The major water demand is for concrete during construction where the requirement is for up to 160 m^3 per day. At a water content of 40% this equates for a peak demand of 24 kL per day potentially over a six-month period. The intention is to source this water from a groundwater well at the concrete batch plant. It is our preliminary assessment, depending on elevation and topography that a groundwater yield of 0.3 L/s will be readily available from a 150 mm diameter well to maximum depth 50 m. Based on the estimates outlined above, a single bore should easily be able to meet this demand. The water storage volume and water delivery system to the batching area would need to be sized based on the duration over which this amount of water is required in any one day during the batching period process.

This well or other more strategically sited wells could then be used for the much lower water demand during operations. Given the relatively small demand there will be no impact on community or other wells providing these are more than 100 m distant.

At a production level of 800m^3 per day, the plant would require about 1,500 t of gravel per day. To meet the production levels required a fleet of up to 24 trucks (making 2 round trips per day) would be required for the gravel transportation.

The prepared concrete will be transported to turbine foundations using rotating mixer trucks. Each of these trucks has a capacity of 8 to 9 m^3. This means that it will take about 75 to 80 loads to complete each foundation. The distance from batching plant to the furthest turbine foundation location is within 3 km. The trucks will use the internal roads to reach the turbine foundations. To move the concrete from the batch plant, 4 truck mixers (plus a standby vehicle) are required and one of the available concrete pumps.

Emissions from the cement batch plant will be carefully managed. This will include particulate release from silo vents, fugitive dust emissions as well as the management of wastewater. It is expected that the particulate emissions from release points, such as silo vents, will meet the Environmental Design Criteria (EDC).

4.3.6 Borrow Pit

Gravel will be sourced from Bili-bili is about 60 km distance. At Bili-bili there are existing quarries used to provide construction materials for the region.

The Bili-Bili Quarry has been originally developed to provide construction materials for the Bili-Bili Dam (The Bili-Bili Dam is a 1,800 m long and 73 m tall rock-fill type; as such the previously mined rock material is several orders of magnitude higher than required for the Tolo wind farm). The construction of the Bili-Bili Dam ceased in 1998, and the quarry continues to supply rock material for local construction since then. The total gravel required for the 20 turbines foundation is about 24,375 ton. This amount is considered insignificant compared to the reserve of Bili-bili quarry of the size mentioned above. Thus, no expansion of the quarry is required to fulfil the aggregate requirements of the Tolo Windfarm Project, and as such inclusion of the quarry into the ESIA is not required. The borrow pit is out-of-scope for this ESIA given that the borrow pits are in operation with or without the Project.

4.4 Project Phases

Construction is to begin in 2017 and operations are expected by Q2 2018. The schedule is detailed in Section 1.5.

4.4.1 Pre-Construction Phase

Permitting

The Project Proponent requires a building/construction permit, a permit for the use of public roads and access roads that intersect with public roads, permits for the transport and use of heavy equipment, as well as permits for operation and maintenance of Tolo I Wind Farm Project facilities and transmission lines (e.g. approved Amdal). These permits will be obtained prior to conducting the related activity.

Surveys

Land Survey - Before to construction activities field surveys will be conducted to mark the location of wind turbines, access roads, power transmission lines, access from public roads, and the location of the main relay station. All areas likely to be disturbed by the Project activity will be included and marked in the construction plans.

Geotechnical Survey - Geotechnical investigations will be carried out to identify the condition of the soil and rock beneath the soil surface that will determine the design specifications of access roads, tower foundations, and the electrical grounding system. Geotechnical investigations will typically use a drilling machine to investigate the subsurface soil conditions down to a certain depth as required by experts, plus a backhoe to identify the type and strength of the soil and rock beneath the soil surface through sampling and laboratory testing.

Geotechnical investigations will be carried out using midsize drilling machine equipment together with a truck transporter or drilling machines that can be moved 'manually' using a tow vehicle. The vehicle will use existing roads if possible or planned access roads. All roads are planned to be used in such a way to avoid or minimize the impact on sensitive areas and streamline the transport during construction and operation.

Pre-construction Site Inspection - About a week before the commencement of construction, at construction sites that have been marked, environmental monitoring personnel, contractors, and

sub-contractors will carry out inspections on foot to the areas to be affected by construction activity.

This pre-construction inspection will be repeated regularly to identify sensitive areas to be avoided. Well-prepared plans for mitigation of erosion and sedimentation (e.g., culverts and drains) will be followed. Modification of the methods or construction sites will be approved before construction begins and changes documented. Consultation with landowners and local government representatives will be conducted during the field inspection.

Socio-economic Survey – The Project require acquiring of about 50 ha of land. To support land acquisition planning (and post-acquisition monitoring) a socio economic survey will be conducted to collect data such as:

- Number and density of population,
- Revenue of local communities,
- Documenting land ownership status,
- Compensation for land acquisition, and
- Acceptance of the community toward the Project development plan.

Environmental Survey – As part of the Amdal and ESIA preparation the Project Proponent has conducted various baseline work to ascertain the environmental setting of the Project.

Based on data collected for this Project, including information on geotechnical conditions, environmental setting, the results of topographical measurements, and other information, the proponent will compose the specifications for planned construction activities, with specific attention to local environmental conditions, during the process of finalizing the detailed engineering design.

Land Acquisition

The land area occupied by the Project measures about 41 hectares. As per September 2017, the land acquisition process has been completed. Consultation with landowners and local government representatives has been conducted throughout the land acquisition process. The owners of land and / or livestock owners will be allowed to use the surrounding land (farmland or pasture) during the operational phase of the Wind Farm. Only landowners who have formal agreement with the Company are allowed to use the land area that is not part of wind farm structure. Priority is given to the landowner or sharecropper who were previously cultivating the land. This will be further described in a stand-alone Community Development Plan document.

Land acquisition is described in more detail in **Appendix 5.** The land acquisition process has been completed in the 8 villages within Jeneponto Regency. During the process, the final configuration of the wind warm layout (e.g. access road) has gone through some modifications to accommodate land owners who did not want to sell their land to the project.

4.4.2 Construction Phase

Construction will start only after all relevant permits (e.g. Environmental Permit, Construction Permit, etc.) have been obtained and land acquisition fully completed. Construction of the Project is split into an early works phase (consisting of early site preparation and detailed geotechnical investigations) and full Project Construction (post-NTP). Construction of the Project will last for 18 months (early works followed by 12 months post-NTP) as summarized in **Table 4 1.**

Table 4-1 Construction Schedule Plans

Activity	Duration in weeks
Site preparation	12
Substation works	13
WTG Foundation	14
Road and hardstands	17
Administration office/operation and maintenance building	10
Underground cable trenching	26
150 kV Transmission Line[2]	41
WTG Erection	20
Commissioning	12

Mobilization of Workers

The number of construction workers in the field is estimated at around 180 people (see also **Section 1**). Local employment is expected to reach 50 to 60%.

Development and Operation of Construction Camp

This activity consists of the construction of a temporary construction camp for the workers, management, workshop equipment, and warehouse, sanitary and water supply facilities, and security posts. Of the workforce that will work on the Wind Farm construction activities, an estimated 60 to 80% will occupy the base camp to facilitate the achievement of the work and save the time and cost of transport. Warehouses are to be built to store building materials, especially construction materials that cannot be exposed to the weather or direct sunlight.

Road Construction

Transport routes will be determined by the haulage contractor and the contractor for the smooth mobilization of construction equipment and workers to the construction site based on standard criteria set by the proponent. This route is determined with the aim to minimize disruption, avoid sensitive areas, and maximize the efficiency of transportation. The transportation plan will include design criteria for existing roads that require modification, any new roads, and other needs. The plan will receive advice and direction from local governments and other relevant agencies' staff who know the areas with potential for conflict as a result of road construction and / or maintenance. The length of the access roads, both new roads and public roads that are to be repaired, will be determined with the finalization of the plan. Traffic planning is also being prepared and will cover all possible measures to reduce the impact of increased truck traffic.

The Project will require access roads for Project vehicle mobility during construction and operation phases. In general, measures for access road construction and upgrading will use road

[2] The construction of the transmission line will be done by EBJ and upon completion will be handed over to PLN for operation and maintenance.

surface coatings designed to withstand in all seasons by using various sizes of gravel covering the road surface to a thickness of 15 to 30 cm.

The intersection with existing roads will be widened in accordance with the requirements for the trucks to turn into and out of the construction area. Rotation radius required is as wide as 50 to 65 m. All site road improvements and new roads will be marked with a flag or marker survey, according to the needs. Access roads will be built in the areas around the turbine sites that do not have roads.

Roundabouts temporarily will be constructed at each end of the turbine transport path. With the completion of the construction of wind turbines, the use of the access roads will be consulted with local government. If necessary, backfill will be done with the removal and transport of waste material out of the construction sites, separated from the usable materials. Once the waste material is transported away, soil surfaces will be compacted and then returned to initial conditions and contours. The roads at the Project site that have deteriorated due to ruts from surface construction vehicles will be graveled and leveled so that they can be reused.

Transport of Equipment and Construction Materials

The main transport activities will be carried out during the construction stage of the wind farm and will include the following:

- main components of the turbines;
- auxiliary plant associated with the wind farm;
- main plant associated with the construction process, including cranes and concrete batching plant;
- temporary buildings and any other modular structures associated with the wind farm construction; and
- road and concrete plinth construction materials, including aggregates, sand and concrete for the concrete batching plant, piling materials and other metal reinforcement materials.

The transport of plant, components and materials to the site can be split in to four phases as:

- Transport of plant components by ship to the port of Makassar;
- Use of the main road network to transport components from the port to the vicinity of the site; and of construction materials, including other large scale equipment and bulk construction materials, that are not brought in to the region via the port of Makassar;
- Local transport from the main roads through local, minor roads to the site access point;
- Transport from local roads at the site boundary to all areas within the site on presently unimproved roads and tracks.

In order to provide optimum transport and assembly conditions for the wind turbines, certain requirements have to be met, as described below. These are based on general characteristics but may vary depending on the final turbine chosen for the project. In general, for each turbine, the access road must be capable to bear the following loads:

- ***Vehicles***
    - about 50 haul vehicles;
    - 12 to 20 trailers for crane assembly and dismantling;

- 9 to 13 trailers for the turbine components (3 to 6 for the tower components, 3 for the blades, 3 trailers for the nacelle, rotor and tracks, 2 for the controller, smaller parts and hoisting containers);

- **Vehicle weight**
  - Maximum axle load will range between 12 and 20 tonnes, for public roads and on-site roads respectively;
  - total load in excess of 150 tonnes;
  - pressure on soil of the crane tracks in the region of 200kN/m^2.

All along the access road, height and width clearance must be minimum 6 metres and width clearance must be 5 metres. In particular, for blade transport, road width in the curves must be extended to a minimum of 7 metres, with a bend radius in excess of 40 m for the transport vehicle, also providing for 50 metre radius clearance in the direction of travel (**Figure 4-6**).

Source: Alternergy Pililla Rizal Wind Farm

Figure 4-5 Typical Special Trucks For Transporting Propeller Blades

The main Sungai Kelara road provides an excellent connection route to the site and it will be used as the main transport connection to the site. The main plant components and equipment will be imported via the port of Makassar. All large items such as cranes and the concrete batch plant as well as and construction materials (e.g. cement aggregates) will also be delivered to site via the Jalan Poros. All plant, equipment and materials will enter the site at a predetermined and controlled point of entry with majority being held at the Logistics Compound. The transport of all plant components and materials is the responsibility of the main EPC contractor and its logistic contractor.

The final route was determined in close cooperation with the selected turbine supplier and local community representative in such a way to, on the one hand, ensure the least possible disturbance to the local population and, on the other, ensure that citizens benefit from road reconstruction (as the reconstructed roads will remain in the ownership of the local government and will be used daily by the citizens).

To provide access for heavy equipment, improvement of the existing village roads will be required involving reinforcement of the embankments and the development of a suitable road system where one does not presently exist. Improvement will consist of lying and compacting gravel

where required. Temporary transport requirements such as passing places on site roads for large scale vehicles will be removed after construction and their condition reinstated for previous use. Access routes to the turbine plots will be 'permanent' project features, will be in use throughout the operational and decommissioning phases of the project.

Access road infrastructure will also include the development of temporary platforms for the parking and manoeuvring of oversized vehicles. The access road layout has been designed such that the use of internal roads are optimised in order to minimise the potential social impact inherent to the use of public roads, especially during construction phase. Once built, internal access roads will also benefit the local community by improving accessibility to the paddy fields, at no additional cost. EBJ shall purchase. The estimated time for the completion of the access roads is approximately 4 months.

Civil, Mechanical, and Electrical Work

As is often the case with ESIAs of large scale development projects, the details of the main equipment enclosures and laydown areas, methods of construction (e.g. the balance of on-site and off-site fabrication) and the precise building programme is currently a subject of negotiations with EPC contract provider. The selection of the construction contractors is in progress. The construction of the wind farm will involve several contractors that will work in parallel on construction, assembly and installations.

The wind turbines and ancillary plant will be manufactured off-site and delivered to site on large road vehicles. Construction activities will include:

- preparation of the site area for development;
- fill importing / exporting and site levelling;
- construction of site roads and construction pads;
- utilities and services connections to site;
- foundation piling / excavations and concrete footings pours;
- erection of building frames and cladding;
- installation of turbines;
- building fitting-out; and
- Commissioning.

Due to the size and nature of the turbines it will be necessary to provide substantial foundations. Also, as is typical of this type of process, there will be a significant movement of materials in and around the wind farm. Typically the topsoil will be used for on-site landscaping or may be given away. The next layer (spoil) is disposed of as close to the site as possible; it can be used for infilling other excavations, or used as fill material for building embankments, berms etc.

Each plot upon which a turbine is constructed will include the following.

- An octagonal foundation within the circle of 20 m in diameter. The foundation has a truncated cone shape, being about 3 m thick at the middle part height of the anchor block, and about 1.4m at the edges. Each base is supported by up to 25 reinforced concrete piles. These piles are set out in three concentric circles, each having 8 piles and one pile in the centre. The average pile length is 16m and the diameter 0.6m (created by drilling rather than percussion piling). The estimate for the foundations indicates that each foundation will require approximately around 700 m^3 of excavation and around 650m^3 of concrete is

required. The foundation which is located within the foundation platform will be 25m x 25m in size. (Note that the final foundation design and size will depend on site-specific geotechnical investigations).

- A service platform for the crane. The platform will be sited near the turbine, covering 50 x 25m, and will be made of crushed stone to support the crane used in installing and eventually dismantling the wind turbine.
- There will also be an access road within the plot of land.

There is also a large plot of land for the ancillary structures (transformers, control centre etc.). It is estimated that the construction programme will start during Q2 2017 and will run for approximately 18 months. According to this timetable it is anticipated that the facility should be operational in 2018.

Service Platform - A platform will be built at the foot of every wind turbine. This platform will be used as the only authorized parking, crane pads and storage place. Before the construction of the platforms can start, the terrain will be flattened and in some cases, some soil will be removed or added before the steam roller can flatten the terrain. In order to reinforce the terrain before the arrival of heavy machinery as trucks and cranes, a top layer will be placed on the flattened land. The different components of this layer are: a geotextile canvas, recycled material and stone-chippings; with a total thickness of about 40 cm.

Foundation - The foundations will be designed and built according to the results of geotechnical studies. Excavated material will be stockpiled for use as backfill in a location close to the turbine sites. Up to 650 m^3 of concrete is required for each turbine foundation (the volume is reduced when using stone anchor foundations). The mixer truck will transport the concrete from the batching plant to the temporary location of each turbine.

Wind Turbines Mounted on Towers - Step-by-step assembly of turbine components is as follows. Steps 1 to 4: The tower base is mounted with bolts on the foundation using a pneumatic wrench followed by a specified torque wrench, and then the other tower parts are progressively mounted by bolting; Step 5: The nacelle is lifted and installed on top of the completed tower; Step 6: The assembled rotor is lifted, stabilized with the help of supporting crane, and installed on the main shaft of the nacelle.

4.4.3 Operation Phase

Management Control

Operation of the wind farm will most likely be through an on-site management facility rather than through a fully automated system which is controlled remotely. There will be personnel on site on a permanent basis for the direct control of the wind farm. Nevertheless, each turbine will have a control system for critical functions, monitoring weather conditions and data reporting which will be relayed back to the control centre. The effective ability to control the wind farm is included within the scope of this assessment.

On site staff may also include staff for security and for post-construction monitoring. On site there will be a local management control centre which will be a separate unit located at the O&M facility. The local control centre will probably be permanently manned, but the final decision has not been made yet.

Maintenance

Scheduled and reactive maintenance activities will be undertaken throughout the operational stage of the wind farm. Specific regular scheduled maintenance activities will encompass:

- turbines to identify areas of rust, corrosion and wear, as well as checks of blades and all moving parts for fatigue and potential failure;
- equipment which holds oil to ensure prevention of leakage and/or damage to equipment;
- oil storage and storage of other hazardous substances to ensure effective containment;
- lubricating oil quality in the moving mechanisms and gears (rotor, generator) and replacement of non-compliant quality oil; and
- all parts and mechanisms whose deterioration may lead to noise emissions outside of the designed operating parameters.

Reactive maintenance activities will include replacement of failed or damaged equipment and parts that cannot be repaired. In regards to hazardous waste, The Amdal documents it is estimated that the volumes of hazardous and non-hazardous waste produced during the operation phase is as follows:

- Hazardous wastes (e.g.lubricants for turbine gearbox) 1.5 tons/yr
- Non-hazardous wastes: 0.5 tons/yr

Non-hazardous waste is collected by the local government (Dinas kebersihan dan Pertamanan) and disposed of at dedicated regency waste landfill.

Source: www.dreamtime.com

Figure 4-6 Turbine maintenance illustrated

Due to the nature of the operations, significant waste volumes are not expected during the operational stage of the wind farm. The largest volume of waste generation will occur in the event of plant or equipment failure and any requirements for replacement of plant or equipment as a result of failure. However, all plant and equipment are designed so as to operate in the environs of the location and therefore, such waste products are not expected but are planned for.

During the operation of the wind farm, typical waste products will be:

- waste oil (lubricating and hydraulic oils);
- packaging waste; and
- metal scrap.

All waste products will be managed so as not to cause pollution to the environment and will be disposed of in accordance with local laws. Waste oils will either be removed from site immediately once maintenance is completed or stored on site in appropriate containment within a locked building on site.

Maintenance will be likely undertaken by offsite staff. Maintenance will be undertaken on as needed basis in line with manufacturer's recommendations and requirements identified by the company technical staff.

4.4.4 Decommissioning Phase

The operational life of a wind farm is typically 30 years. At this stage the situation will be reviewed as to whether the wind farm should be decommissioned or the wind turbines replaced.

The decommissioning of a wind farm is not a complicated process and largely comprises the dismantling of the turbines and site clearance. The operational process does not typically involve the use of large volumes of hazardous materials which may result in releases of particularly harmful materials into the ground and therefore, with appropriate management during operation, it should not be necessary to conduct post operational clean up. Basic measures will be included in the design to ensure ease of decommissioning, such as incorporating construction and fabrication techniques that facilitate ease of dismantling and recycling, where appropriate. Key difficulties associated with the decommissioning of a wind farm are the removal of foundations (if considered necessary) and the disposal of turbine blades, if their design does not facilitate ease of recycling.

Prior to decommissioning, the operator or their representatives will produce a decommissioning plan that will be approved by the local authorities before decommissioning commences. The plan will include measures to recycle materials where ever possible. The decommissioning of the Wind Farm will start as soon as the activities of the Wind Farm operations cease and approval has been obtained. The decommissioning stage will take an estimated 1.5 to 2 years and will include the following main activities:

- Dismantling and removal of the constitutive parts of the Wind Farm; and
- Environmental rehabilitation in the affected areas.

Decommissioning works will be undertaken by contractors. In providing for specific decommissioning activities at the Wind Farm site, the site logistics Compound will be re-established using the same initial structure as during construction as will any platforms for storage and manoeuvring of vehicles and cranes during decommissioning.

Decommissioning activities will be conducted under safety conditions and in consideration of environmental protection, under the relevant legislation in force at the time of decommissioning.

The turbine reinforced concrete base will not be completely removed. Instead, the concrete will be demolished and excavated down to a depth to be determined prior to decommissioning. Nominally a depth of 1.0 m is expected to be sufficient to allow for agricultural activities to be undertaken safely once the pit has been filled with top soil. Similarly, any ground associated with the wind farm which has been affected will be reinstated. This includes areas of temporary roads, areas where the land has been compressed by heavy plant activities, and laybys and temporary platforms. All electrical cables laid more than 1 m deep will be abandoned in place and will not cause any long term significant environmental impact.

CHAPTER 5
RESOURCE EFFICIENCY AND POLLUTION PREVENTION

Wind Farm Power is universally considered to be clean and sustainable. In addition, EBJ proposes using proven technology, in line with internationally accepted technologies and practices. The project is designed to comply with GoI and GIIP standards and requirements. The Environmental Design Criteria (Section 3) present numeric environmental standards adopted for this Project. When Indonesian regulations differ from GIIP, the project will adopt the more stringent level and/or measure.

EBJ will consider additional strategies and adopt measures that avoid or reduce negative effects. These strategies include, but are not limited to, evaluation of project location alternatives, use of a pollution abatement technology, and emissions offsets.

5.1 Resource Efficiency

By design, the Wind Farm project as proposed by EBJ excels in resource efficiency in areas considered core business—Wind Farm Power, the main project input, is at least on a human time scale unlimited and renewable. The project activity is about producing electricity using wind energy and exporting it to the electricity grid systems. Wind power is currently one of the most cost effective renewable energy technologies. Since the the project activities generates electricity from wind, which is a zero emission source, there are no associated project emission or can be called the zero emission project.

5.2 Greenhouse Gases

Wind energy does not emit any greenhouse gases, and has an extremely good energy balance. The calculations on just how much CO_2 could be saved by wind energy is based on an assumption for the carbon intensity of the global electricity sector, i.e. the typical amount of CO_2 emitted by producing one kWh of power. Individual countries' emissions differ substantially, but the IEA's (International Energy Agency) estimate of 600g/kWh as an average value for the carbon dioxide reduction to be obtained from wind generation.

5.3 Waste Management

The Project will avoid the generation of hazardous and non-hazardous waste materials. Where waste generation cannot be avoided, the Project will reduce the generation of waste and recover and reuse waste in a manner that is safe for human health and the environment. Where waste cannot be recovered or reused, the Project will treat, destroy, or dispose of it in an environmentally sound manner that includes the appropriate control of emissions and residues resulting from the handling and processing of the waste material. If the generated waste is considered hazardous, the Project will adopt industry best practices alternatives for its environmentally sound disposal (and consider issues related to trans boundary movement to a permitted treatment and disposal facility).

CHAPTER 6
LABOR AND WORKING CONDITIONS

EBJ will be an economic contributor to Indonesia at the local and national levels through payment of taxes, royalties, employment, and income generation, including protecting the fundamental rights of workers and promoting community development. EBJ expects the Wind Farm Project to create a solid foundation for the Company's future operations within Indonesia.

6.1 Human Resources Policies and Procedures

As a new company operating in Indonesia, EBJ will develop robust human resources policies and procedures that are consistent with global standards and national law. The policies and procedures are to be clear and understandable and comprehensively cover worker rights under national labor and employment law and applicable collective agreements, including rights related to hours of work, wages, overtime, compensation, and benefits upon beginning the working relationship and when any material changes occur. EBJ will comply with local regulations related to labor and working conditions and maintain a human rights policy that is consistent with global standards.

6.2 Indonesian Labor Law

It is important to note that Indonesian labor regulations are comprehensive, and as such fully conform to ILO requirements (**Table 6-1**). The Wind Farm Project must develop Human Resources Policies and procedures in accordance with national labor regulations reflected in a formal Company Handbook approved by management and GOI (*Peraturan Perusahaan* in Bahasa Indonesia) and appropriately communicated to employees. The Company Handbook will detail Working Conditions and Terms of Employment (see **Appendix 6)**.

Table 6-1 Summary of Core ILO Conventions Ratified by GOI

(Source: Indonesian Labour Law No 13/2003 on Labour)

Four Core Conventions	Ratified by Indonesian Government
ILO Convention 87 on Freedom of Association and Protection of the Right to Organize	In Force in 09 Jun 1998
ILO Convention 98 on the Right to Organize and Collective Bargaining	In Force in 15 Jul 1957
ILO Convention 29 on Forced Labour	In Force in 12 Jun 1950
ILO Convention 105 on the Abolition of Forced Labour	*UU-19-1999*
ILO Convention 138 on Minimum Age (of Employment)	*UU-20-1999*
ILO Convention 182 on the Worst Forms of Child Labour	*UU-01-2000*

Four Core Conventions	Ratified by Indonesian Government
ILO Convention 100 on Equal Remuneration	*UU-80-1957*
ILO Convention 111 on Discrimination (Employment and Occupation)	*UU-21-1999*

Indonesian law prohibits harmful child labor and forced labor. It also requires equal employment opportunity and includes articles against workplace harassment. This approach affects most aspects of its business, from recruitment, training, and development, to supply chain (purchasing). The Wind Farm Project will aim to ensure gender equality by creating job opportunities for women.

6.3 Working Conditions and Management of Worker Relationship

EBJ provides reasonable working conditions and terms of employment, as detailed on the REI EHS-MS Manual, January 2017. It is include:

- Conditions in the workplace refer to the physical environment, health and safety precautions and acces to facilities (including all basic services such as sanitary facilities, access to drinking water, etc)
- Treatment of workers referes to all aspects related to respect for the worker's personal dignity, disciplinary practices and reasons and process for termination; and
- Term of employment refer to remuneration and benefits, deductions, hours of work, breaks, rest days, overtime arrangements, overtime compensation, medical insurance, pension, and leave for illness, vacation, maternity/paternity, or holiday.

6.4 Protecting the Workforce

6.4.1 Child Labour

The Project will not employ children in any manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. The Project will identify the presence of all persons under the age of 18. Where employment of minors is allowed under Indonesian law, the Project will follow applicable laws. Children under the age of 18 will not be employed in hazardous work. All work of persons under the age of 18 is subject to an appropriate risk assessment and regular monitoring of health, working conditions and hours of work.

6.4.2 Forced Labour

The Project does not employ forced labor, including any kind of involuntary or compulsory labor (e.g. indentured labor, bonded labor, or similar labor-contracting arrangements). The Project does not employ trafficked persons.

6.5 Occupational Health and Safety

EBJ is committed to providing a safe and healthy work environment, taking into account inherent risks, including physical, chemical, biological and radiological hazards and specific threats to women. The Project takes steps to prevent accidents, injury and disease arising from, associated with, or occurring during work by minimizing, as far as reasonably practicable, the causes of hazards. EBJ will maintain a comprehensive occupational health and safety program to assess the risk of exposure to occupational health hazards and implement adequate controls for the workforce. Every workplace job task will include an evaluation of physical hazards, as well as the potential consequences related to occupational illness.

EBJ will develop an overall EHS management system consistent with the World Bank Group Environmental, Health and Safety Guidelines to address:

- Identification of potential hazards to workers, particularly those that may be life-threatening;
- Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances;
- Training of workers;
- Documentation and reporting of occupational accidents, diseases, and incidents; and
- Emergency prevention, preparedness, and response arrangements.

In addition, EBJ will comply with applicable Indonesian laws, most notably Minister of Health Decree No 1405 of 2002 on Health Requirements in the Office and Industry Working Environment and Regulation of Minister of Public Works no. 05/PRT/M/2014 regarding Health and Safety Management System (SMK3) guidelines for Public Constructions.

6.6 Workers Engaged by Third Parties

With respect to contracted workers the Project takes commercially reasonable efforts to ascertain that the third parties who engage these workers are reputable and legitimate enterprises and have an appropriate ESMS that allows them to operate in a manner consistent with the requirements of performance standards. The Project has established policies and procedures for managing and monitoring the performance of such third-party employers in relation to the requirements of performance standards. In addition, the Project incorporates these requirements in contractual agreements with such third-party employers.

The Project's grievance mechanism will be made available to contract workers.

6.7 Supply Chain

Supply chain management during operaton is important in case of a wind farm given that there are few 'Project impacts' other than wind. That said to address risk of child labor or forced labor in the primary supply chain, the Project identifies those risks through a disciplined and documented process. If child labor or forced labor cases are identified, the Project takes appropriate steps to remedy them. The Project monitors its primary supply chain on an ongoing basis in order to identify any significant changes in its supply chain and if new risks or

incidents of child and/or forced labor are identified, appropriate steps are taken to remedy them.

Even given that EBJ has not operated in South Sulawesi previously, the Project is confident that its Supply Chain procedures will identify suppliers that do not use child and forced labor (e,g, at the concrete aggregate quarries during construction). Additionally, EBJ will develop contractor management procedures and mitigation measures to ensure that suppliers take steps to address high risk significant safety issues.

CHAPTER 7
ENVIRONMENTAL AND SOCIAL BASELINE

This chapter describes existing conditions in the area closely surrounding the Project site. Sections 7.2 through 7.5 describe physical, chemical, and biological environmental conditions, and section 7.6 describes socioeconomic conditions.

7.1 Data Source

7.1.1 Primary Data

The following data sources were used to establish the environmental setting for the Tolo Wind Farm Project and to provide inputs for modeling:

- KA ANDAL (Term of Reference of Environmental Impact Assessment) of Tolo Wind Farm Project (2016);
- ANDAL (Environmental Impact Assessment) of Tolo Wind Farm Project 2016;
- RKL-RPL (Environmental Management and Environmental Monitoring Plan) of Tolo Wind Farm Project 2016;
- Noise monitoring in Project Area, Sucofindo, November 2016;
- Bats and birds monitoring in Project Area, ESC, November 2016;
- Landscape survey in Project Area, ESC, November 2016;
- UKL-UPL (Environmental Management Efforts-Environmental Monitoring Efforts) of Tolo Wind Farm Transmission Line Project, 2017.

7.1.2 Secondary Data

- Jeneponto Regency in Figures 2015;
- District Binamu in Figures 2015;
- District Turatea in Figures 2015;
- District Batang in Figures 2015;
- District Arungkeke in Figures 2015.
- Meteorological data were obtained from climate-data.org, TRIMM, BIOCLIM, PODAAC, and windprospecting.com
- GRDC Geology Maps
- ITB Hydrology Maps
- Public Domain GIS Data: SRTM, Landsat, GoogleEarth, Koppen Climate Classification Data.

7.2 Atmosphere

7.2.1 Climate

The climate of Indonesia is almost entirely tropical. The uniformly warm waters that make up 81% of Indonesia's area ensure that temperatures on land remain mostly constant, with coastal plains averaging 28 C, inland and mountain areas averaging 26 C, and higher mountain regions, 23 C. Temperature and air pressure vary little from season to season, and therefore rainfall is the main variable of Indonesia's climate. The region's relative humidity ranges between 70-90%. Winds are moderate and generally predictable, with dry winds originating from Australia usually blowing in from the south and east in June through September (dry season); conversely in December through March, northerly winds originating from Asia and the Pacific Ocean contain abundant water vapor causing the monsoon (wet season).

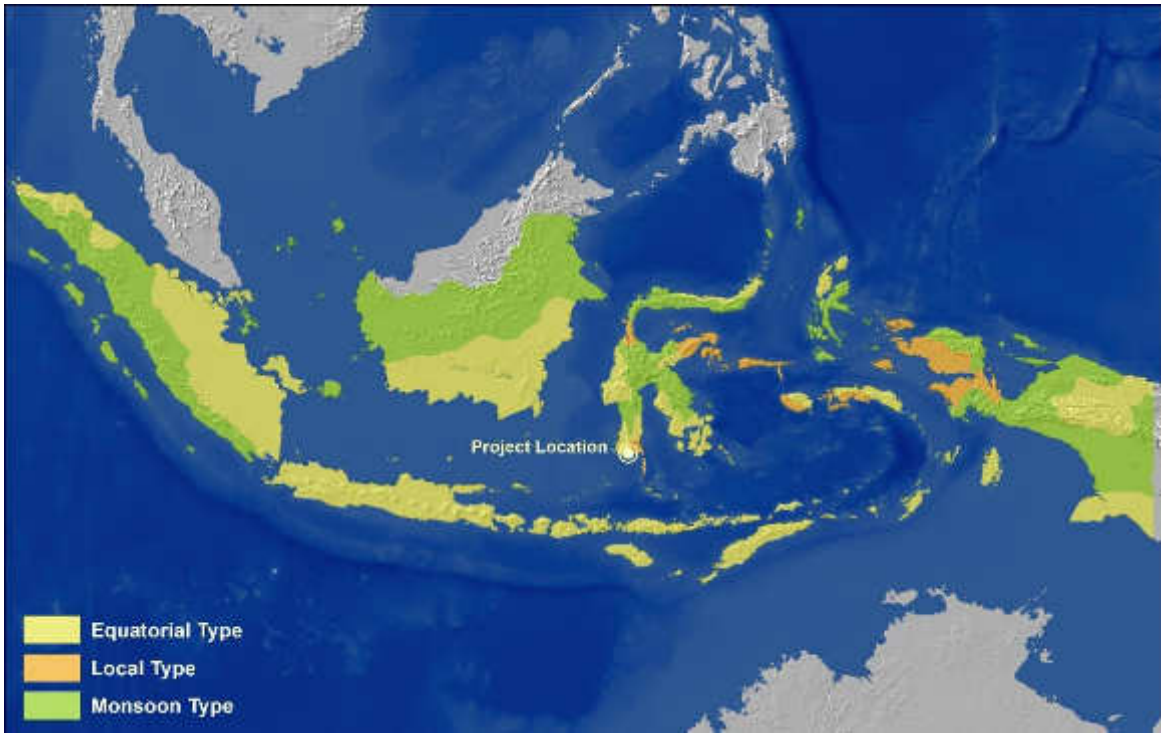


Figure 7-1 Climate Zones with Project Location

The Tolo I Wind Project is located in Binamu, Turatea, Batang, and Arungkeke Districts in Jeneponto Kabupaten (Regency), South Sulawesi, some 86 km by road from Makassar.

As with many areas of Indonesia, Jeneponto Kabupaten only experiences two seasons, dry and wet, closely governed by wind patterns in Indonesia. Two transitional periods occur each year in April and November.

“Hard” climate data records (precipitation, temperature, humidity, solar radiation) for this region are limited. The nearest hard data location to the Project site is the Meterological Station at Hasanuddin Airport (Makassar), approximately 67 km away. This was considered for a proxy for the Project site, but due to the different climates at each location and the significant rainfall difference between these locations, the hard data from Makassar are not applicable for Jeneponto.

Various modelled climate data sets showing strong correlations were therefore used for rainfall, temperature, humidity, and solar radiation in this report.

Summary meterological information may be found in **Table 7-1** below.

Table 7-1 Meterological Summary Table

Seasons		Temperature
Dry season: July to October Wet season: December to March Transition period: April and November		Annual average: 26.3°C Range of monthly average temperatures: 20.2°C to 32.0°C
Rainfall	Relative Humidity	Wind Pattern
Annual average: 101 mm/month Highest monthly average: 272 mm Lowest monthly average: 6 mm Wettest Month: January Driest Month: September	Annual average: 73% Highest monthly average: 79% (February) Lowest monthly average: 59% (September)	Semi-annual reversal wind Wind direction: Predominantly from the Southeast (Dry Season) and Northwest (Wet Season) Average wind speed: 3 m/s

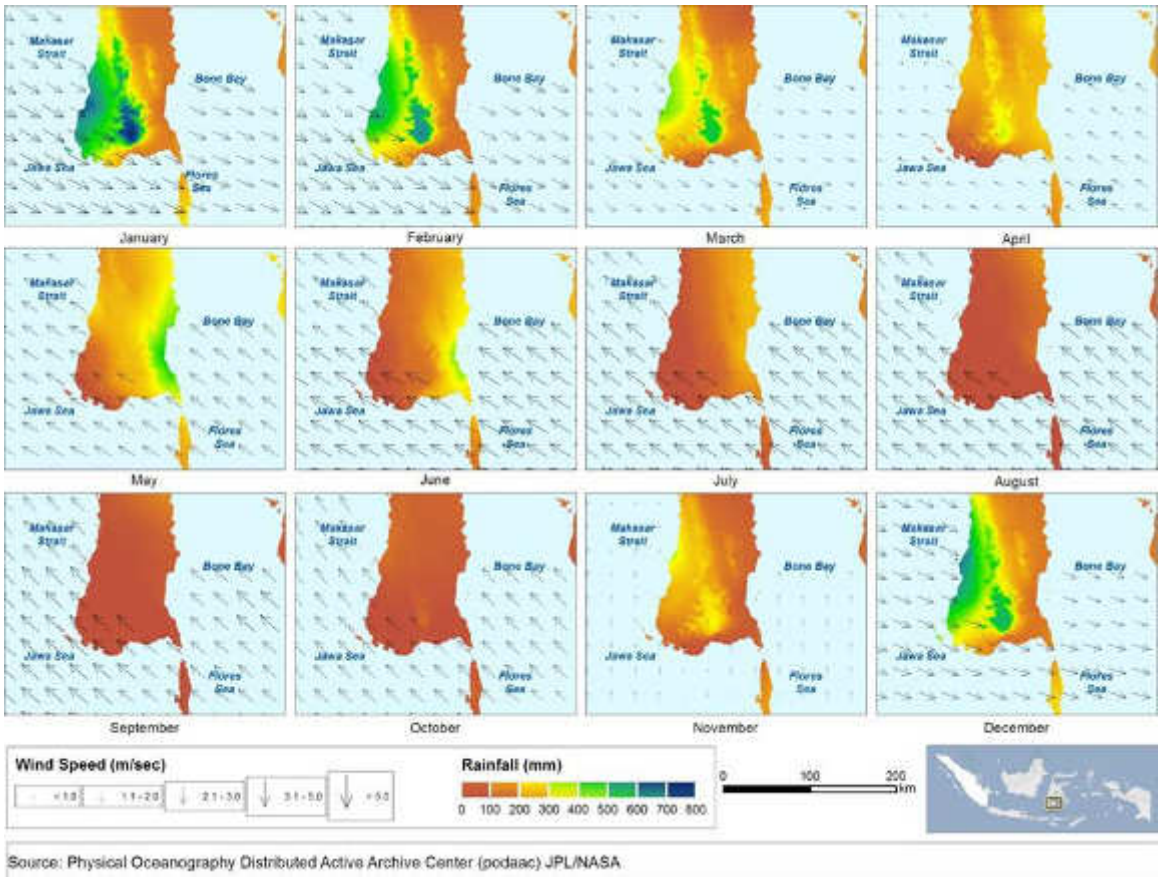


Figure 7-2 Rainfall and Wind Patterns by Month

Based on the climate type in the southern part of South Sulawesi in general, including the Project location, is classified as Equatorial Savannah. Equatorial Savannah is described by many experts using several terms such as follows: 1) Aw Climate (Equatorial Savannah Climate, Dry Winter), by Koppen; 2) E4 Climate (rather dry area), by Schmidt-Ferguson 1950; and 3) E Climate region (<3 consecutive wet months) by Oldeman 1979.

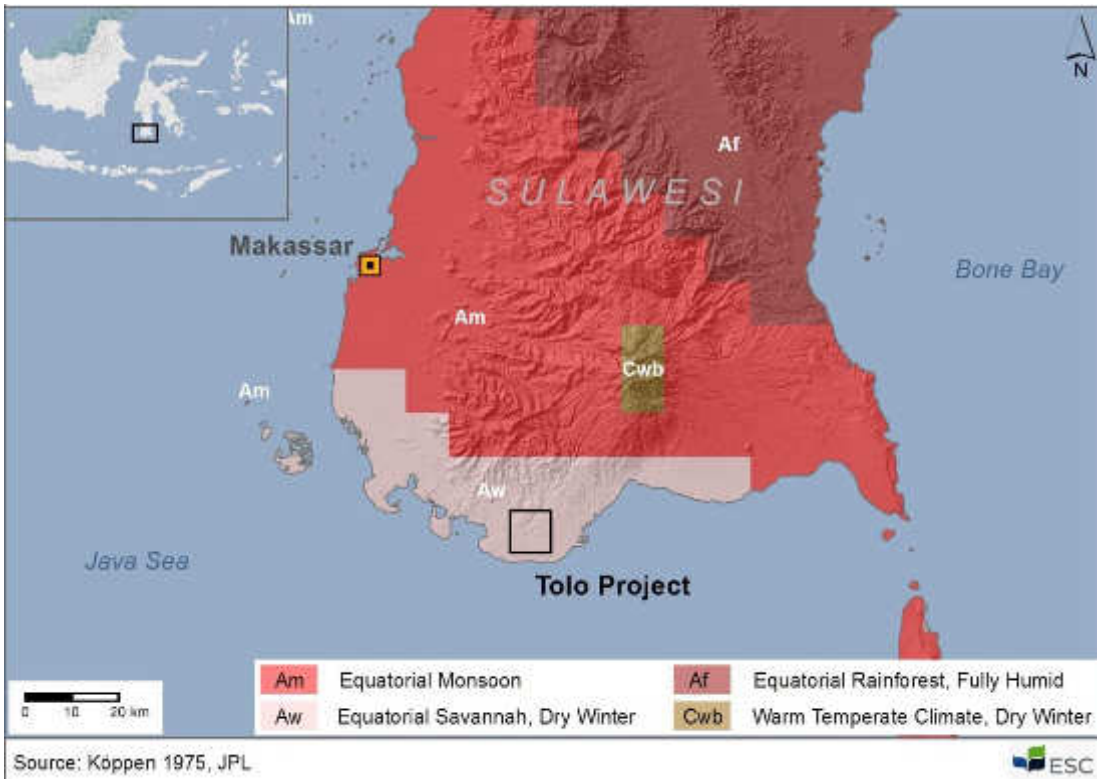


Figure 7-3 Koppen Climate Classification 1975 – South Sulawesi Region

7.2.1.1 Rainfall

Rainfall is the amount of water falling on a flat ground surface during a certain period and measured in depth (mm) on a horizontal surface in the absence of evaporation, runoff, and infiltration. A rainy day is defined as a day and night period with at least 0.5 mm total rainfall.

Rainfall in a specific location is influenced by climate, topography, and rotation/combination of air currents. Climate (distribution pattern and the amount of annual rainfall) in Jeneponto is relatively dry in almost all Districts, although District Rumbia and District Bangkala Kelara in the northern, more elevated area, are wetter. Climatic conditions like this indicate that the productivity of various agricultural commodities in Jeneponto will likely encounter periods of extreme water shortage.

Based on modelled data (**Figure 7-3**), the study area has two seasons similar to other areas in Indonesia in general, i.e., the rainy season and dry season. Rainfall data at the study location showed that the rainy season (rainfall > 50 mm per month) occurs in December to February and the dry season (rainfall < 50 mm) occurs from July to October. The nature of extended dry seasons indicates that the Project location is also within a relatively dry area. The amount of average monthly rainfall ranges between 6 to 272 mm, with the highest rainfall occurring in January and the lowest in September. Based on the average yearly rainfall, the Project location is classified as Equatorial Savannah rather than Equatorial Monsoon. From **Figure 7-4** it can be observed that the Jeneponto region lies within a rain shadow.

2016 data show that overall precipitation was significantly higher in the wet season (often twice the amount) than the average, with the dry season showing little variability. 2016 was the last year of an El-Nino weather event.

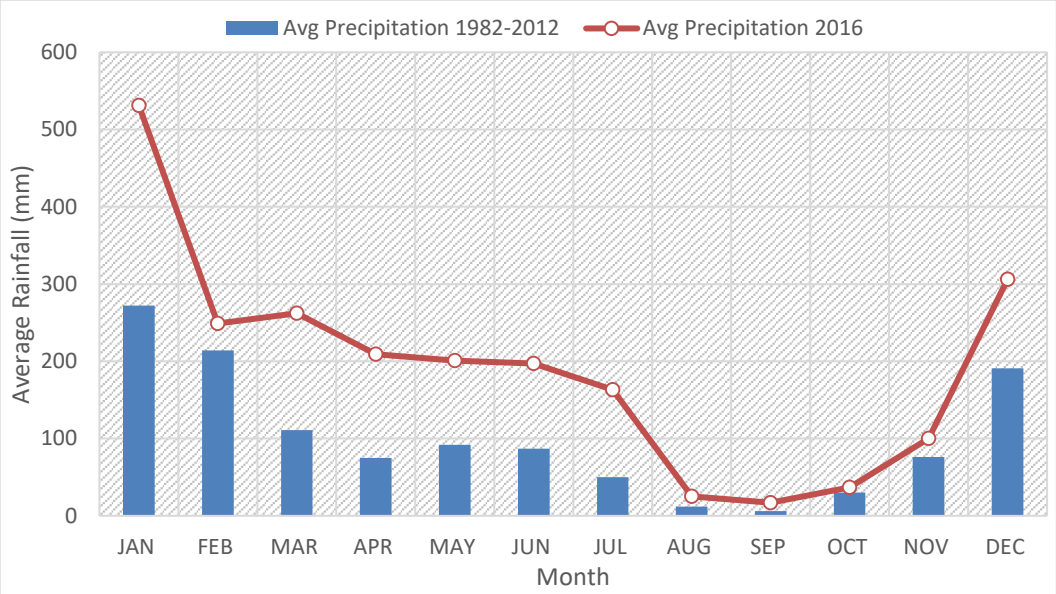


Figure 7-4 Monthly Average Rainfall (mm) Graph: 30-year Period and 2016

7.2.1.2 Temperature

The air temperature at a specific location is determined by elevation relative to mean sea level and proximity to the coast. The Jeneponto region is a lowland area surrounded by hills and mountains approximately 25 km from the sea. The average monthly temperature during the modelled 30-year period (1982-2012) in the Project area ranged from 25.6 to 26.9°C. The highest average temperature was recorded in October (32°C), while the lowest was recorded in August (20.2°C).

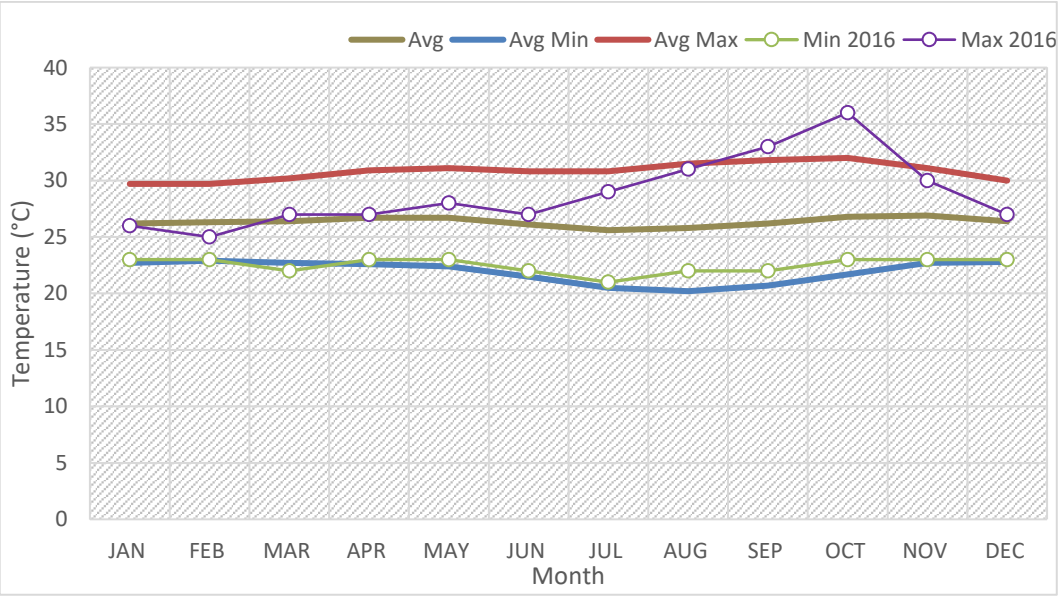


Figure 7-5 Monthly Average Air Temperature (°C) Graph: 30-year Period and 2016

From **Figure 7-5**, it may be seen that the temperatures reach locally maximum highs immediately after transitional periods and are lowest prior to transitional periods.

For 2016, the average lows correlate closely with the 30-year average lows, whereas the 2016 average highs are in most part significantly lower than the 30-year average, matching the

increased precipitation experienced during 2016 in the region. The exception being the hotter transition period (Sept-Oct) which exceeded the average 30-year highs.

7.2.1.3 Humidity

As is typical for the tropics, the air humidity is relatively high in the Jeneponto region where monthly humidity ranges between 55% to 99% during the period of 2004-2014, where the average monthly highest was in January (84.0%) and the lowest in September (71.2%), as presented in **Figure 7-6**. From **Figure 7-6**, it is observed that humidity levels peak in the wet season and trough in the dry season, and essentially are inversely proportional to Solar Radiation throughout the year.

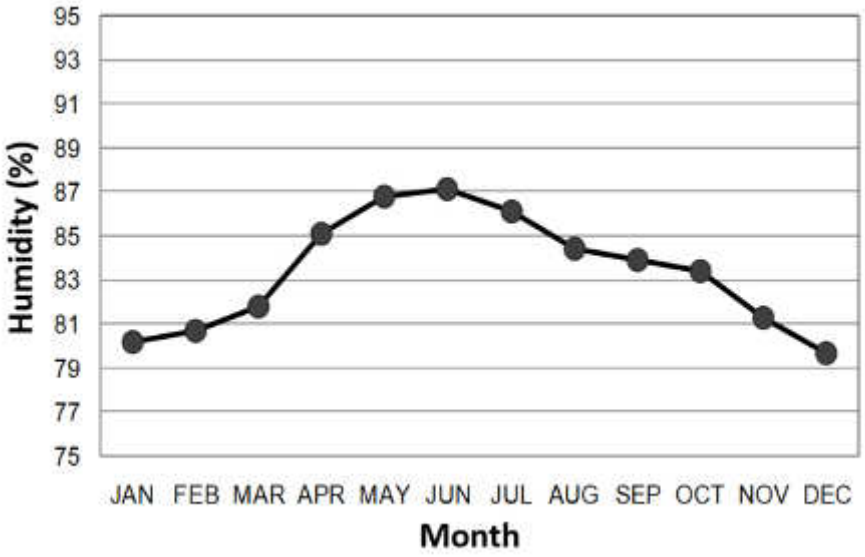


Figure 7-6 Air Humidity (%) Average Graph during the Period of 2004-2014

7.2.1.4 Wind Speed and Direction

Hourly surface wind data for the last 10 years (2004-2014) were used in this study. For analysis purposes, data was averaged by month and presented as windroses in **Figure 7-7**. In December-January-February-March equatorial regions dip below the elliptic plane, developing a low-pressure center south of the equator, facilitating dominant winds to blow from the northern hemisphere to the south. In the Project area the dominant direction of surface winds blow from the northwest and reach maximum speeds of >10m/s.

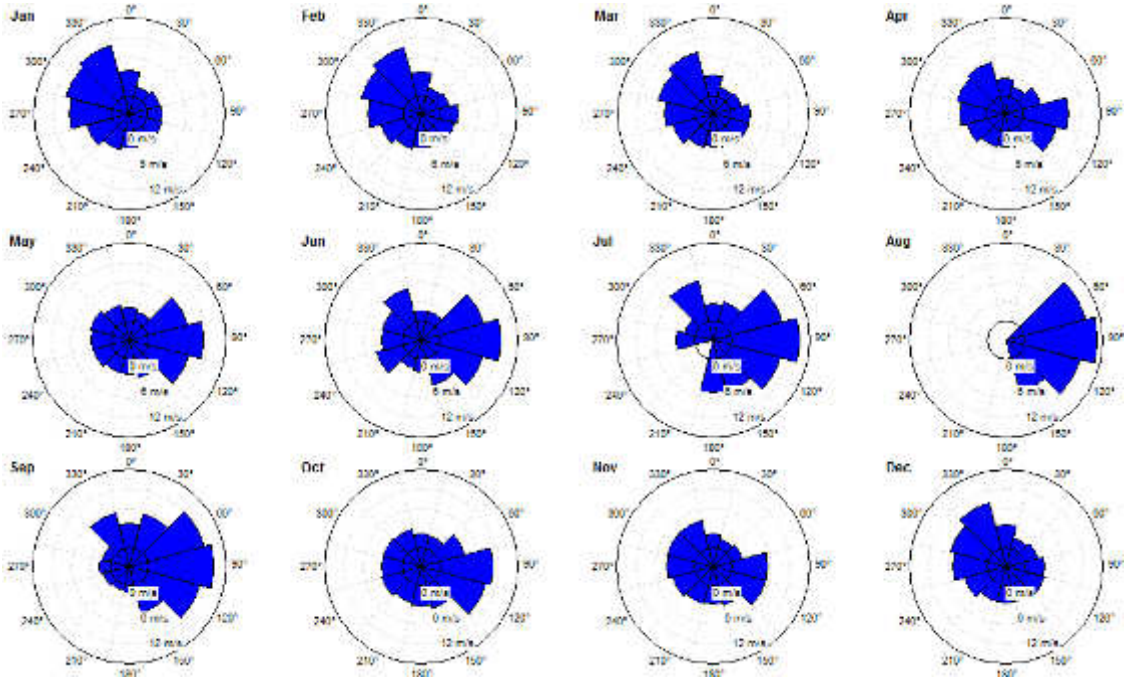


Figure 7-7 Jeneponto Region Windroses 2004 – 2014 (Month Averages)

Mid to late March, the sun angle is directly above the equator and by April, winds continue to blow from the northwest, but also from the east. The east winds become more dominant through April, as the low pressure center shifts into in the northern hemisphere causing winds to blow from the south, which veer eastward close to the equator. This eastern wind dominantly blows until October with a speed of >6 m/sec. This condition indicates that the Project location falls in dry season from May to October with the dominant wind blowing from the east. The percentage of wind blowing from the E/SE throughout the year is greater than from the W/NW. This indicates that the Project location is predominantly influenced by the SE monsoon from Australia. The windrose annual average profile over 10 years (2004-2014) shows the Project area has dominant winds blowing from the east with average speed >8 m/s with most of the winds >3m/ sec.

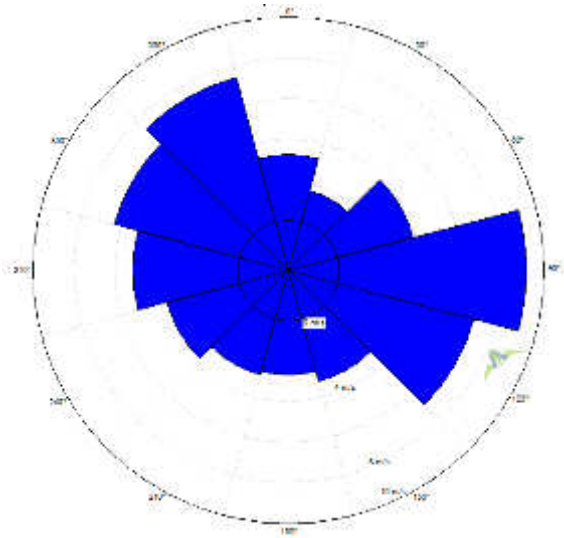


Figure 7-8 Jeneponto Region Windrose 2004 – 2014 (Annual Average)

7.2.1.5 Solar Radiation

Monthly solar radiation is based on data from the Meteorological Station, during the period 2005 – 2015 in the region Jeneponto ranges from 0 hours – 11.1 hours. The monthly solar irradiation average for the period was highest in September (7.39 hours) and the lowest occurred in January (3.74 hours), as presented in the **Figure 7-9**. The picture also shows the pattern of average solar irradiation in the transitional season I continued to climb and reached a maximum in the east season, then declined into the transitional seasons II and reaches a minimum in the west season.

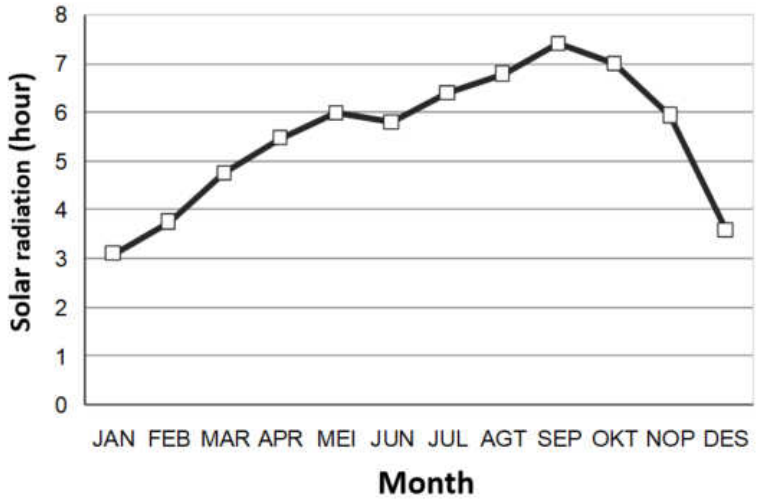


Figure 7-9 Solar Irradiation (hour) Average Graph During Period of 2005-2015

7.2.2 Air Quality

Clean air is considered by the World Health Organization (WHO) to be a basic requirement of human health and well-being. According to this institution, air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. Motor vehicles, industrial facilities, and combustion are common sources of air pollution because the release pollutants of major public health consequence such as carbon monoxide, ozone, nitrogen dioxide, and sulfur dioxide that can cause respiratory and cardiovascular problems (WHO, 2006).

Where air quality is degraded, it is likely to be of higher sensitivity to additional impacts than where air quality is good. This is because air quality thresholds and standards may be exceeded and impacts may arise on human health or vegetation.

The air quality in the Project area is acceptable because there are no major industrial facilities emitting large quantities of Green House Gases. However, home cooking fires and regular traffic on the roads are sources of air pollution. These sources of emissions are present, but not likely to exceed international standards.

The air quality within the Tolo I Wind Farm Project area is expected to be affected during the construction and ongoing operation of the wind farm / power station. Changes in air quality will arise from exhaust emissions and dust resuspension during mobilization of equipment and construction activities, amongst other sources. The impact on air quality can be measured

through changes in concentration of standard air quality testing parameters like, SO_2, NO_2, CO, NH_3, Pb, and TSP in accordance with GOI and local government requirements.

Ambient air quality data were obtained through direct sampling in three sampling locations (**Figure 7-10**) and (**Table 7-2**) across the Project area.

Table 7-2 Air Quality Sampling Locations

Sample ID	Location	Longitude	Latitude
U-1	Tower Area, Ujung Boni Village, District of Turatea	E: 119° 46' 02.86"	S: 5° 37' 26.44"
U-2	Access Road / Settlements, Mangongi Village, District of Kelara	E: 119° 45' 16.16"	S: 5° 40' 09.36"
U-3	Settlement, North Empong Village, District of Binamu	E: 119° 45' 38.746"	S: 5° 40' 09.25"

Source: UNHAS Amdal, 2016

The data in **Table 7-3** below show that the results of the tested parameters of ambient air quality are quite variable but still well within the Threshold Values, except TSP at the U-3 sample location which slightly exceeds the quality standard. Differences in concentrations of parameter results in each measurement location are highly dependent on environmental conditions and activities in the surrounding community.

Table 7-3 Ambient Air Quality Results

Parameter	Unit	Result			Standards	
		U-1	U-2	U-3	Local*	IFC
Sulfur Dioxide (SO_2)	µg/Nm^3	15.63	8.67	16.90	900	500
Nitrogen Dioxide (NO_2)	µg/Nm^3	17.00	12.97	18.14	400	200
Carbon Monoxide (CO)	µg/Nm^3	1,947	1,603	1,603	30,000	-
Ammonia (NH_3)	ppm	0.010	0.011	0.013	2	-
Lead (Pb)	µg/Nm^3	0.010	0.026	0.021	2	-
Particulates (TSP)	µg/Nm^3	182	130	240	230	-

Source: UNHAS Results of the tests in cooperation with the Center for Development of Occupational Safety and Health Makassar, April 2016 (Accredited KAN Number: LP-825-IDN is valid until June 17, 2018)

* Standards for air quality by South Sulawesi Governor Regulation No. 69 of 2010 and Indonesian Government Regulation No. 41 of 1999 on Air Pollution Control.

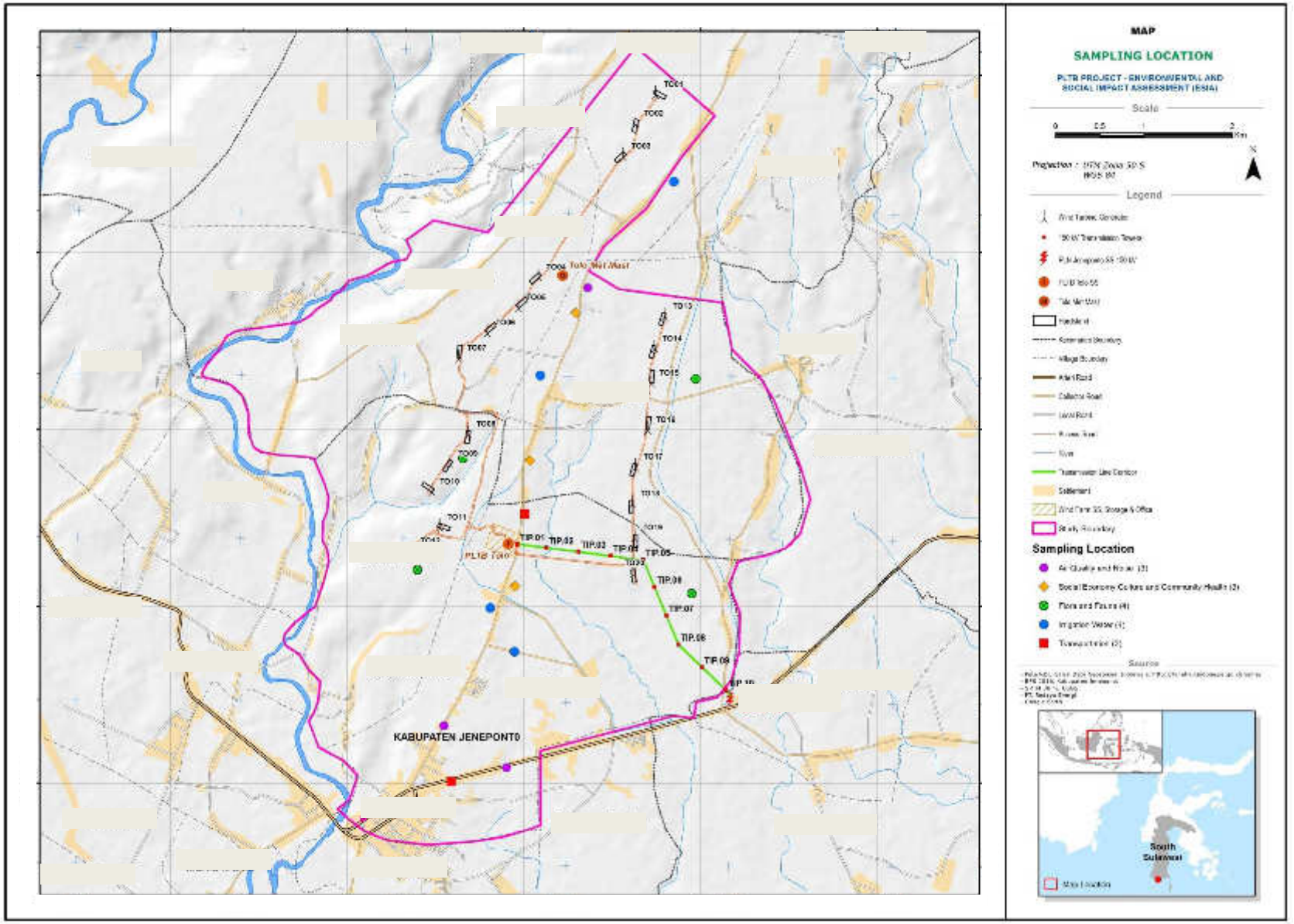


Figure 7-10 Sampling Locations (UNHAS and ESC Field Campaigns)

Details on air quality test parameters are described in **Table 7-4** below:

Table 7-4 Main Air Pollutants and Potential Impacts

Sulfur Dioxide – SO_2
Sulfur Dioxide is one component of air pollutants originating from the burning of sulfur containing materials such as in motor vehicle engines, electric generators, or burning of organic waste. At certain concentrations, this gas can cause disruption to the environment, irritation to the human respiratory tract, disturbance to vegetation and can increase the acidity of rainwater. SO_2 gas content in the ambient air in the study area ranged from 8 to 17 µg/Nm^3. The concentration of SO_2 is still well within the quality standard set at 900 µg/Nm^3 and so will not have an impact on humans or other living environments. The main source of emissions is probably caused by motor vehicles operating in the study area and its surroundings.
Carbon Monoxide – CO
CO gas is sourced from the incomplete combustion of organic materials, such as gasoline or diesel fuel combustion in motor vehicles, coal, or wood. At certain concentrations, this gas can cause toxic effects on the human body with symptoms such as headaches, dizziness, and shortness of breath. The highest concentration of this gas in the ambient air in the region was 1,947 µg/Nm^3 and the lowest was 1,603 µg/ Nm^3. Although quite high, the concentrations are still far below the quality standard threshold so will not have a significant impact on humans and other environmental components. The main source of CO gas is likely from transportation activities, exhaust emissions from vehicles operating proximally to the sampling sites.
Nitrogen Dioxide – NO_2
Nitrogen Dioxide gas can be sourced from nature, the burning of organic matter, or motor vehicle exhaust. At certain concentrations, this gas can cause irritation and lung bleeding in humans, disturbance to vegetation as well as physical damage to buildings. In addition, NO_2 contributes to lowering the acidity of rainwater. The test results of air quality in the study area indicate that concentrations of this gas are still far below the quality standard threshold and maximum values only attain 18 µg/Nm^3. There are no reported impacts with these low NO_2 concentrations. The main sources of NO_2 gas are predicted to be from transportation activities and photochemical reactions in air.
Ammonia – NH_3
The test data of ambient air quality in the study area indicate that concentrations of NH_3 gas are still relatively low compared to the quality standard threshold, with a maximum recorded value of just 0.013 ppm. The ammonia may be derived from the decomposition of solid waste, domestic wastes, or natural processes.
Lead – Pb
Lead is one of the heavy metals that are harmful to human health. The main source of Pb in ambient air is engine exhaust from motor vehicles that use gasoline containing fuel additives such as tetraethyl lead. The existence of lead in the air at certain concentrations can cause health problems such as lack of appetite, headache, anemia, paralysis of limbs, convulsions, or impaired vision. The highest Pb levels detected in ambient air in the study area were only 0.03 µg/Nm^3. The content of Pb is still below the quality standard threshold, but presence indicates that vehicles operating in the study area use fuel containing additive compounds. Continuous Pb exposure and the cumulative nature of these heavy metals are harmful and a potential threat to community health.
TSP covers airborne particles produced by mechanical or natural events in the form of dust and dispersed by wind. The particle size ranges from 0.1 µm to 25 µm. Dust can cause respiratory system disorders, irritation of the eyes, and visual disturbances. The content of dust in the ambient air in the study area is quite high, with one of the measurement locations just exceeding the quality standards established, namely the Project access road (U-3), while at other locations it ranges between 130 and 182 µg/Nm^3. Resuspension of dust due to road transportation activities and natural events such as the dispersion of fine particles of leaf crops (rice) due to wind are alleged to be the main sources of ambient air TSP in the study area.
Air Pollution Index – ISPU
ISPU is a number that does not have a unit, but describes the condition of the ambient air quality in a specific location and time based on impacts to human health, aesthetic value, and other living organisms. ISPU parameters include: CO and SO_2 and TSP with several categories:

Sulfur Dioxide – SO_2
1-50 = Good (Green)
51-100 = Medium (Blue)
101-199 = Unhealthy (Yellow)
200-299 = Very Unhealthy (Red)
300 More = Dangerous (Black)

ISPU that can be displayed based on the measurement data for ambient air quality in the study area only using SO_2, CO, and TSP as parameters and measured in the span of hours of 13:00 to 16:00 may be found in (Table 7-5) below.

Table 7-5 ISPU (Indeks Standar Pencemaran Udara – Standard Index for Air Pollution) using Three Parameters of Ambient Air Quality in Study Area (April 2016)

Test Parameter	ISPU	Ambient Air Quality
Sulfur Dioxide (SO_2)	5.4 – 10.6	Good
Carbon Monoxide (CO)	16.0 – 19.5	Good
Particlates (TSP)	72.3 – 123.3	Medium – Unhealthy

Source: UNHAS, 2016

The laboratory result of air quality assessment is provided in **Appendix 12**.

7.2.3 Noise

Any construction Project creates noise during construction and decommissioning phases. Wind-farm projects also create noise during operation that can have an impact on the surrounding communities.

Indonesian legislation defines permissible limits for noise levels in different areas. Noise sampling was conducted in accordance with Ministry of Environment Decree No 48 of 1996. The threshold values applicable in this regulation are industrial (70 dBA) and settlement (55 dBA) areas.

Noise data were directly sampled at three sites across the Project area of influence (using the same locations as air sampling). Results of the noise level analysis are presented in the following **Table 7-6**.

Table 7-6 Noise Level Analysis Results (Direct Reading)

Sample ID	Location	Date/Time	Noise Level (dBA)	Threshold Value (dBA)*
U-1	Tower Area, Ujung Boni Village, District Turatea	06/04/2016 13:00 WITA	45	55
U-2	Access Road/Settlements, Mangongi Village, District Kelara	06/04/2016 14:29 WITA	48	55
U-3	Settlement, North Empong Village, District Binamu	06/04/2016 16:00 WITA	47	55

Source: Results of UNHAS Field Measurements BBK 3, April 2016.

As shown the noise levels in the Project area were below the threshold standards of the Ministry of Environment Decree No 48 of 1996 for settlement areas.

These samples were collected by the AMDAL consultant over a 1-hour period. Following IFC General EHS Guidelines as part of ESHIA/AMDAL Gap Analysis, ESC conducted additional noise sampling at three representative potential receptor locations. These were each conducted for a 72-hour period at 10 minute intervals, covering weekday and weekend periods. One location was sampled at a 10-metre height from the ground. Sample locations may be reviewed in **Figure 7-10** and summarized below **Table 7-7**.

Table 7-7 Noise Level Sampling Locations

Sample ID	Location	Longitude	Latitude
NS1	Tolo Meterological Mast, 10m above ground level, near Ujung Boni Village	E: 119° 45' 57.09"	S: 5° 37' 23.28"
NS2	Located within turbine corridor, 400m from Turbine TO-06 proposed location, next to Berua Village	E: 119° 45' 30.11"	S: 5° 37' 57.91"
NS3	Located within turbine corridor, 700m from Turbine TO-22 proposed location, next to Bontocini Village	E: 119° 46' 57.54"	S: 5° 39' 32.94"

Source: ESC, 2016

Summary results are tabulated below in **Table 7-7**.

Noise sample NS1 is overall the most compliant location, with only a single reading exactly reaching the threshold value of 55.0 dBA between 02:30-02:40 AM. This location was the most distal from any village related noise and 10 metres above ground level. Day and nighttime average differences at NS1 were negligible, but are similar average values as recorded at NS2 and NS3. This may be due to the more elevated and exposed nature of this sampling location regarding wind noise. The quietest reading in the entire survey came from this location.

Table 7-8 Noise Level Analysis Results

Sample ID	Date/Time	L eq (dBA)	L max (dBA)	L min (dBA)	Day Avg (dBA)	Night Avg (dBA)	Threshold Value (dBA)
NS1	Start: 13/11/2016 12:00 PM End: 15/11/2016 12:00 AM	50.9	55.0	28.3	42.4	44.1	Local Regulation*: 55 dBA (day and night at residential area)
NS2	Start: 10/11/2016 11:00 PM End: 13/11/2016 11:00 AM	50.7	60.8	28.7	40.3	39.8	
NS3	Start: 10/11/2016 12:00 PM End: 13/11/2016 12:00 AM	52	2	34.9	45.5	41.74	IFC Standard: Residential area Day: 55 dBA Night: 45 dBA

Source: Results of ESC (Sucofindo) Field Measurements (72-hour Period; 10 min Intervals) Time: WITA

*) Ministry of Environment Decree No 48 of 1996 regarding Noise Threshold Value

Noise sample NS2 had the quietest Leq value and the quietest daytime/nighttime averages. However, the loudest reading in the entire survey came from this sampling location, and a total of nine (9) readings exceeded threshold values. These excessive readings tend to be clustered and occurred on each night between the hours 19:00 - 21:00 and are certainly related to a local village activity. Day and nighttime average differences at NS2 were negligible.

Noise sample NS3 has the loudest Leq value, the loudest daytime average and by far the loudest Lmin values. Daytimes were clearly louder the nighttimes, and this is likely due to some minor local construction activities taking place in the locality during daylight working hours. A total of eight (8) readings exceeded threshold values, and like in NS2 tend to also be clustered although the times seem random; ~17:00, ~10.00 and ~6:00 on three consecutive days.

In conclusion, the ambient noise levels in the area, especially proximal to villages are already quite high and close to threshold values.

Wind speed measurements recorded at the 120 m level of the Tolo I met mast during periods of background noise measurement indicate that noise measurements at sensitive receptors were undertaken during periods of relatively low wind.

Background noise during periods of higher wind (when the wind turbines would be operating, or generating more power) are likely to be higher than the measured background noise levels.

Note that measured background noise levels already exceed the IFC guideline thresholds at occasions.

7.2.4 Shadow Flicker

One of the major impacts of wind-farm projects is shadow flicker effect.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 known as shadow flicker. In an equatorial latitude such as that in South Sulawesi, this impact is minimized. Shadow flicker issues are likely to be more important in higher latitude location, where the sun is lower in the sky and therefore casts longer shadows that will extend the radius. Potentially significant shadow flicker impact will be experienced.

Shadow flicker impact modelling has been developed by Equis Energy, particularly to identify the distance to which potential shadow flicker may extend, predict the duration and timing of shadow flicker occurrence under real and worst case weather conditions at specific receptors located within the zone of potential shadow flicker impact.

DNV GL's Shadow Flicker Module available in the WindFarmer software were used in this model. Equis Energy has made use of astronomical worst-case scenario to model and predict shadow flicker from each turbine on identified receptors from hig resolution up-to-date satellite imagery. The aforementioned astronomical worst-case scenario is defined as follows:

- There is continual sunshine and permanently cloudless skies from sunrise to sunset;
- There is sufficient wind for continually rotating turbine blades;
- Rotor is perpendicular to the incident direction of the sunlight;
- Sun angles less than 3 degress above the horizon level are disregarded (due to likelihood for vegetation and building screening);
- Distances between the rotor plane and the tower axis are negligible;
- Light refraction in the atmosphere is not considered;
- The turbines are rotating 100% of the time in a year.

The result of shadow flicker modelling is presented in Appendix 10, with conclusion as follows:

- Worst case shadow flicker at closest receptor to layout is 140 hours/year. 11 out of 57 groups of receptor have shadow flicker greater than the World Bank Guideline with 10 out of the 11 have shadow flicker levels of 40 – 90 hours/year. Layout is largely compliant with World Bank Guidelines of no more than 30 hours/ year of shadow flicker at receptors.
- When using realistic atmospheric and turbine condition, 10 out of 57 groups of receptors will have shadow flicker levels of 30 – 54 hours/ year. Cloud cover of 28% results in a 28% reduction of shadow flicker impact. Wind turbine rotating for 84% of the year, results in a 16% reduction of shadow flicker impact. Worst shadow flicker at closest receptor to layout is 84 hours/year according to the model with realistic condition.

7.3 Lithosphere

7.3.1 Topography and Geomorphology

The regional morphology of the South Sulawesi region is governed by a volcanic eruption center, namely the Lompobatang caldera of Pleistocene age (Sukamto and Supriatna, 1982). The mountainous area occupies the central area down to the south at an altitude ranging from 1397 m to 500 m above sea level, then hilly and undulating with a height of less than 500 m, and finally to the southern low-lying areas, with a rather flat morphology and at an elevation of less than 15 m above sea level. The Project area is situated in this low lying, low elevation terrain.

Figure 7-11 Typical Terrain within Project Area (November 2016), with Clear View of Sea to South

7.3.2 Geology

7.3.2.1 Regional Geology

The regional geology of South Sulawesi (**Figure 7-12**) both surface and subsurface is based on secondary data and primary outcrop observations in the field including drilling results. Based on the Geological Map Sheet, 2010, 2110 and 2109; Ujung Pandang, Benteng and Sinjai scale of 1: 250,000 (Rab Sulamto and Supriatna, 1982) the location of the project site and surrounding areas are dominated by volcanic rocks, sedimentary rocks, and alluvium of Quaternary age. Based on the regional stratigraphy there are three lithologies in this area. The sequence from the most recent to the eldest is as follows.

Quaternary Alluvium Deposits – Qac

This sediment blankets on top of older rocks, with a widespread distribution in the floodplains of rivers and along coastal locations within the project site. These alluvium deposits have been recently formed in the Quaternary era as alluvial rivers, swamps, and beaches and are the youngest lithologies in the region. Generally, these deposits consist of gravels, coarse sands, silts and clay, and may contain organic matter and broken marine fossils. This sediment was found at a height of approximately 2 meters above sea level.

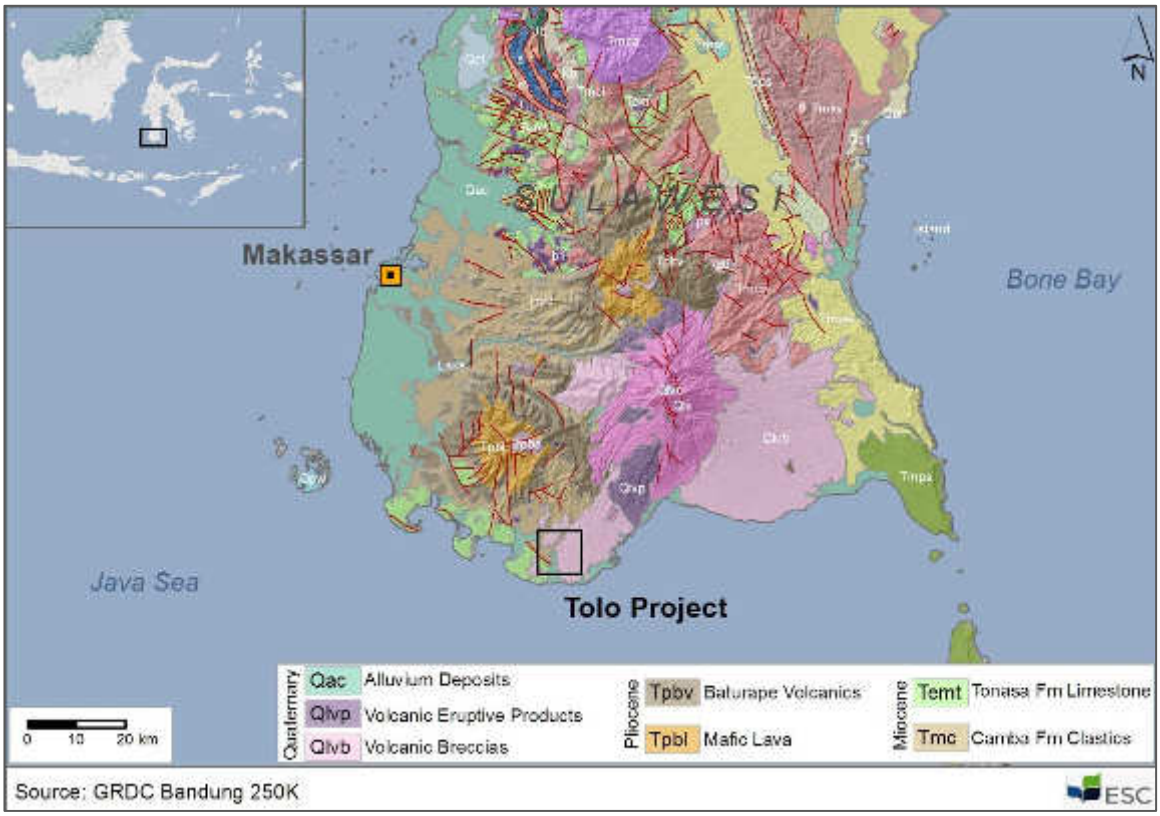


Figure 7-12 Geology at 250K Scale, Southern Sulawesi Region

Quaternary (Pleistocene) Volcanic Rocks of Lompobatang – Qlv, Qlvp1, Qlvp2, Qlvb

Volcanic rocks of Lompobatang are composed of agglomerate, lava, breccia, and tuff, forming a stratovolcano cone with the highest peak at 2,950 m above sea level. The volcanic rock is primarily of andesitic and basaltic composition. Lava flows located approximately 2.5 km north of Bantaeng are comprised of pillow lavas, local breccia, and tuff.

Morphology of the volcanic caldera is still clearly visible on aerial photographs; Qlvc depicts the eruption center and the lava dome, whereas a conical shape secondary vent shows there are at least two periods of activity, namely Qlvp1 and Qlvp2. The area around the eruption center is mainly composed of lava flows and agglomerates (Qlv), but moving distally is more likely to be composed of breccia, and lahar tuff deposits (Qlvb). Based on the estimated position regarding regional stratigraphy, these volcanic rocks are of Pleistocene age. The Lompobatang volcanic sequences unconformably overly Tertiary units, comprising the Baturape-Cindako (Tpbv) volcanic rocks and Camba Formation clastics (Tmc).

Miocene Tonasa Formation Limestone – Temt

The Tonasa Limestone formation is the oldest rock unit underlying the area of study and outcrops in the west of Jeneponto City, around Punagaya and Karampuwampaga. The Tonasa Formation is composed of solid and layered limestone alternating with marl and calcareous sandstones. These massive limestones are generally cohesive and almost impermeable. Based on the estimated stratigraphic position, these limestones range in age from the Eocene to Middle Miocene and unconformably overlie the Camba Formation clastics (Tmc).

7.3.2.2 Regional Structural Geology

In the eastern part of the project site are faults that are trending N-S and NW-SE. These faults occur in the Tonasa and Camba Formations, including some inactive faults. In addition, there is also stratigraphic faulting within Tonasa Formation limestones and sedimentary rocks of the Camba Formation due to overburden pressures.

Observations and analysis of field data in the project site location and correlations with geotechnical drilling data from the nearby Punagaya and Sul Sel-2 power plants, found no indication that the structures are active and significant. The location of the project site is relatively far from the regional normal faults located to the east and the strike-slip faulting located offshore to the southwest. This may be seen in **Figure 7-13** depicting the seismotectonic setting of South Sulawesi province. The geological structure of bedrock in the project area is stable and relatively safe from active and dynamic geologic processes that contribute to tectonic risk.

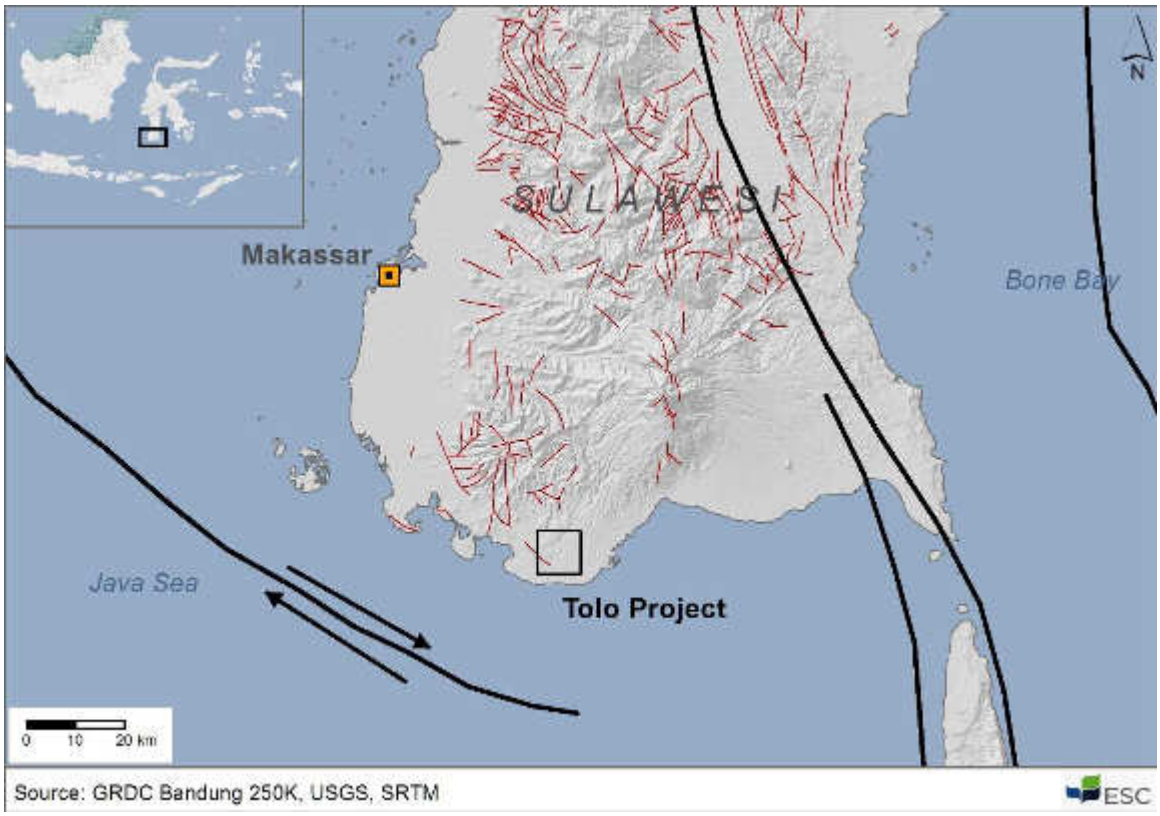


Figure 7-13 Seismotectonic Setting of Southern Sulawesi Region

7.3.2.3 Project Site Geology and Geomorphology

The Project site covers a relatively flat area with elevations ranging from 15 to 25 meters above sea level and gently sloping from the north to the south (**Figure 7-14**). Elevations in the north are slightly higher, where bedrock comprises volcanic rocks mapped as Lompobatang (Qlv) consisting of agglomerate, lava, breccia, and tuff deposits. This unit may likely be more weathered to the south. This and localized weathering effects form an overall flat but locally bumpy terrain. Slope varies from flat to moderately sloping, with slopes less than 3 to 10%.

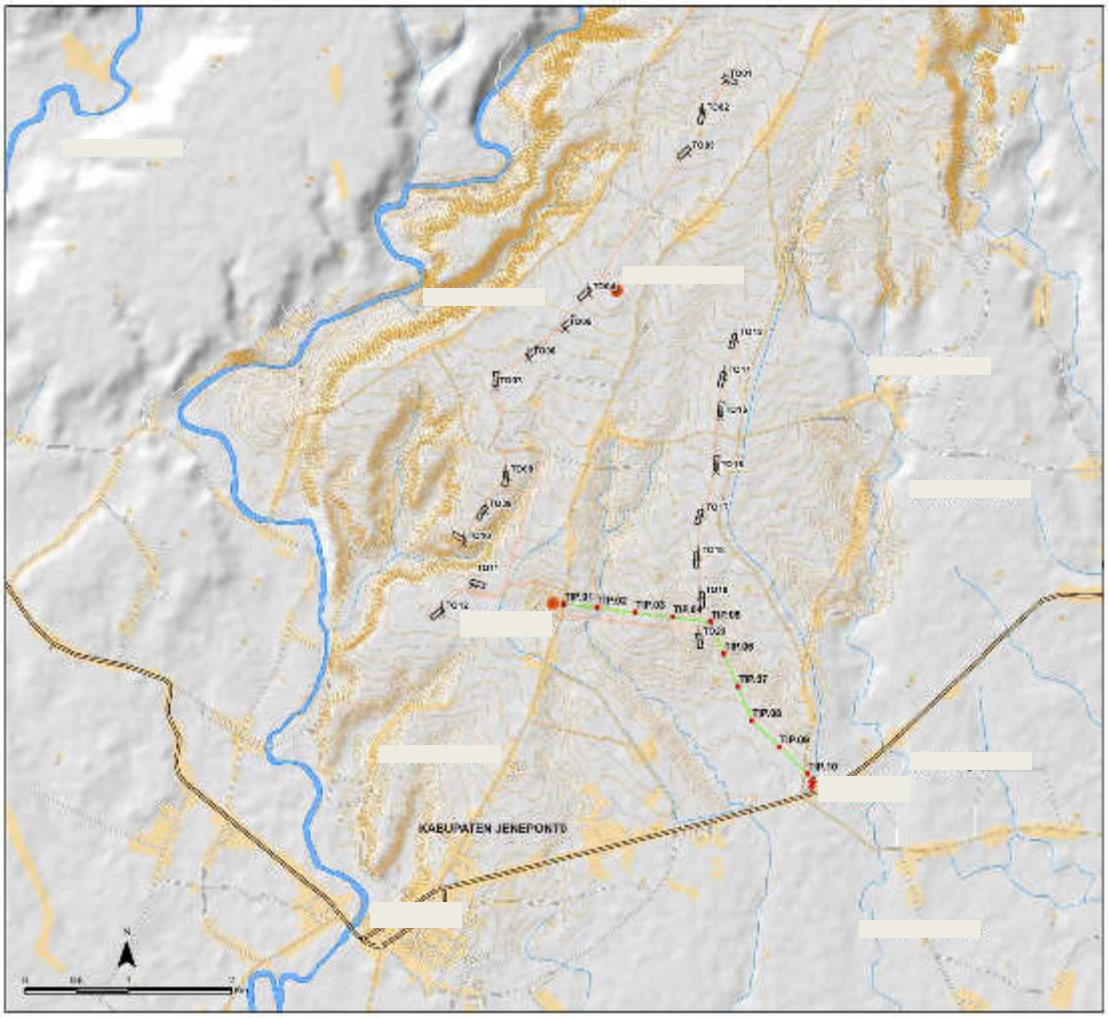


Figure 7-14 Study Area Topography Map

Based on appearance and landform classification (Marsoedi, et al, 1994), the Project site location includes Uplifted Landform and Tilted Uplift Lompobatang volcanic rocks.

Field observations and drilling results have not uncovered evidence for active tectonic activity in the way of faulting, folding or signs of ground movement or landslides. The structure and state of the bedrock geology indicate long-term stability.

Slope stability is based on analysis of the type and nature of the constituent rocks and signs of ground movement. Bedrock is constituted of Lompobatang volcanic rocks (Qlv), displaying a low degree of weathering, and covered by a very shallow layer of soil (5 to 25 cm). Alluvial deposits are not locally aligned and there are steep cliffs (near rivers) as well as no sign of rock-fall, indicating ground movement is insignificant. The rock and soil making up the location of the Project site are relatively stable against the process of ground movement and the angle of slope is relatively small.

7.3.3 Seismicity

A review of the seismicity of the Project area is intended to highlight any associated risks and ensure planned infrastructure has sufficient resistance to potential earthquakes/tsunamis and to mitigate the following:

- Human fatalities from the collapse of building structures in strong earthquakes;
- Limit structural damage to buildings caused by mild to moderate earthquakes so they can be readily repaired;
- Limit discomfort for the occupants of residential buildings during mild to moderate earthquakes;
- Maintain vital services and functionality at any time of impacted buildings.

Based on the Seismic Hazard Map (GSHAP, 2000), Indonesia is categorized into six (6) earthquake zones; Zone 1 is the region with the lowest seismicity and Zone 6 with the highest seismicity. The Zones are defined by averaged bedrock peak accelerations due to the influence of recurring earthquakes on a 500-year periodicity.

South Sulawesi Province brackets Zone 2 through Zone 6, with the Project site falling within Zone 2.

Based on historical earthquake damage in South Sulawesi over the last 100-year period, there are no unprecedented earthquakes or tsunamis that have affected Jeneponto City and surrounding areas, including the Project site.

Seismicity literature studies also show that the influences of active geological structures and faults do not appear to contribute to earthquakes or tsunamis in the Project site.

Figure 7-15 shows the complete lack of any significant seismic activity from 2004-2016 in the region.

Several earthquake hazard maps are produced in Indonesia and all indicate the Project region is relatively safe from the danger of significant seismic events:

- Indonesian Earthquake Zone Distribution Map (Water Resources Research Center, 2004) places the Project site in Earthquake Zone B (low risk coefficient).
- Indonesian Earthquake Zone Map (Public Works, 2010), places the Project site within earthquake Zone 2 (coefficient 0.10 g – low criteria).
- Earthquake Zone Alert Map (GRDC, 2010) indicates the Project site area is not included in the alert zone for earthquake.
- Earthquake Sources Zone Map in Indonesia indicates the Project Site area is not on the track of earthquake source zones.

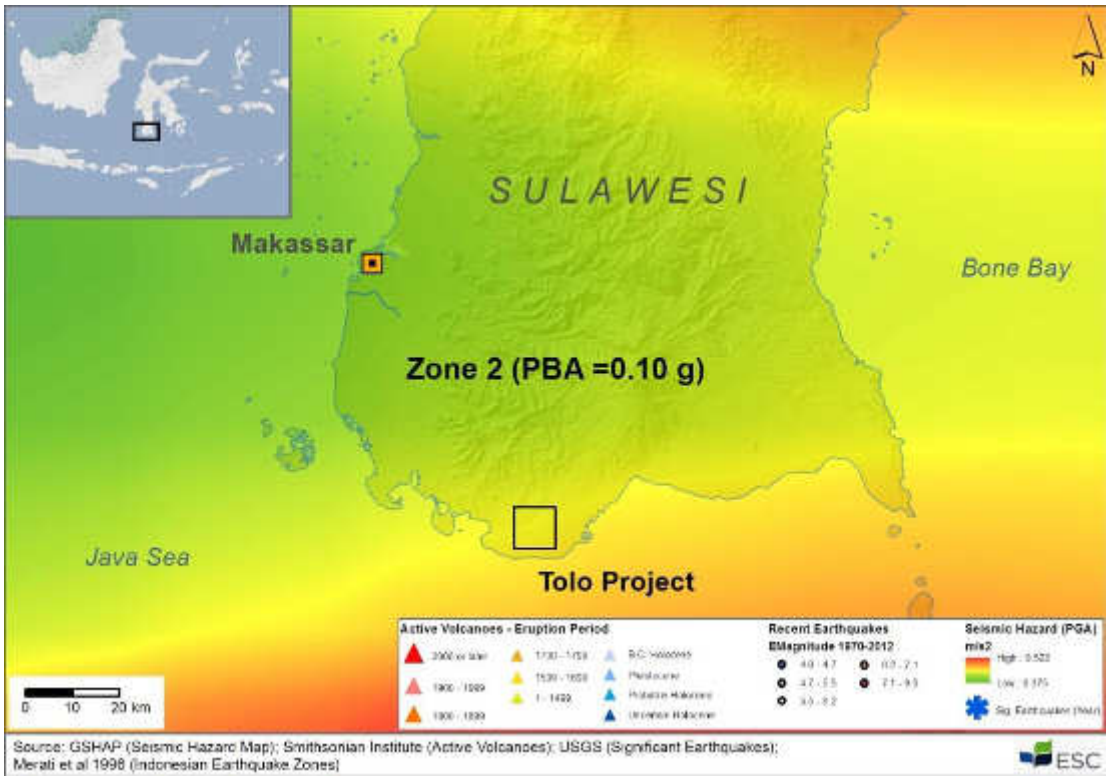


Figure 7-15 Seismic Hazard Map of Southern Sulawesi Region

7.3.4 Geological Hazards

Physical properties of rocks/soils at the Project site govern soil stability and load-bearing capacity of the local soil and bedrock foundation. Based on the underlying Lompobatang volcanic bedrock (Qlv) characteristics, the subsurface soil conditions can be inferred to be compact and stable.

Ground movement and level of vulnerability of soil movement in the location are determined by the physical properties of soil and rock, slope angle, structural geology, and vegetation.

Vulnerability of soil movement in the Project location may be classified as follows.

Very Low Land Movement Vulnerability Zone

Most of the study area has a very low level of vulnerability to ground movement. Ground movement occurrences are very rare to almost never for both old and new ground movement, except in the immediate areas around river banks.

This zone is an area with a slope of 0-5% and these slopes are not formed by stacking of material by ground movement nor contain swelling clay minerals. This unit is generally formed of Brown-Gray alluvial soil (Inceptisols) and Old Gray Grumosol (Vertisols) as the direct result of weathering of highly compact volcanic breccia.

Low Land Movement Vulnerability Zone

The area has a low level of susceptibility to ground movement. In this zone, ground motion is a rare occurrence if the slope is not impaired, and where occurrs quickly returns to a more stabilized state. Ground movements on a very small scale may occur, especially at river bank settings. This unit is generally formed of Mediterranean Brown (Ultisols) which is the direct result of weathering of highly compact volcanic breccia.

Slope stability

In general, the topographic setting of the project area adopts the form of gently waving to undulating ramp terrain, and characteristically stable. The main turbine corridors have a relatively low slope of no more than 5%, indicating no potential for ground movement in the form of landslides. Corridor details may be seen in **Figure 7-16**.

Source: ESC

Figure 7-16 Turbine Corridor Setting

7.3.5 Soils

Classification of soil types found in the study area and surroundings based on the Soil Map Review of South Sulawesi province, Soil Research Institute, Bogor (1968) are listed in **Table 7-9**, as well as the corresponding names. Based on the USDA Soil Taxonomy (1992), the soils in the study area were classified at the order levels Ultisols, Vertisols, and Inceptisols.

Table 7-9 Soil Classification in Tolo I Wind Project Jeneponto Site Development Plan

Pusat Penelitian Tanah, Bogor (1968)	USDA Soil Taxonomy (1992)	
	Order	Sub Order
Mediterranian Brown	*Ultisols*	*Ustults*
Grumusol Dark Gray	*Vertisols*	*Usterts*
Alluvial Brown Gray	*Inceptisols*	*Umbrepts*

Source: Soil Research Institute, 1968; Land Suitability Report, 1988, Nippon Koei Co., Ltd. & Associates, 1998.

Ultisols (Mediterranian Brown)

Mature to old soil, moderate to shallow effective depth, reddish yellow to red horizon identifier B-Argillic ground color, loam to clay texture, angled structure (angular blocky), sticky to very sticky moisture content, moderately acidic to acidic soil reaction and moderate permeability. Organic matter content is low to very low, cation exchange capacity and base saturation are low. Total nitrogen is very low and P_2O_5 and K_2O content are also low. Ultisols tends to cover more hilly terrain.

Inceptisols (Alluvial Brown Gray)

Young soil, varying effective depth and texture, unstructured and no defined horizons with Very sticky consistency, slightly acidic soil reaction, low organic matter content, low cation exchange

capacity, and moderate to low base saturation. Total nitrogen is very low and P_2O_5 and K_2O content are also low. Inceptisols develop in low areas along the river and sloping land.

Vertisols (Grumusol Dark Grey)

Mature to moderately old soil, generally deep in effective depth, clay to heavy clay texture. The structure of the upper layers is angular and the bottom layers are cubic (blocky). Consistency is very sticky and plastic; very hard and cracked when dry with very low permeability. Moderate to low organic matter levels, low cation exchange capacity and high saturation. This soil type contains moderate levels of nitrogen and moderate contents of P_2O_5 and K_2O.

Full details are presented in **Table 7-10,** and a photograph of the Mediterranean Brown (Ultisols) soil type exposed during foundation excavations on the meteorological observation tower is presented in **Figure 7-17**.

Source: ESC

Figure 7-17 *Ultisols* Soil exposed at the Tolo Metereological Tower

Table 7-10 Soil Physical and Chemical Results

Parameter	Unit	*Ultisols*	*Inceptisols*	*Vertisols*
Soil Chemistry				
Soil pH	-	5.4	6.2	6.9
C-organic	%	1.8	1.4	2.5
N-total	%	0.7	0.8	0.46
P_2O_5	ppm	11.8	13.5	22.8
K_2O	cmol/kg	12.3	16.1	30.2

CEC	cmol/kg	15.4	22.7	25.9
BS	%	34,4	41.6	54.5
Soil Physics				
Texture	-	Clayey Loam	Sandy Loam	Clay
- Sand	%	22.1	60.2	3.5
- Silt	%	42.3	17.3	25.2
- Clay	%	35.6	22.5	71.3
Structure	-	rounded glob	Crumb	rounded glob
Bulk Density	g/cm^3	1.20	1.14	1.22
Porosity	%	62.1	56.4	48.21

Source: Laboratory Analysis of Fertility and Soil Physics, Faculty of Agriculture, UNHAS, 2016

TOR Land Capability Survey, Land Research Center, Bogor, 1982

Description:

CEC : Cation Exchange Capacity

BS : Base saturation

7.4 Hydrosphere

There are several natural watercourses within the Project area, but no permanent surface waters. Locally constructed primary and secondary irrigation canals are present throughout the area. Temporary surface waters are present as paddy fields during the wet season. The groundwater aquifers are limited.

7.4.1 Hydrogeology

The regional hydrogeological setting includes surface and subsurface hydrogeology (groundwater), the system of aquifers as a medium for accumulation of groundwater, general potential of groundwater, and types of groundwater. The physical condition of the surface of the water catchment areas are classified as poor, because the soil layer is quite thin with alluvial deposits estimated to range from several meters to 0.5 to 1.0 m depending on location and the local soil surface. Open land (green open spaces) is widespread, and the Project area comprises mostly grasslands, mixed farms, paddy-fields, and settlements.

7.4.2 Surface Water

Waterbodies

Catchments for seven (7) natural water courses exist within the Project footprint. Six minor drainages flow broadly north-south through the Project area, with the western edge of the Project area defined by a small river, Sungai Kelara. There are no lakes or wetlands within the Project footprint.

Water Quality

Construction and operation of Tolo I Wind Project could adversely affect the quality of groundwater, river water, and sea water in this area. Some parameters tested can be indicators

of changes in environmental components such as: turbidity, TSS and TDS, pH, BOD_5, COD, DO, oil and grease, as well as several other parameters. Water quality baseline data in the study area could be the basis for evaluating the potential impact that will arise against this environmental component due to Project activities.

Water sample testing in the study area was taken from secondary irrigation channels in April 2016. The sample coordinates and the locations of each are in **Table 7-11**.

Table 7-11 Water Sampling Locatsions in EIA Tolo Tolo I Wind Farm Project Development Study Area

Test Sample	Water Body	Coordinate Point	
A-2	Secondary irrigation canal, Bontomate'ne Village, Turatea District	S: 05°36'48.1"	E: 119°46'4.8"
A-3	Secondary irrigation canal, North Empoang Sub District, Binamu District	S: 05°38'33.2"	E: 119°45'43.2"
A-4	Secondary irrigation canal, South Empong Sub District, Binamu District	S: 05°39'41.2"	E: 119°45'39.9"

Water sample A-1 was removed from this study as it was collected several kilometres to the north of the turbine corridors, and far outside the project footprint.

The water samples were tested at the Center for Health Laboratory in Makassar, accredited by KAN Number: LP-825-IDN valid until June 17, 2018. Determination of test parameters and water quality standards refer to South Sulawesi Governor Regulation No. 69 of 2010. Water quality results are as follows:

- *Physical parameters*. Physically, irrigation water in the study area was clear with dissolved solids content 128-364 mg / L (quality standard: 1,000 mg / L) while TSS is only about 8-32 mg / L (quality standard: 50 mg / L. The temperature of the water bodies was ~28 °C.
- *Chemical parameters*. Acidity of the water samples ranged from pH 7.3 to 7.5 which is still within range of quality standards, set between pH 6.0 to 8.5. BOD5 and COD parameter values of test samples were low, at about 1.0 BOD5 mg/L (the quality standard is 3 mg / L) while COD ranged from 5.4 to 5.7 mg / L (the quality standard: 25 mg / L). Dissolved oxygen is quite high, at about 7 mg / L (quality standard: 4 mg / L). Phosphates are fairly high at certain locations, reaching 0.3 mg / L while the quality standard is only 0.2 mg / L. Although not required, the ammonia content of the irrigation water is high, ie, from 0.05 to 0.16 mg / L. Free chlorine values were from 0.05 to 0.40 mg / L, higher than the quality standard of this parameter (0.03 mg / L). The presence of phosphate is expected from agricultural waste and domestic wastewater. Other test parameter values were very low, and some were below analysis detection limits.
- *Microbiological parameters*. The irrigation canal water samples in the study area contain coliform bacteria, at 156-225 MPN / 100 mL. Although there are coliforms, this is well within the quality standard threshold at 5,000 MPN / 100 mL.
- *Pollution Index (PI*). Irrigation water quality in the study area has been polluted, based on several quality standards for parameters in PP 82 of 2001 and South Sulawesi Governor Regulation No 69 of 2010, as well as based on the calculation of PI with values ranging

from 1.26 to 9.50 (**Table 7-12**). Polluted status is mainly due to phosphate and free chlorine (Cl_2) which exceeded the quality standards established. Status of the inflowing river water quality is in the scale of 3-4 based on the scale of environmental quality.

Table 7-12 Pollution Index (PI) of Surface Water

Test Sample	Water Body	PI	Category
A-2	Secondary irrigation canal, Bontomate'ne Village, Turatea District	1.26	light pollution
A-3	Secondary irrigation canal, North Empoang Village, Binamu District	9.50	Medium pollution
A-4	Secondary irrigation canal, South Empong Village, Binamu District	3.38	light pollution

The laboratory result of surface water quality assessment is given in **Appendix 12**.

7.4.3 Groundwater

An aquifer is an underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand, or silt) from which groundwater can be extracted using a water well.

Based on review of Hydrogeology Map Sheets 2010 Ujung Pandang, 2109 Benteng and 2110 Sinjai Sulawesi (Mudiana. W, Mukna. HS and Soetrisno, S, 1984), and field observations of existing local wells and wellbores, the regional aquifer system (including at the Project site) is formed by two groups of aquifers:

- Upper aquifer group is predominantly alluvial deposits consisting of loose material, with groundwater flowing through the pore spaces between grains.
- Lower aquifer group consists of fissures or other hollow spaces within the underlying bedrock.

The main lithologies of the upper aquifer are swamp sediments, stream sediments, and coastal sediments consisting of fine to coarse sand, silt, and clay. Sand layers or lenses host the main pore spaces. In general, this kind of aquifer is characterized as unconfined (free aquifer) and contains free ground water.

The lower bedrock aquifer is formed by mostly compact volcaniclastic rocks consisting of sandstone, claystone, siltstone, tuff, and tuffaceous sandstones. These lithotypes generally have low permeability and at less coherent sections have moderate permeabilities. This groundwater is obtained in drill holes which penetrate a permeable layer between two impermeable layers and the groundwater is pressurized (artesian).

Regional free groundwater is potentially found in the producing aquifer type with medium to high distribution; this type of aquifer has moderate to somewhat high transmissivity, with moderate to high discharge rates (1 liter/sec - 5 liter/sec from wells), found in river and beach alluvial deposits. The aquifer with medium to rare productivity has widespread distribution, and characterized by being discontinuous, thin, and of low transmissivity, with a low well discharge rate and found in volcanic rocks. Potentially pressurized groundwater regional aquifers are of rare

to very rare distribution; these types of aquifer have very low transmissivity with very low discharge rates deeper than 60 meters below the soil horizon and found in volcanic rocks.

Project Area Local Hydrogeology

Shallow bedrock in the Project area includes alluvial deposits of rivers and swamps, consisting of fine to coarse sands, silt, and clay. In Lompobatang (Qlv) volcaniclastic terrains, consisting of agglomerate, lava, breccia, and minor tuff, free ground water levels are generally found at depths of ± 2.5 m within the vicinity of the seashore.

The area is conducive for the establishment of water wells. Free groundwater levels based on observations in several residential wells throughout the project site and surrounds may be found at depths of 1.5-3.0 meters in the rainy season (**Figure 7-18**). This aquifer flows through fissures and pore spaces. In aquifers with highly variable transmissivity, free ground water depth is generally deep and wells usually have less than 5 ltr/sec discharge rates. Thickness of water bearing layers (aquifers) is locally highly variable, in part due to variations in weathering, fractures and bedrock lithotypes.

Free groundwater level -1.5 m from ground level Free groundwater level –3.0 m from ground level

Figure 7-18 Dug Wells in Project area

7.5 Biosphere

This chapter covers the regional ecological system integrating all living beings and their relationships, including their interaction with the elements of the lithosphere, hydrosphere, and atmosphere.

Wind energy's ability to generate electricity without carbon emissions is expected to reduce the risk of negative impacts on wildlife from unmitigated climate change. The siting and operation of wind energy facilities also may present a risk of adverse impacts to wildlife. While effects on wildlife populations have not been measured (e.g., NAS 2007), adverse impacts of wind energy facilities to wildlife have been documented, particularly to individual birds and bats (Arnett et al. 2008; Strickland et al. 2011).

The potential for biologically significant impacts to wildlife continues to be a source of concern as populations of many species overlapping with proposed wind energy developments are experiencing long-term declines as a result of habitat loss and fragmentation, disease, non-native invasive species, and increased mortality from numerous other anthropogenic activities (e.g., NABCI 2009; Arnett and Baerwald 2013). However, the Project area has already been extensively degraded through agriculture, and there is almost no primary habitat remaining.

7.5.1 Ecosystems

7.5.1.1 Land Cover and Land Use

The Project area and surrounds have been utilized for a variety of land-usage, such as pasture/mixed farms, fields, forest, and gardens amongst others. Based on the type of land use, rice paddy fields occupy the largest portion of land as compared to other types of land use, followed by for fields/dry land agriculture. This is an indicator that the farming communities in Jeneponto Regency have a great interest in trying to farm rain-fed rice paddies, because the main limiting factor in the local region is water availability. No primary forest or mangrove is present within the Project footprint and and it is 100% degraded by settlements and agriculture.

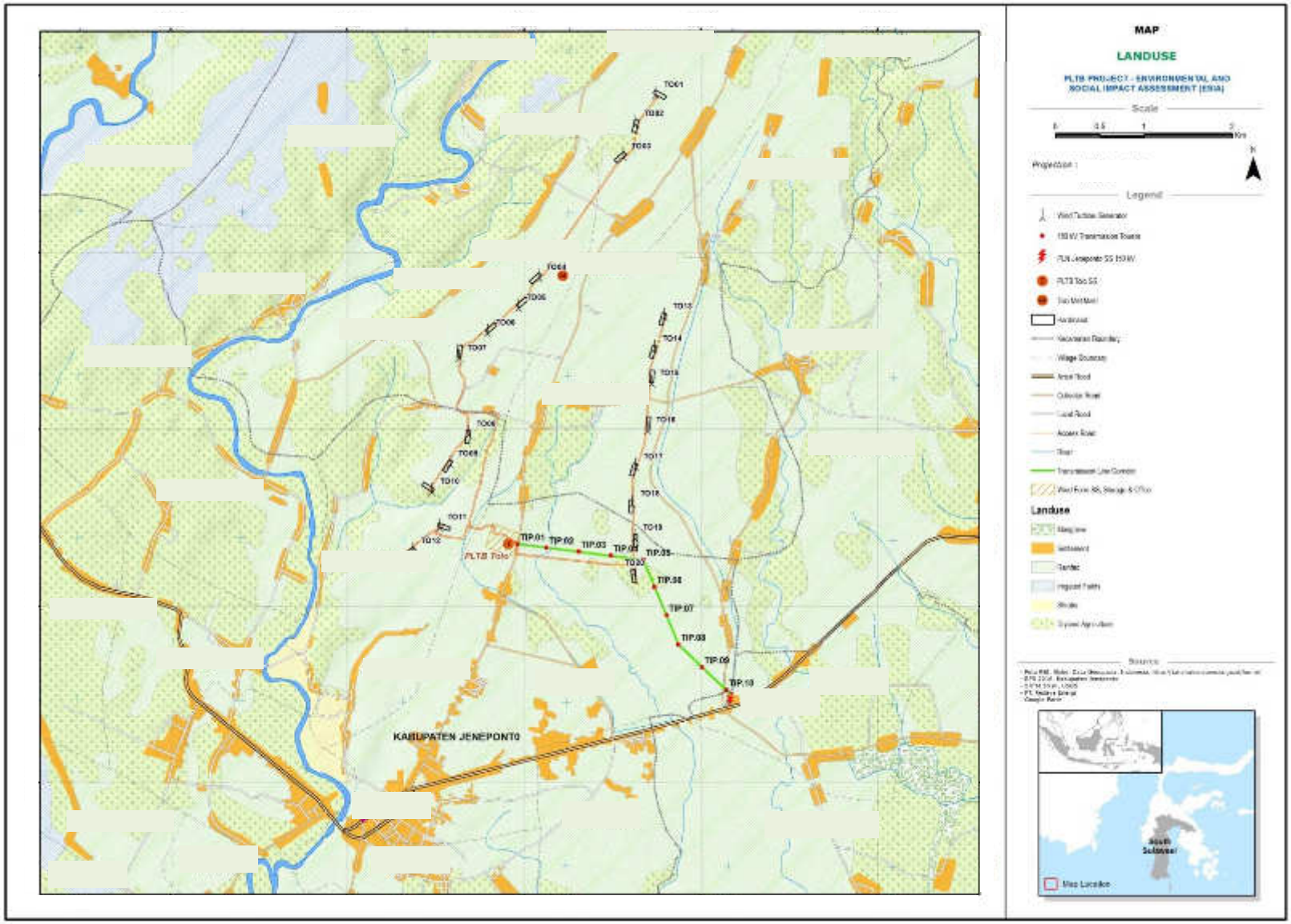


Figure 7-19 Land Use Map

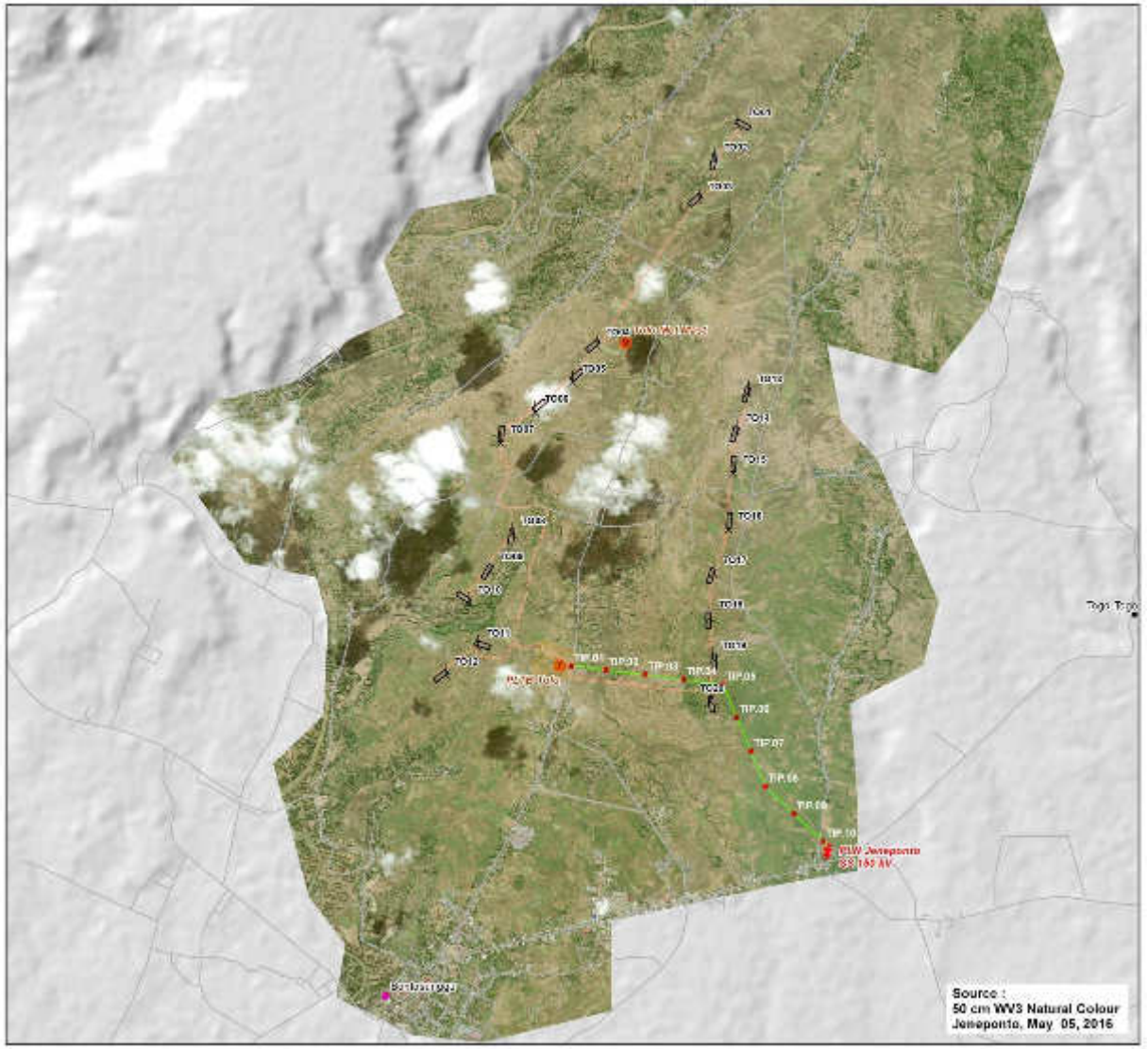


Figure 7-20 Land Use Aerial Photo

Based on field surveys some Project area locations include Kelara Karalloe Irrigation Area Network (IAN Kalara Karalloe) and other areas have the potential for development of rainfed rice, mixed garden plants include maize intercropped with mung beans, mung beans monoculture crops or corn. Details may be seen in **Figure 7-21**. Main tree types documented include coconut, breadfruit, soursop, sarikaya, mango, tune, orange, and others.

The turbine corridors occupy developed irrigated land, rain-fed paddies, and mixed farms, with turbines and foundations planned for construction within this setting.

a. Channel/Primary Network IAN Kelara Karalloe

b. Secondary Network IAN Kelara Karalloe

c. Wet rice, corn, and mixed plantings

d. Wind speed observation tower

Figure 7-21 Wet and Dry Land Farming Conditions in Project Area

7.5.2 Flora and Fauna

The sources of flora and fauna data are baseline study of AMDAL document (UNHAS, 2016) and Baseline Study of Bird and Bat Report (ESC, 2017).

Methodology and approach of flora and fauna data collection as follow:

- Flora: Flora data collection is using rapid assessment method. The project area is modified habitat, therefore flora data collection focused on species inventory on dry-land agriculture area (UNHAS, 2016).
- Mammals: Mammal's data collection is using rapid assessment on modified habitat (UNHAS, 2016). Especially of bat groups, study approaches are observation rapid assessment method and mist net trapping (ESC, 2017).

- Bird: Bird data collection are using Literature review, point transect, concentration count sampling, observation rapid assessment and mist-net trapping (ESC, 2017)
- Habitat: Habitat data analysis using Remote Sensing and spatial data approaches. The field data survey is collected to confirmation of desktop study using satellite imagery (ESC, 2017).
- Protected area: the national and international literature review includes IUCN spatial data of species and protected area, report and scientific paper (ESC, 2017).

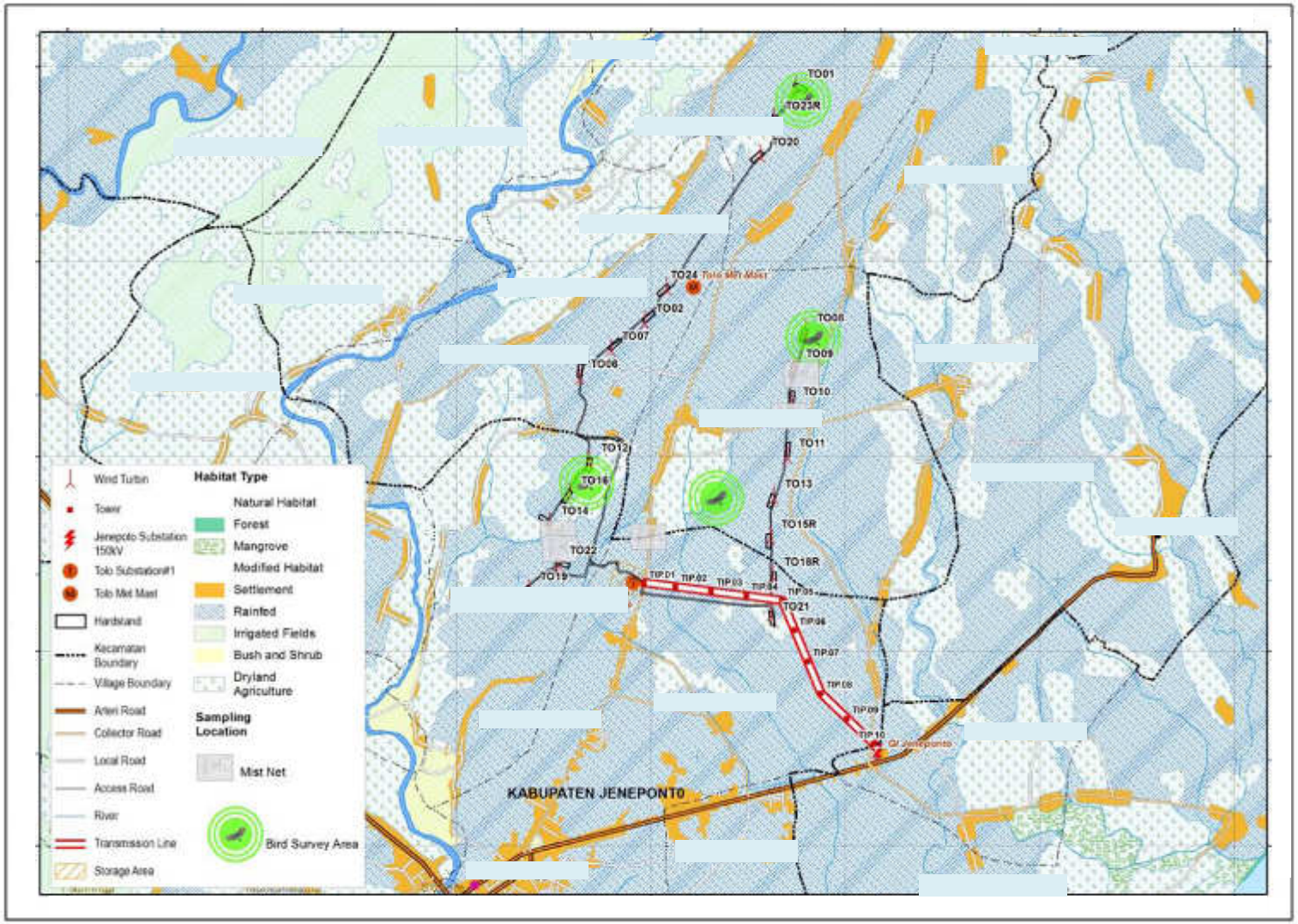


Figure 7-22 Sampling Location of Bird and Bat Study

7.5.2.1 Terrestrial Flora

Project location is located on modified habitat. Based on the habitat mapping analysis (Figure 7-23), habitat project location is dominated by paddy field and dry-land agriculture.

Vegetation found in the study area in general is groups of plants that grow in the rice fields around the Project site. It also includes groups of cultivated plants that grow in smallholder plantings between rice fields and around the settlements. Various species on dryland agriculture such as mix-garden is natural secondary plant individuals can be found spread through the area of this study and the existence of natural vegetation is strongly influenced by the activities of the local community, who use the land primarily for residential and agricultural purposes.

In groups of existing plants in rice fields generally are the kinds planted or allowed to grow on land that is not converted into rice paddies. Some plant species can still be found growing naturally, though in scattered small groups. Many of the plant species are located around settlements or grown in areas abandoned along with a variety of herbaceous ruderal. These species include *Litsea* sp., *Mussaendah* sp., *Lannea coromandelica*, Kalumpang (*Sterculia feotida*) and tala (*Borassus flabellifer*). Generally, these species grow on bunds of the rice fields or lands that are relatively small that cannot be turned into rice fields due to the large rock outcrops that exist and the bottom layer is usually filled by a variety of herbaceous chronic. In the yard areas around the settlements, plant species recorded are also relatively diverse, such as jackfruit (*Artocarpus heterophylla*), moringa (*Moringa oleifera*), kapok (*Ceiba pentandra*), mango (*Mangifera indica*) and coconut, (*Cocos nucifera*). Groups of relatively tall trees are generally located in the yards around the settlements.

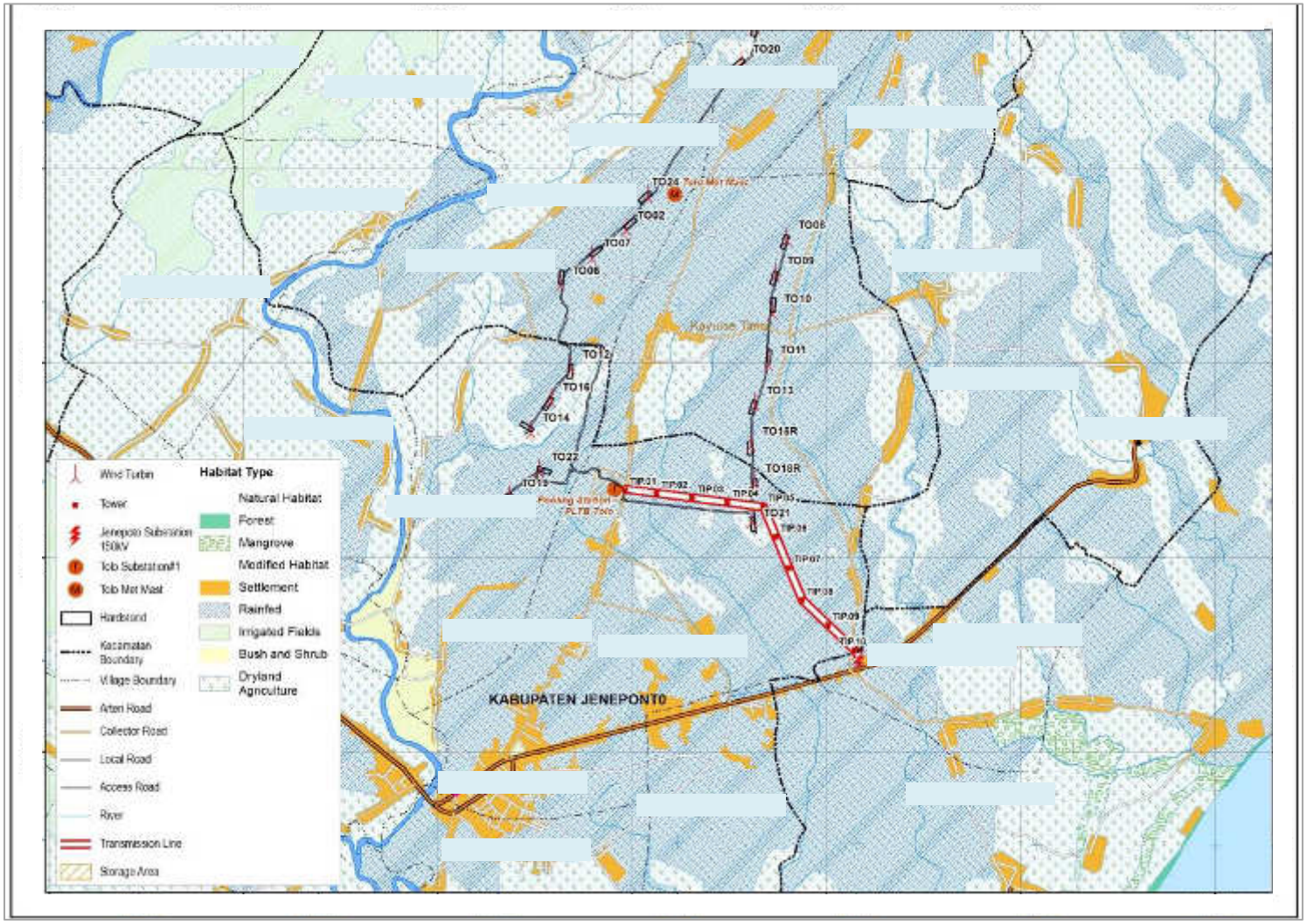


Figure 7-23 Habitat Type of Project Location

Various species of herbaceous ruderal can also be found growing together in this community, including *Plucea indica, Ageratum conizoides, mitracarpus hirtus, Pasphalum conjugatum* and *Acalypha indica*. In addition, various other invasive plant species can also be found, such as *Leucaena leucochepala, Lantana camara,* and *Mimosa Invisa*.

7.5.2.2 Volant Fauna (Bats and Birds)

The data of Bird and Aves will refer to baseline study report of Bat and Bird (**Appendix 9**). Aves (birds) are the most commonly found animal group within the Project area.

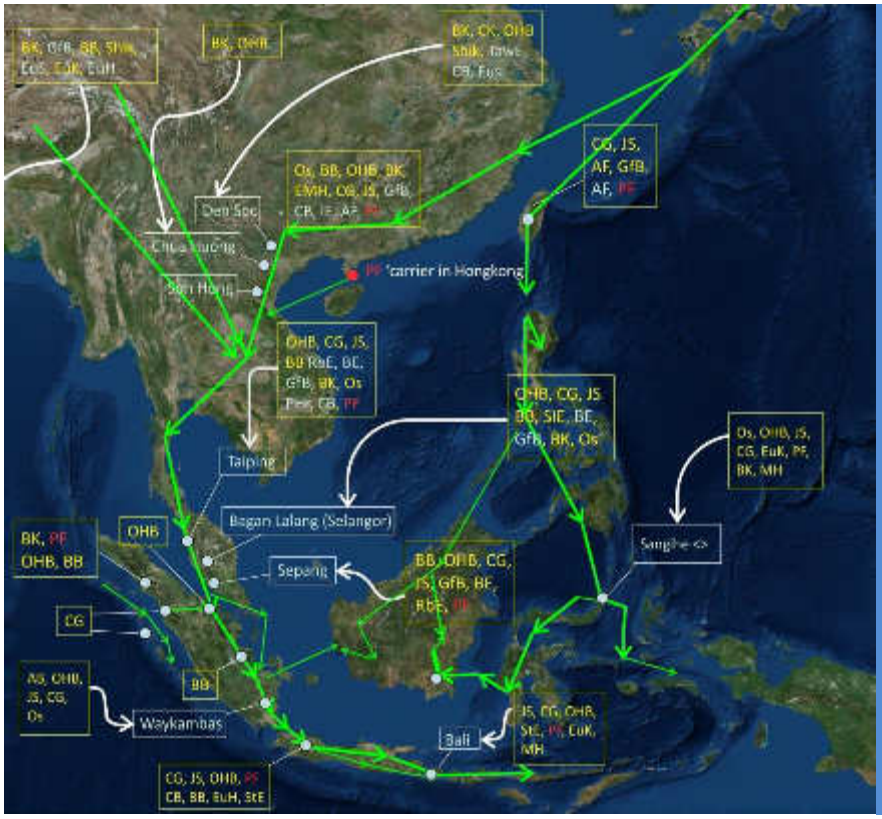
The study recorded 29 species of birds of 20 families, of which 9 species are protected species under Indonesia Regulation. Observation data shows most of the findings are terrestrial and shrub birds. This species has low flying paths, less than 20 meters from the ground.

In dry-land agriculture habitats, the study recorded abundant species. A transect was developed from Turbine 12 to Turbine 14 (T12 to T14). In that region, some water birds were recorded such as the White-breasted Waterhen and Collared Kingfisher. Landscape was predominantly paddy fields, making dry-land agriculture habitats as favorite places for shelter and cover as provided by the trees.

Presence of trees in paddy field habitats has an important role. Trees have a role as shelter and cover for small birds from predators, such as raptors. Some species that were commonly recorded in this setting were the Scaly-breasted Munia, Tricoloured munia and White-shouldered triller.

Local migration was recorded in the Project area, by the cattle egret. Every morning, cattle egrets were flying in groups to paddy field habitat for foraging, then returning in the evening to sleeping trees. These birds have the ability to fly fairly high, but during the survey cattle egret flying heights never exceeded 30 meters. Low flying of this bird group is influenced by the distance between location as sleeping and foraging sites were proximal to each other. The study noted mutual symbiotic relationships between livestock and cattle egret. Bush and paddy fields become communities' livestock grazing during dry season.

The project location is not traversed by global migration routes of bird species or other groups. **Figure 7-24** shows global migration routes of raptor groups. Some raptor species are migrating from the northern hemisphere to the southern hemisphere (Yamazaki et al, 2012) for the winter season. Migration activity for wildlife is movement from one location to another for specific purposes such as foraging or breeding (Clark, 1990). Migration is undertaken in groups with individual numbers in the hundreds or even thousands. Raptors will utilize thermals to reach certain heights and then glide towards the target location. This is done to conserve their energy for achieving flight over very long distances (Clark, 1990). Areas in South Sulawesi are already known to be regional trajectories and destinations for migration of raptors, based on results of monitoring with satellite tracking in Polewali - Mapili (Higuchi et al, 2005).



Note:

- OHB (Oriental Honey Buzzard)
- JS (Japanese sparrow hawk)
- CG (Chinese Goshawk)
- PF (Peregrine Falcon)
- BB (Black Baza)
- StE (Short toated Eagle)
- MH (Montagu's Harrier)
- EuH (Eurasian Hobby)
- GfB (Grey faced Buzzard)
- BK (Black Kite)
- RbE (Rofous bellied Eagle)
- BE (Booted Eagle)
- PHr (Pied Harrier)
- CB (Common Buzzard)
- Os (Osprey)

Figure 7-24 Raptor Bird Migration Route

Table 7-13 Avifauna in study area

No	Name			Family	Conservation Status			Restricted Range Distribution	Number	Diversity Index
	Local	English	Scientific		CITES	IUCN	PP 7/99			
1	Elang sayap coklat	Rofous wingged buzzard	*Butastur liventer*	Accipitridae	App.II	LC	P	-	4	0.05
2	Elang tikus	Black winged kite	*Elanus caeruleus*	Accipitridae	App.II	LC	P	-	1	0.02
3	Cekakak sungai	Collared Kingfisher	*Todiramphus chloris*	Alcedinidae	-	LC	P	-	5	0.06
4	Walet linci	Linchi Swiftlet	*Collocalia linchi*	Apodidae	-	LC	-	-	10	0.10
5	Blekok sawah	Javan Pond-heron	*Ardeola speciosa*	Ardeidae	-	LC	-	-	1	0.02
6	Kuntul kerbau	Cattle Egret	*Bubulcus ibis*	Ardeidae	-	LC	P	-	50	0.28
7	Kekep babi	White-breasted Wood swallow	*Artamus leucorhynchus*	Artamidae	-	LC	-	-	10	0.10
8	Kapasan sayap putih	White-shouldered Triller	*Lalage sueurii*	Campephagidae	-	LC	-	-	10	0.10
9	Cerek asia	Oriental Plover	*Charadrius veredus*	Charadriidae	-	LC	-	-	16	0.14
10	Cici merah	Golden headed cisticola	*Cisticola exilis*	Cisticolidae	-	LC	-	-	10	0.10
11	Cici padi	*Zitting Cisticola*	*Cisticola juncidis*	Cisticolidae	-	LC	-	-	10	0.10
12	Perkutut jawa	Zebra Dove	*Geopelia striata*	Columbidae	-	LC	-	-	7	0.08
13	Punai gading	Pink-necked Green Pigeon	*Treron vernans*	Columbidae	-	LC	-	-	9	0.10
14	Tekukur biasa	Spotted Dove	*Streptopelia chinensis*	Columbidae	-	LC	-	-	10	0.10
15	Wiwik uncuing	Rusty-breasted Cuckoo	*Cocomantis sepulcralis*	Cuculidae	-		-	-	1	0.02
16	Bondol peking	Scaly-breasted Munia	*Lonchura punctulata*	Estrildidae	-	LC	-	-	50	0.28
17	Bondol rawa	Tricoloured Munia	*Lonchura malacca*	Estrildidae	-	LC	-	-	10	0.10
18	Burung gereja erasia	Eurasian Tree Sparrow	*Passer montanus*	Estrildidae	-	LC	-	-	10	0.10
19	Alap – alap macan	Oriental hobby	*Falco severus*	Falconidae	App.II	LC	P	-	1	0.02

No	Name			Family	Conservation Status			Restricted Range Distribution	Number	Diversity Index
	Local	English	Scientific		CITES	IUCN	PP 7/99			
20	Alap – alap sapi	Spotted kestrel	*Falco moluccensis*	Falconidae	App.II	LC	P	-	9	0.10
21	Layang – layang batu	Pacific Swallow	*Hirundo tahitica*	Hirundinidae	-	LC	-	-	10	0.10
22	Apung tanah	Australasian Pipit	*Anthus novaeseelandiae*	Motacillidae	-	LC	-	-	10	0.10
23	Decu belang	Pied Bushchat	*Saxicola caprata*	Muscicapidae	-	LC	-	-	10	0.10
24	Burung madu kelapa	Plain-throated Sunbird	*Anthreptes malacensis*	Nectarinidae	-	LC	P	-	7	0.08
25	Burung madu sriganti	Olive-backed Sunbird	*Nectarinia jugularis*	Nectarinidae	-	LC	P	-	5	0.06
26	Gemak loreng	Barred Buttonquail	*Turnix suscitator*	Phasianidae	-	LC	-	-	3	0.04
27	Cucak kutilang	Sooty-headed Bulbul	*Pycnonotus aurigaster*	Pynonotidae	-	LC	-	-	50	0.28
28	Kareo padi	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	-	LC	-	-	4	0.05
29	Kacamata laut	Lemon-bellied White-eye	*Zosterops chloris*	Zosteropidae	-	LC	-	-	10	0.10
								Total Individual (N)	343	
								Shannon Wiener Diversity Index (H')		**2.91**
								Richness Index (R)		**1.57**
								Evenness Index (E)		**0.50**

Source: ESC, 2017; Note: CITES = the Convention on International Trade in Endangered Species of Wild Fauna and Flora, App. II = Appendix II; IUCN = The International Union for Conservation of Nature, LC = Least Concern; PP 7/99 = Preservation of Plants and Wildlife, P = Protected

The survey recorded five species of bats of two families, capturing four species of Pteropodidae and a species of Vespertilionidae. **Table 7-14** shows the list of bat species recorded in the Project area.

Based on literature reviews and habitat mapping, bat habitats can fall under two categories, insectivorous bats prefer paddy fields and dry-land agriculture as their main area for foraging and dry-land agriculture for roosting habitat. The insectivore bat recorded was the Flute-nosed Bat.

For frugivore bat species, dry-land agriculture is their primary important ecological function. Dry land agriculture has fruit plants as food sources. Therefore, dryland agriculture habitats support foraging and roosting for the frugivore bat group

Table 7-14 Bat Species Findings

No	Name			Ordo - Family	Conservation Status			Restricted Range Distribution
	Local	English	Scientific		CITES	IUCN	PP 7/99	
1	Kalong Kelabu	Gray Flying Fox	*Pteropus griseus (E. Geoffroy, 1810)*	Chiroptera - Pteropodidae	II	DD	-	Sulawesi, Nusa Tenggara
2	Nyap biasa	Geoffroy's Rousette	*Rousettus amplexicaudatus (E. Geoffroy, 1810)*	Chiroptera - Pteropodidae	-	LC	-	Southeast Asia
3	Codot barong	Greater Shortnosed Fruit Bat	*Cynopterus sphinx (Vahl, 1797)*	Chiroptera - Pteropodidae	-	LC	-	South Asia and Southeast Asia
4	Cecadu pisang-kecil	Dagger-toothed Long-nosed Fruit Bat	*Macroglossus minimus (E. Geoffroy, 1810)*	Chiroptera - Pteropodidae	-	LC	-	Thailand, the Malay Peninsula, Philippines Indonesian archipelago
5	Ripo flores	Flute-nosed Bat	*Murina florium (Thomas 1908)*	Chiroptera - Vespertilionidae	-	LC	-	Sulawesi, Nusa Tenggara, Nugini and Australia

Note: - = not applicable; CITES = the Convention on International Trade in Endangered Species of Wild Fauna and Flora, App. II = Appendix II; IUCN = The International Union for Conservation of Nature, LC = Least Concern; PP 7/99 = Preservation of Plants and Wildlife, P = Protected, DD = Data Deficient

Based on the bird and bat survey study the CR and/or EN bird species are not included in the list of bird species that was recorded in the study area. This is to confirm that yellow crested cockatoo, Christmas frigate bird and Great Knots bird species have not been found in the project area and these bird species live in coastal areas. No coastal bird species have been noted during the field work at the project site.

Additional/extended birds and bats survey will also be conducted to include more survey points and will cover two seasons. The terms of reference (TOR) for the extended bird and bat survey is presented in Appendix 17.

7.5.2.3 Other Terrestrial Fauna

Some animals are deliberately domesticated like cattle (*Bos taurus*), dogs (*Canis familiaris*), and horses (*Equus caballus*). Based on information from people around the study site, other animal species encountered are snakes (Serpentes), and Water monitor (*Varanus salvator*).

There are the domesticated mammals specie such as dogs and cats. However, rats (*Rattus argentiventer*) and house mice (*Mus domesticus*) are species of mammal classified as pests that tend to cause damage. For amphibians recorded, the Common frog is widespread in lowlands (*Fejervarya cancrivora*) as well as the Moor frog (*Fejervarya limnocharis*). Usually these species are found in waterways or in places that are damp. Reptiles are usually a shy animal group that rarely manifest themselves. Gecko (*Hemidactylus frenatus*) is a species of reptile discovered to be the most common and widespread, together with gecko (Gecko gecko) that is usually found hiding in houses. Similarly, the lizards (*eutropis multifasciata*) and the biawak or monitor lizard (*Varanus salvator*) are reptiles that are common and widespread, commonly found in drains or in holes under rocks.

Table 7-15 Animals in Study Area

Type Name	Local Name	Scientific Name	Family	CITES	IUCN	PP 7/99
Mammal Group (Terrestrial)						
Mencit rumah	Balao	*Mus domesticus*	Muridae		LC	-
Tikus	Balao	*Rattus argentiventer*	Muridae		LC	-
Anjing	Asu	*Canis familiaris*	Canidae			-
Kambing	Bembe	*Capra hircus*	Bovidae			-
Bajing		*Callosciurus notatus microtis*	Sciuridae		LC	-
Kuda	Jarang	*Equus caballus*	Equidae			-
Sapi		*Bos indicus*	Bovidae			-
Amphibians Group						
Katak sawah	Tumpang	*Fejervarya cancrivora*	Ranidae		LC	-
Katak tegalan	Tumpang	*Fejervarya limnocharis*	Ranidae		LC	-
Reptiles Group						
Cecak	Cicca	*Hemidactylus frenatus*	Geckonidae		LC	-
Tokek	Tokke	*Gecko gecko*	Geckonidae			-
Kadal	Buncini	*Eutropis multifasciata*	Scinoidae			-
Biawak	Pararang	*Varanus salvator*	Varanidae		LC	-
Type Name	**Local Name**	**Scientific Name**	**Family**	**CITES**	**IUCN**	**PP 7/99**
Mammal Group (Terrestrial)						
Mencit rumah	Balao	*Mus domesticus*	Muridae		LC	-

Type Name	Local Name	Scientific Name	Family	CITES	IUCN	PP 7/99
Tikus	Balao	*Rattus argentiventer*	Muridae		LC	-
Anjing	Asu	*Canis familiaris*	Canidae			-
Kambing	Bembe	*Capra hircus*	Bovidae			-
Bajing		*Callosciurus notatus microtis*	Sciuridae		LC	-
Kuda	Jarang	*Equus caballus*	Equidae			-
Sapi		*Bos indicus*	Bovidae			-
Amphibians Group						
Katak sawah	Tumpang	*Fejervarya cancrivora*	Ranidae		LC	-
Katak tegalan	Tumpang	*Fejervarya limnocharis*	Ranidae		LC	-
Reptiles Group						
Cecak	Cicca	*Hemidactylus frenatus*	Geckonidae		LC	-
Tokek	Tokke	*Gecko gecko*	Geckonidae			-
Kadal	Buncini	*Eutropis multifasciata*	Scinoidae			-
Biawak	Pararang	*Varanus salvator*	Varanidae		LC	-

Source: UNHAS Field Observations, 2016; Note: - = not applicable; CITES = the Convention on International Trade in Endangered Species of Wild Fauna and Flora; IUCN = The International Union for Conservation of Nature, LC = Least Concern; PP 7/99 = Preservation of Plants and Wildlife

7.5.3 Freshwater Biota

Nekton

Aquatic biota includes all animals that are living in aquatic environments: benthos, nekton, and plankton. Nekton are fauna actively moving in water. Nekton observation methods were straightforward and based on interviews with surrounding community residents. Types of nekton present around the site development plan for Tolo I Wind Farm Project Tolo in Jeneponto are presented in Table 7-16.

Table 7-16 Types of Aquatic Biota Nekton in Study Area of Tolo I Wind Farm Project, Jeneponto

No.	Local Name	Latin Name
1	Betok/bale balang	*Anabas testudineus*
2	Ikan gabus/kanjilo	*Ophiocephalus striatus*
3	Ikan mujair/jabir	*Tilapia mosambica*
4	Kepiting sungai	*Varuna* sp
5	Udang air tawar	*Syncaris pasadenae*

Benthos

Benthos are aquatic organisms that live on the bottom of slow moving waters. Benthic fauna have an important role in an aquatic ecosystem, and occupy the second level in the food chain; and also play a role in the process of cycling organic materials that increase fertility in a water body. Analysis of benthic fauna can be used as one indicator (bio-indicator) in a water body based on diversity index. Benthic samples are taken with Ekman-Grab or plot method, then separated with a sieve, preserved, and analyzed in a laboratory. Based on the observed data, the types of benthic biota contained in the study area for Tolo I Wind Farm Project Jeneponto are presented in **Table 7-17;** identification results may not distinguish types of aquatic benthic fauna that are endemic and or protected, but these are generally uncommon.

Table 7-17 Types of Aquatic Benthic Biota in Study Area for Tolo I Wind Farm Project

No.	Nama Indonesia/lokal	Nama Latin	Abundance (per m^2)
1	Siput air tawar/Cuci	*Melanoides tuberculata*	3
2	Siput air tawar	*Bellanya javanica*	2
3	Tubifex	*Tubifex sp*	1
4	*Syncaris*	*Syncaris (Crustaceae)*	1

Source: UNHAS Field Observation

Plankton

Plankton are the microscopic aquatic organisms that live floating along the direction of water movement, generally near the surface. Plankton is made up of phytoplankton (plant plankton) and zooplankton (animal plankton). Analysis of aquatic plankton in a body of water is with the aim of determining the condition of these waters by plankton diversity index. Samples were obtained using a plankton net, and observed by using SRC under the microscope in a laboratory. The observation and analysis of plankton samples obtained from the two sampling points are presented in **Table 7-18** and **Table 7-19.**

Based on analysis of the diversity index from two observation stations showed that the phytoplankton diversity index was between 1.99 and 2.01, and the diversity index of zooplankton was between 1.79 and 1.83. Based on the criteria for plankton diversity index (Center and Hill, 1981), it is said to be good when the index value is above 1.6 and very good if above 2.0. So based on these criteria, indications are that water conditions at both observation points around the site of Tolo I Wind Farm Project, Jeneponto, are quite good.

Table 7-18 Type, Number of Individuals, and Diversity Index of Plankton in Primary Irrigation Channel Paitana Village, Turatea District

Phytoplankton			
No.	Species Name	Total (Ind/L)	H’
1	*Rhizosolenia sp*	320	
2	*Nitzschia sp*	230	
3	*Microcystus flosagua*	150	
4	*Lyngbya contoria*	90	
5	*Synedra cunningtoni*	180	1.99
6	*Oscilatoria formosa*	40	

7	*Cymbela obtusiusenla*	70	
8	*Pediastrum simplex*	170	
9	*Rhizoclonium*	30	
	Zooplankton		
No.	Species Name	Total (Ind/L)	H’
1	*Grizaloina bressal*	180	
2	*Daphnia sp*	80	
3	*Brachionus bakeri*	50	
4	*Cyclops fimbriatus*	90	1.83
5	*Ceratium hirundinella*	110	
6	*Euglena sp*	70	
7	*Stentor sp*	40	

H’ = Diversity Index

Table 7-19 Type, Number of Individuals, and Diversity Index of Plankton in Secondary Irrigation Channel Kayuloe Turatea District

Phytoplankton			
No.	Species Name	Total (Ind/L)	H’
1	*Rhizosolenia sp*	340	
2	*Nitzschia sp*	150	
3	*Microcystus flosagua*	60	
4	*Lyngbya contoria*	110	
5	*Synedra cunningtoni*	190	2,01
6	*Oscilatoria formosa*	80	
7	*Cymbela obtusiusenla*	60	
8	*Pediastrum simplex*	210	
9	*Rhizoclonium*	60	
Zooplankton			
No.	Species Name	Total (Ind/L)	H’
1	*Grizaloina bressal*	200	
2	*Daphnia sp*	90	
3	*Brachionus bakeri*	40	
4	*Cyclops fimbriatus*	70	1,79
5	*Ceratium hirundinella*	160	
6	*Euglena sp*	50	
7	*Stentor sp*	70	

H’ = Diversity Index

With these conditions, salt farming/production is a common activity in the area especially from May to November.

7.5.4 Transportation

The Tolo I Wind Farm Project, planned to be built on both sides of the road leading to the Malikaji area, will be one of the main power plants to be built in Jeneponto. In its development activities, Tolo I Wind Farm Project will have an impact on transport conditions on roads that are in the vicinity of Tolo I Wind Farm Project, namely: Poros Jeneponto-Takalar Road and Poros Jeneponto-Malikaji Road.

Both roads will also be influenced by the Tolo I Wind Farm Project development activities and community activities around the roads, in the form of road network congestion as a result of the traffic volume density. Observations of traffic volume on Tolo I Wind Farm Project development activities were carried out on two streets in the vicinity, namely: Poros Jeneponto-Takalar Road and Poros Jeneponto-Malikaji Road. Location determination of this observation was based on the consideration that they are access roads that will be used by trucks carrying equipment and building materials as well as materials for the construction of Tolo I Wind Farm Project. These observations were made on a day that also represents the weekday / busy times. The field survey was conducted on the traffic volume, traffic speed, and capacity of the road surveyed, so that the observed level of service can be known.

The traffic volume survey uses the manual count method, where all the vehicles passing on the transverse line on the observation location during the observation time are recorded as the traffic volume. Vehicle speed data retrieval in the field was conducted by the local velocity by measuring the travel time using a stopwatch. This method is intended to measure the characteristics of speed at a certain location and traffic conditions that exist at the time. Measurement / observation of vehicle volumes from at 06:00 to 18:00 in the period recorded volume of traffic every 60 minutes. The timing of these observations is carried out by considering traffic conditions in the vicinity of the study and development activities hours.

7.5.4.1 Geometric Road Conditions

Based on the transportation observation survey results on the locations in the field, it can be seen that there are geometric road conditions in the vicinity of the construction of the Tolo I Wind Farm Project, as presented in **Table 7-20**.

Table 7-20 Geometric Road Conditions around Site of Tolo I Wind Farm Project

No	Geometric Parameters	Movement Direction	Dimension (m)
A.	Poros Jeneponto-Takalar Road		
1	Road Type		2/2UD
2	Road Lane	Left	2.80
		Right	2.80
3	Median		N/A
4	Roadside (Shoulder)	Left	0.30 – 0.50
		Right	0.30 – 0.50
B.	Poros Jeneponto-Malikaji Road		
1	Road Type		2/2UD
2	Road Lane	Left	2.50
		Right	2.50
3	Median		N/A

No	Geometric Parameters	Movement Direction	Dimension (m)
4	Roadside (Shoulder)	Left	0.20 – 0.30
		Right	0.20 – 0.40

Source : UNHAS Field Observation, 2016

Table 7-20 shows that the sections of Poros Jeneponto-Takalar Road and Poros Jeneponto-Malikaji Road observed both are UD 2/2 type (two-lane undivided or two-way / no median) with the width of the road ranging from 5.0 to 5.2 meters and roadside ranging from 0.20 to 0.50 meter.

7.5.4.2 Road Condition and Environmental Conditions Around Side of The Road

Road conditions and environmental conditions around the roads at the site development plan Tolo I Wind Farm Project, namely Poros Jeneponto-Takalar Road and Poros Jeneponto-Malikaji Road, based on the results of field surveys are presented visually in Figure 7-25 – Figure 7-27.

Figure 7-25 Road and Left-Right Side Conditions of Poros Jeneponto-Takalar Road Around the Entrance to Site for Development of Tolo I Wind Farm Project

Figure 7-26 Road and Left-Right Side Conditions of Poros Jeneponto-Malikaji Road Near the Wind Observation Tower of Tolo I Wind Farm Project

Figure 7-27 Road and Left-Right Side Conditions of Poros Jeneponto-Malikaji Road in Turatea District Around the Site Development Plan Tolo I Wind Farm Project

The above pictures show that the environmental conditions of the left-right section Poros Jeneponto-Takalar Road and Poros Jeneponto-Malikaji Road around the site of Tolo I Wind Farm Project, both from the south and the north, have excellent road conditions with the visual environmental conditions generally a mix of farms, residential communities, and buildings that are temporary functioning as stalls / kiosk, where the distances between the shops are quite far. The condition of all of these roads is paved and in good condition.

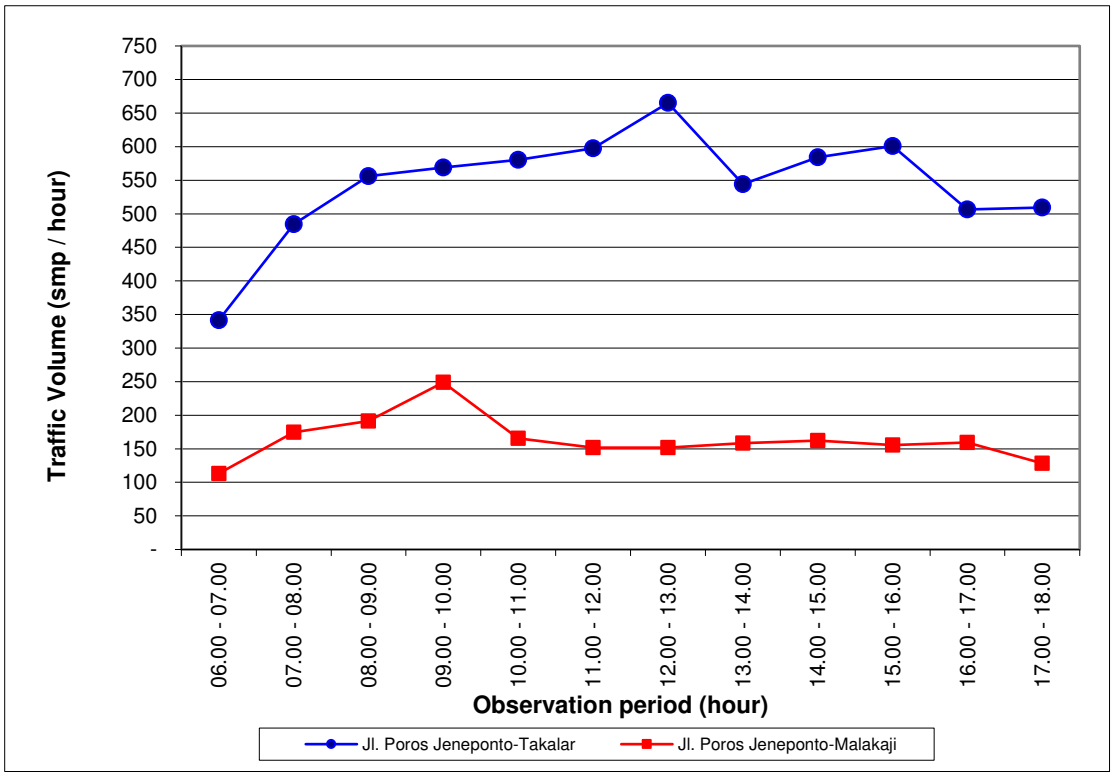
7.5.4.3 Traffic Characteristics and Performance

Traffic Volume Movement

The observation of traffic volume and its products show a picture of the movement of the traffic volume conditions on the roads observed, namely: Poros Jeneponto-Takalar Road and Poros Jeneponto-Malikaji Road, as shown in **Table 7-21.**

Table 7-21 Traffic Volume Around Tolo I Wind Farm Project Site Development Plan

Observations Time (Hours)	Traffic Volume (smp / hour)	
	Poros Jeneponto-Takalar Road	Poros Jeneponto-Malikaji Road
06.00 – 07.00	342	113
07.00 – 08.00	485	174
08.00 – 09.00	556	192
09.00 – 10.00	569	249
10.00 – 11.00	581	166
11.00 – 12.00	597	152
12.00 – 13.00	665	152
13.00 – 14.00	544	158
14.00 – 15.00	584	162
15.00 – 16.00	601	156
16.00 – 17.00	507	159
17.00 – 18.00	509	128
Peak Volume / hour	665 & 601	249 & 162
Average Volume / hour	545	163



Sources: UNHAS Field observation, 2016

Figure 7-28 Traffic Volume Graph around Tolo I Wind Farm Project Site Development Plan

Table 7-22 and **Figure 7-28** show that roads around the site for Tolo I Wind Farm Project, Jeneponto Regency, the Poros Jeneponto-Takalar Road section has a peak volume of 665 smp / hour, which occurred at 12:00 to 13:00 the morning and 601 smp / hour, which occurred at 15:00 to 16:00 during the day, with an average volume of 545 smp / hour, while Poros Jeneponto-Malikaji Road has a peak volume of 249 smp / hour, which occurred at 9:00 to 10:00 the morning and 162 smp / hour, which occurred at 2:00 p.m. to 15:00 noon, with an average volume of 163 smp / hour.

The large size of the traffic volume on Poros Jeneponto-Takalar Road and Poros Jeneponto-Malikaji Road is due to the many road users travelling toward Jeneponto or Takalar. An increasing volume of traffic is closely related to trading activities and other general activities carried out by people who live nearly, and the people using the road leading to the other districts. This is a local road that connects Jeneponto with Bantaeng and KabupatenTakalar as well as other districts.

- **Road Capacity**

Based on the traffic volume results obtained and after data processing, capacity value of the roads in the vicinity of the Tolo Jeneponto wind power station, are as shown in Table 7-22.

Table 7-22 Road Capacity

Observation Locations	Basic Capacity (Co)	Adjustment Factors for Capacity				Capacity I (smp/ hour)
		Lane Width (FCw)	Directions Segregation (FC_{SP})	Side Barriers (FC_{SF})	City Size (FC_{CS})	
Poros Jeneponto-Takalar Road	2900	0,87	1,00	0,92	0,90	2.089
Poros Jeneponto-Malikaji Road	2900	0,56	1,00	0,94	0,90	1.374

Source: Calculation Results, 2016

In Table 7-22**,** it appears that the value of the road capacity on roads around the site of Tolo I Wind Farm Project, namely: Poros Jeneponto-Takalar Road of 2089 smp / hour and Poros Jeneponto-Malikaji Road of 1374 smp / hour).

- **The Traffic Degree of Saturation**

According to survey results and data processing, a picture of the traffic degree of saturation (DS) was obtained on the observed roads, around the site for Tolo I Wind Farm Project, Jeneponto Regency, as presented in **Table 7-23.**

Table 7-23 Traffic Degree of Saturation (DS)

Observations Time (Hours)	Degree of Saturation (DS)	
	Jl. Poros Jeneponto-Takalar	Jl. Poros Jeneponto-Malakaji
06.–0 - 07.00	0.164	0.082
07.–0 - 08.00	0.232	0.127
08.–0 - 09.00	0.266	0.139
09.–0 - 10.00	0.272	0.181
10.–0 - 11.00	0.278	0.121
11.–0 - 12.00	0.286	0.111
12.–0 - 13.00	0.318	0.110
13.–0 - 14.00	0.261	0.115
14.–0 - 15.00	0.280	0.118
15.–0 - 16.00	0.288	0.113
16.–0 - 17.00	0.242	0.116
17.–0 - 18.00	0.244	0.093
Peak Degree of Saturation / hour	0.318 & 0.288	0.181 & 0.118
Average Degree of Saturation / hour	0.261	0.119

Source: Calculation Results, 2016.

In **Table 7-23**, it appears that the degree of saturation (DS) on roads around the site of Tolo I Wind Farm Project, Jeneponto Regency are far below the Degree of Saturation (DS) limit value required by the Directorate General of Highways and Transportation, namely DSmax = 0.75. The calculation results obtained: Jl. Poros Jeneponto-Takalar DS value, namely 0.318 at peak hours at 12:00 to 13:00 noon and 0.288 at peak hours at 15:00 to 16:00 pm, with an average

0.261 DS, while Jl. Poros Jeneponto-Malikaji DS value, namely 0.181 at peak hours at 9:00 to 10:00 morning and 0.118 at peak hours 14:00 to 15:00 during the day, with an average 0.119 DS.

Based on the phenomenon of the DS value, it can be said that the concentration of traffic flow on Jl. Poros Jeneponto-Takalar and Jl. Poros Jeneponto-Malikaji, with the highest current concentration on the road occurs at peak hours during the day.

- **Service Level Index (SLI)**

Service Level Index (SLI) values on Jalan Poros Jeneponto-Bantaeng, obtained by looking at the degree of saturation of the roads are observed, as presented in **Table 7-24.**

Table 7-24 Service Level Index (ITP) Values

Observations Time (Hours)	Service Level Index (SLI)			
	Jl. Poros Jeneponto-Takalar		Jl. Poros Jeneponto-Malakaji	
	DS	SLI	DS	SLI
06.–0 - 07.00	0.164	A	0.082	A
07.–0 - 08.00	0.232	A	0.127	A
08.–0 - 09.00	0.266	A	0.139	A
09.–0 - 10.00	0.272	A	0.181	A
10.–0 - 11.00	0.278	A	0.121	A
11.–0 - 12.00	0.286	A	0.111	A
12.–0 - 13.00	0.318	A	0.110	A
13.–0 - 14.00	0.261	A	0.115	A
14.–0 - 15.00	0.280	A	0.118	A
15.–0 - 16.00	0.288	A	0.113	A
16.–0 - 17.00	0.242	A	0.116	A
17.–0 - 18.00	0.244	A	0.093	A
Peak SLI/hour	A		A	
Average SLI/hour	A		A	

Source: Calculation Results, 2016.

Note: Determination of SLI Classification by the saturation level of the road.

In **Table 7-24** SLI values seen on roads around the site of Tolo I Wind Farm Project, Jeneponto Regency, namely Jl. Poros Jeneponto-Takalar and Jl. Poros Jeneponto-Malikaji, in general still have SLI value A, due to the low activity of the road on Jl. Poros Jeneponto-Takalar and Jl. Poros Jeneponto-Malakaji.

In general, the Service Level Index (SLI) of roads was observed by looking at the saturation levels obtained:

SLI A: The condition of the traffic flows freely from one vehicle to another vehicle, the magnitude of the speed is completely determined by the driver's wishes and in accordance with a predetermined speed limit.

- **Road Service Performance Assessment**

The performance assessment is based on the service road Highway Capacity Manual Indonesia (MKJI, 1997), which at the MKJI distinguished road service performance over the two (2)

categories, the performance of the service ro'd 'Good' and the performance category of service bad.

Degree of Saturation Value : < 0.75 = Good

Degree of Saturation Value : > 0.75 = Bad

The results of the analysis of the performance assessment of service on roads around the site of Tolo I Wind Farm Project, Jeneponto Regency, are presented in **Table 7-25.**

Table 7-25 Results of Roads Service Performance Assessment

Road Section Name	Degree of Saturation Average Value	Degree of Saturation Maximum Value	Road Service Performance Assessment
Jl. Poros Jeneponto-Takalar	0.261	0.318	Good
Jl. Poros Jeneponto-Malakaji	0.119	0.181	Good

Source: Calculation Results, 2016.

Based on the results presented in **Table 7-25**, it appears that the observed road still has the service performance categorized as Good.

7.6 Social and Cultural Sphere

Social, economic, and cultural baseline conditions in Tolo Wind farm study area in Jeneponto Regency are based on primary and secondary data. Secondary data were collected from the statistical offices in the publications Binamu, Turatea, Batang, and Arungkeke Districts in Figures 2015 and Jeneponto Regency in Figures 2015. Also obtained were, the booklets People's Welfare Indicators (Inkesra) and GDB, published by the statistical bureaus. Primary data were collected through interviews with people who live and work as farmers, traders, local government, and other stakeholders around the Tolo Wind Farm location. Respondent selection was done through the following steps:

(1) Scoping was conducted in areas in the vicinity of the Project site that are potentially affected. Scoping results showed that the Tolo Wind Farm location in Jeneponto Regency is administratively located in Empoang and North Empoang Kelurahans, Binamu District; East Kayuloe, West Kayuloe, Bontomatene, and Parasangan Beru Villages, Turatea District; Maccini Baji Village, Batang District; and Kalumpang Loe Village, Arungkeke District, all in Jeneponto Regency.

(2) Respondent selection was conducted using Purposive Sampling method, that is by direct selection of respondents to be interviewed with consideration of the flow of impacts likely to occur, the residential locations in proximity to Project area, status in the community, and types of livelihoods. Number of respondents was 135 people selected from the population of the eight affected villages, and is considered to represent the homogenous communities at the Project area.

Further to the above mentioned activity, EBJ has also conducted a detailed socio-economic census commenced in March 2017 until August 2017 to assess the vulnerability of the affected community caused by land acquisition. The summary of socio-economic census result is presented in **Appendix 5**.

7.6.1 Project Affected Communities

The project footprint crosses four Districts (Binamu, Turatea, Batang and Arungkeke) in Jeneponto Regency, South Sulawesi. The communities and people affected by the Project can be summarized as living mainly in four these districts as follows:

- Binamu District: Empoang and North Empoang Villages
- Turatea District: East Kayuloe, West Kayuloe, Pa'rasangang Beru and Bontomatene Villages
- Batang District: Maccini Baji Village
- Arungkeke District: Kalumpang Loe Village

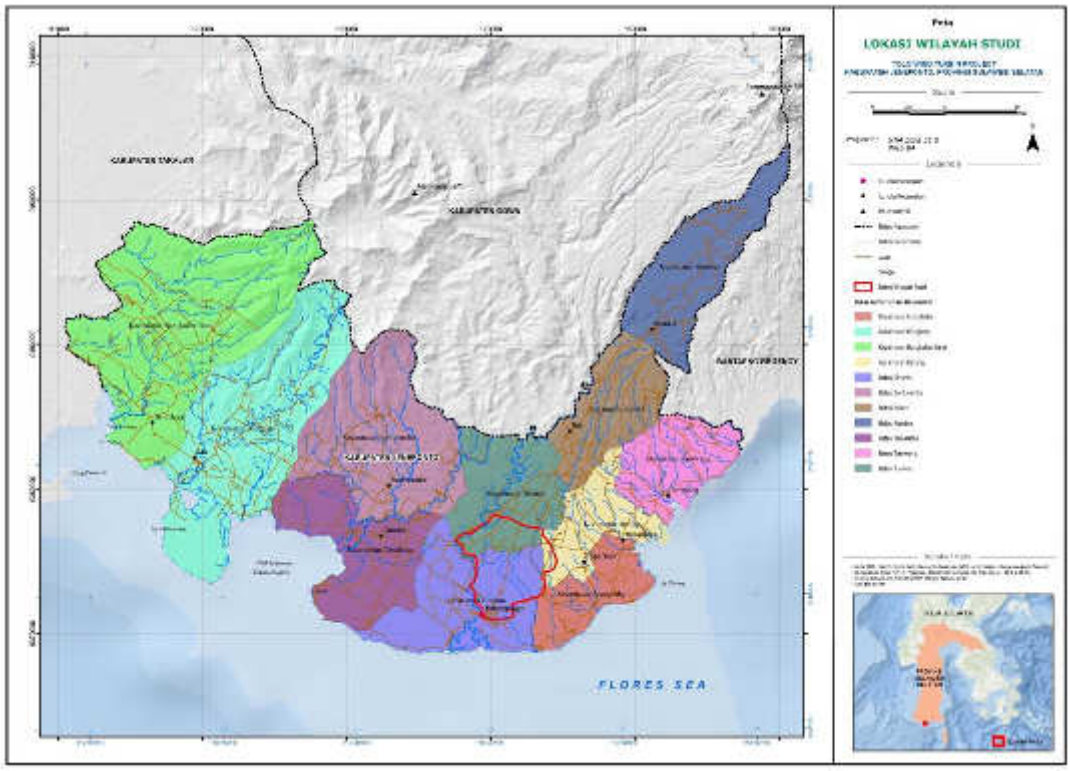


Figure 7-29 Location of Affected Communities

The following section describes the social data for these communities to gain a better understanding of the baseline conditions.

7.6.2 Demography

This section looks at demographic key indicators to understand Project-affected communities, existing population dynamics, and how they may be influenced by the Project as well as availability in numbers and quality of human resources. Population density in the Project area is on average over 500 people per square kilometer. Gender ratios of all villages are well below 100, an indication that the male population may be seeking work outside of the area with little option for employment opportunities. Household consists of 4 to 5 members. **Table 7-26** lists the demographic details.

Table 7-26 Population, Households, Area, and Density of Districts and Villages in Region of Development Plan for Tolo I Wind Farm Project (Binamu, Turatea, Batang, and Arungkeke Districts, Jeneponto Regency)

District/ Village	Size Area (km^2)	Population					Households	Average Household Numbers
		Male	Female	Total	Population Density Person/ Km^2	Gender Ratio		
Binamu District	69.49	26,229	27,811	54,040	778	94	11,688	4.6
Empoang Village	9.45	4,141	4,376	8,517	901	95	1,852	4.6
North Empoang Village	10.09	1,822	1,953	3,775	374	93	794	4.8
Turatea District	53.76	14,889	15,955	30,884	574	93	6,951	4.4
East Kayuloe Village	2.41	590	736	1,326	550	80	307	4.3
West Kayuloe Village	6.77	1,236	1,340	2,576	381	92	537	4.8
Bontomatene Village	4.76	1,885	1,983	3,868	813	95	851	4.5
Pa'rasangan Beru Village	1.86	674	793	1,467	789	85	303	4.8
Batang District	33.04	9,313	10,472	19,784	599	89	4,548	4.4
Maccini Baji Village	5.48	1,742	1,860	3,602	657	94	814	4.4
Arungkeke District	29.91	8,979	9,817	18,796	628	91	4,410	4.3
Kalumpang Loe Village	4.38	1,093	1,181	2,274	519	93	520	4.4
Jeneponto Regency	749.79	170,873	182,414	353,287	7,096	94	80,068	4.4

Source: Jeneponto Regency in Figures, 2015

Both age and gender structure of a population can help to understand economic characteristics of a region such as workforce potential and econonomic dependency. The composition of the population by age group and gender in Binamu, Turatea, Batang, and Arungkeke Districts, as can be seen in **Table 7-26, s**hows that the young and the elderly are making up nearly half of the total population, or on average around 40%, and therefore dependency ratio is relatively high, ranging between roughly 60 to 66%.

The dependency ratio is a calculation used to assess the age-population ratio of those not considered working (that is, those younger than 15 or older than 64) over those typically in the labor force. It can be used to measure the pressure on the productive population. A high dependency ratio indicates that a greater burden is placed on the productive age group to support those in need, the young and the old. According to Pollard, Yusuf and Pollard (1974), a dependency ratio value of 0–30 is considered low, 31–60 moderate, while >60 is heavy dependency. The dependency ratio for the Project affected area is much higher compared to the Indonesian average of 49%. This means that for every productive age person there is more

than one of non-productive age, or in other words, dependent on that productive age person for goods and services they consume.

Table 7-27 Population by Age Group and Gender in Project Affected Districts Binamu, Turatea, Batang and Arungkeke

Age Group (Years)	Population (People)			Percentage (%)	Dependency Ratio
	Male	Female	Total		
Binamu					
0 – 14	8,760	8,216	16,976	31.41	
15 – 59	15,801	17,241	33,042	61.14	
> 60	1,668	2,354	4,022	7.45	
Total	26,229	27,811	54,040	100	63.5%
Turatea					
0 – 14	4,847	4,549	9,396	30.46	
15 – 59	8,782	9,824	18,606	60.33	
> 60	1,259	1,582	2,841	9.21	
Total	14,888	15,955	30,844	100	65.8%
Batang					
0 – 14	2,924	2,794	5,718	28.91	
15 – 59	5,523	6,481	12,004	60.68	
> 60	865	1,196	2,061	10.41	
Total	9,312	10,471	19,783	100	64.8%
Arungkeke					
0 – 14	2,881	2,643	5,524	29.66	
15 – 59	5,481	6,197	11,678	62.69	
> 60	617	807	1,424	7.65	
Total	8,979	9,817	18,626	100	59.5%

Source: Districts Binamu,Turatea, Batang, and Arungkeke in Figures, 2015

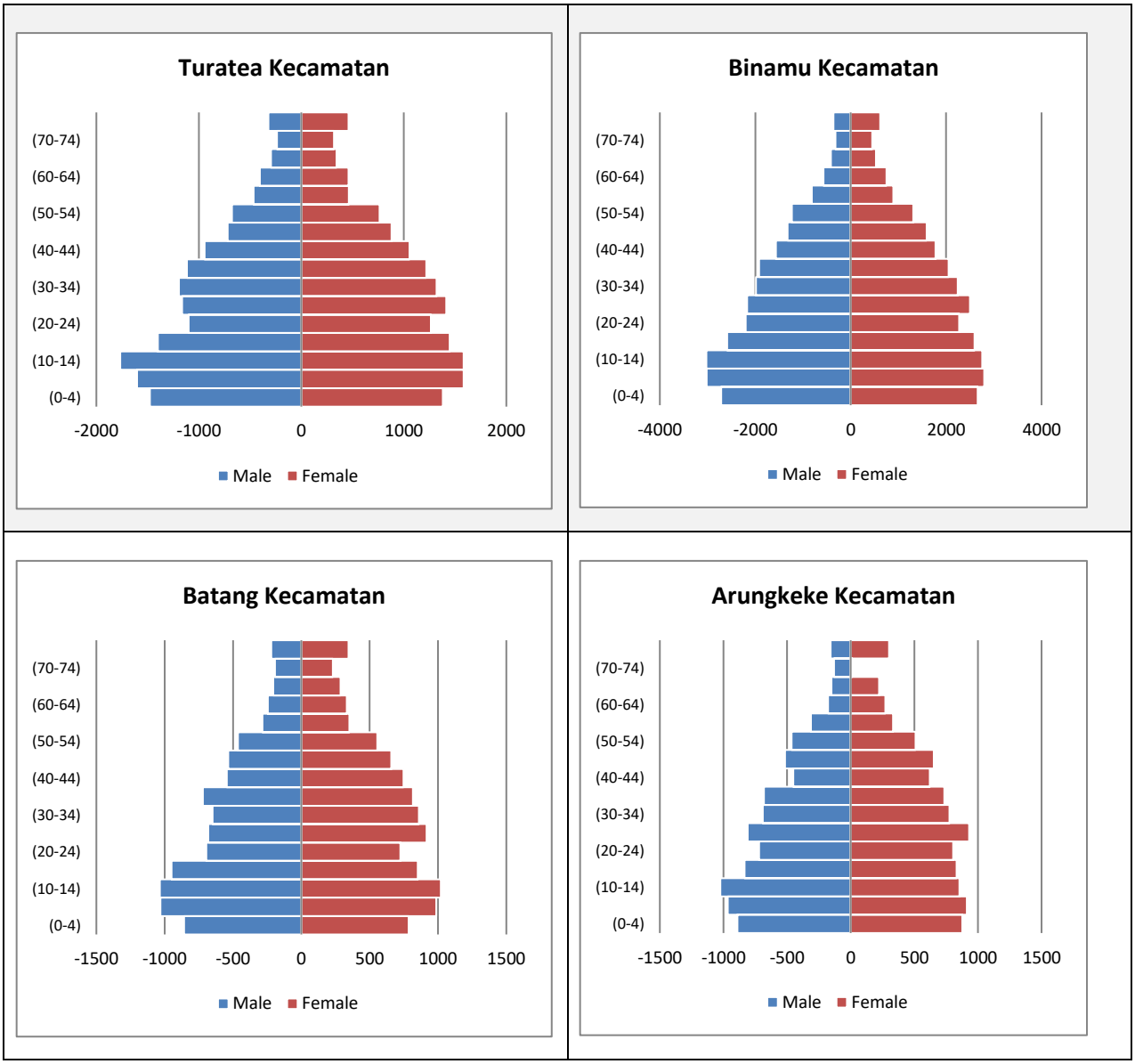


Figure 7-30 Population Pyramids in Study Area

The population pyarmids of the Project-affected Districts show a relatively steep "Christmas tree" shape, an indication that the younger population is on the decline. Interestingly there is a relativey high segment of the elderly above 75 years of age in all these Districts.

7.6.3. Local Economy

1). Gross Regional Domestic Product (GRDP)

Gross Domestic Product is one reflection of the economic progress of a region; it is defined as the total value-added of goods and services produced in a year in region. The size of the Gross Domestic Product (GDP) of a region is determined by the potential economic resources owned. Based on the results of the calculation of the GDP for the year 2014, the value of GDP at current prices of Jeneponto is Rp 6,139,984,700 million. Jeneponto's economic development can be seen from the performance of the GDP (Gross Domestic Product), which can be illustrated in the economic fluctuations from year to year, as seen in **Table 7-28**.

Table 7-28 Gross Regional Domestic Product (GRDP) at Current Prices by Industry in Jeneponto, 2012-2014 (Million)

No	Business Field	2012	2013	2014
1	Agriculture, Forestry and Fisheries	2,408,673.6	2,657,663.3	3,221,349.5
2	Mining & Quarrying	89,549.7	107,218.6	144,121.7
3	Processing industry	157,450.5	178,241.7	206,372.9
4	Provision of Electricity and Gas	7,600.5	7,589.6	8,244.5
5	Water Supply, Waste Management, Waste and Recycling	4,163.8	4,711.2	5,174.7
6	Construction	426,674.8	488,419.2	553,645.1
7	Wholesale and Retail: Repair of Cars and Motorcycles	568,204.5	622,866.4	682,016.3
8	Transportation and Warehousing	45,735.2	52,851.3	62,571.2
9	Provision of accommodation, foods & drinks	12,330.4	13,674.2	16,251.0
10	Information and Communication	179,980.6	217,758.4	238,477.4
11	Financial Services and Insurance	114,224.1	130,058.4	145,085.9
12	Real Estate	117,279.3	132,705.7	144,606.9
13	Company Services	906.7	1,024.6	1,036.7
14	Administration, Defence and Compulsory Social Security	352,567.7	379,868.8	414,191.1
15	Educational Services	109,986.0	121,051.6	131,513.3
16	Health Services and Social Activities	100,095.6	114,729.0	133,461.1
17	Other services	24,955.9	27,919.2	31,865.4
	Total	4,720,379.0	5,258,354.3	6,139,984.7

Source: BPS –Jeneponto Regency GRDP, 2015

Table 7-28 shows that during 2012 and 2014, the value of the Jeneponto GDP based on current prices showed a significant growth, that in 2012-2013 the value of GDP grew by 11.4%. In 2013-2014 it grew by almost 17%.

The business field with by far the most contribution to the Jeneponto GDP in 2014 was the agricultural sector at Rp. 3,221,349.5 billion following the wholesale and retail trade, repair of cars and motorcycles at Rp. 682,016.3 billion, and the smallest sector's contribution to the GDP of Jeneponto, the sector of water supply, sewage treatment, waste, and recycling, at only Rp. 5,174.7 million, while the provision of electricity and gas sector amounted to Rp. 8,244.5 million.

2). Locally-Generated Revenue (PAD)

Jeneponto BPS data in 2014 showed that the Regional Revenue Budget in Jeneponto was Rp. 823,240,112 thousand, an increase of 12.8% from the year 2013 when it was only Rp. 729,821,356 thousand. The increase comes from PAD, Balance Funds, and Other Revenue. For more details, the development of Jeneponto PAD in years 20–3 - 2014 is presented in **Table 7-29**.

Table 7-29 Locally-Generated and Other Revenue, Jeneponto Regency, 2013 – 2014

Description	Revenue/Year (000 Rp)	
	2013	2014
Regional Revenue Budget	729,821,356	823,240,112
Locally-Generated Revenue	16,617,581	46,032,161
Balance Funds	599,305,499	637,516,658
Other Revenue	106,068,791	120,863,247

Source: BPS – Jeneponto Regency in Figures, 2015

7.6.4. Labor Force and Employment Levels

Working Age Population (PUK) is defined as the population aged 10 years and over. The Labor Force consists of residents who are working and those looking for work. Meanwhile, the non-labor force is made up of people in school, taking care of households, or those doing other activities besides paid employment.

Residents who are seeking employment in Jeneponto by education level and gender, according to Central Statistics Bureau (BPS) in 2015, can be seen in **Table 7-30.**

Table 7-30 Unemployed Population by Education and Gender in Jeneponto 2014

No.	Level of Education	Male (People)	Female (People)	Total (People)	Percentage (%)
1.	Primary School	10	-	10	1.00
2.	Junior High School or equivalent	82	19	101	10.13
3.	Senior High School or equivalent	400	260	660	66.19
4.	Diploma 1-3 or equivalent	25	40	65	6.52
5.	Bachelors Degree	90	70	160	16.05
6.	Masters Degree	1	-	1	0.10
	Total	608	389	997	100.00

Source: B–S - Jeneponto in Figures, 2015

Table 7-30 shows that the numbers of people looking for work with a variety of educational backgrounds are still quite high at around 997 people, with 608 males and 389 females, with the population of job seekers educated to Senior High School (SLTA) at 660 or 66.19% of the job seekers, followed by those with a Bachelor Degree (S1) of 160 people or 16.05%, Junior High School educated number 101 or 10.13%, Diplomas 1 to 3 account for 65 people or 6.52% and the population of job seekers with a Masters education is 1 person or 0.10%.

7.6.5. Livelihoods and Economic Activities

Based on profile data for the Regency, the livelihoods of residents in the study area of the Tolo I Wind Farm Project development in the Districts of Binamu, Turatea, Batang, and Arungkeke vary from farmers, livestock breeders, seaweed and fish farmers, fisherman, market traders

and retail workers, transport workers, industrial workers/craftsmen, and service workers and civil servants, military, and police, as can be seen in **Table 7-31.**

Table 7-31 shows the livelihoods of residents in Batang are largely food farmers at 93.2%, similarly in Binamu at 45.2%, in Turatea at 53.7%, and in Arungkeke at 59.5% Farmers in the project area are dominant due to the widespread availability of agricultural land, so the majority of workers are food farmers and livestock breeders.

Table 7-31 Types of Livelihood of Residents in Tolo I Wind Farm Project Study Areas

Districts	Type of Work	Total Population	Percentage (%)
Binamu	PNS / Police / Army	2,338	13.21
	Food farmers	8,057	45.52
	Fish farmers, fishermen, seaweed farmers	1,356	7.66
	Breeders	1,620	9.15
	Traders (kiosks, shops, restaurants)	1,422	8.03
	Transport workers	499	2.83
	Industry / craftsman	353	1.99
	Service workers	2,054	11.61
	Total	**17,699**	**100**
Turatea	PNS / Police / Army	783	5.94
	Food farmers	7,071	53.66
	Fish farmers, fishermen, seaweed farmers	-	-
	Breeders	3,429	26.02
	Traders (kiosks, shops, restaurants)	664	5.04
	Transport workers	820	6.22
	Industry / craftsman	270	2.05
	Service workers	139	1.05
	Total	**13,176**	**100**
Batang	PNS / Police / Army	264	4.97
	Food farmers	4,891	93.23
	Fish farmers, fishermen, seaweed farmers	226	4.26
	Breeders	3,610	68.07
	Traders (kiosks, shops, restaurants)	292	5.5
	Transport workers	77	1.45
	Industry / craftsman	169	89.62
	Service workers	184	3.46
	Total	**5,303**	**100**
Arungkeke	PNS / Police / Army	211	2.4
	Food farmers	5,222	59.45
	Fish farmers, fishermen, seaweed farmers	862	9.81
	Breeders	177	2.01
	Traders (kiosks, shops, restaurants)	730	8.31
	Transport workers	802	9.13
	Industry / craftsman	444	5.05
	Service workers	335	3.81
	Total	**8,783**	**100**

Source: B–S - Districts Binamu, Turatea, Batang, and Arungkeke in Figures, 2015

From the interviews, it is known that more than 50% of the people within Jeneponto Region mainly work as a food farmer owner. The number of farmers (consisting of farmers who own

the land and sharecroppers) identified during the interview are proportionate with the secondary data, gathered previously. Whereas there are similar number of traders and civil servants, reaching 11.7% and 15% respectively. This differs slightly with the secondary data where normally the traders have a higher number of people compared to civil servants. Nevertheless, the amount isn't starkly different, therefore it could be because the secondary data didn't account for the side work that people do.

About 66% of the population in Jeneponto have side jobs besides their main occupation of work. The type of work is scattered on a very diverse list from construction workers to entrepreneurs. The most common occupation is farmers at about 15% and construction workers at about 12%. The other occupations mainly consist of garage workers, horse traders, and also entrepreneurs.

7.6.6. Land Use

Land use in the Tolo I Wind Farm Project study region is dominantly pasture and paddy field in Binamu and Batang Districts, and paddy field in Turatea and Arungkeke Districts, as illustrated in **Table 7-32.**

Table 7-32 Land Utilization in Binamu, Turatea, Batang and Arungkeke Districts

No.	Districts	Land Use	Area (Ha)	Percentage (%)
1.	Binamu	Paddy field	2,090	37.42
		Yard	-	-
		Pasture	3,280	58.72
		Fishpond	215.7	21.76
		Other	-	-
	Total		*5,585.7*	100.00
2.	Turatea	Paddy field	3,060	56.96
		Yard	200.11	3.72
		Pasture	2,085.8	38.82
		Fishpond	-	-
		Other	26.65	0.50
	Total		*5,372.56*	100.00
3.	Batang	Paddy field	1,430	48.37
		Yard	147	4.97
		Pasture	1,494	50.54
		Fishpond	32	1.08
		Other	-	-
	Total		*2,956*	*100.00*
3.	Arungkeke	Paddy field	1,870.84	61.87
		Yard	154.52	5.11
		Pasture	499.82	16.52
		Fishpond	498.64	16.49

No.	Districts	Land Use	Area (Ha)	Percentage (%)
		Other	-	-
	Total		*1,023.82*	*100.00*

Source: BPS Districts Binamu, Turatea, Batang and Arungkeke Districts in Figures, 2015

According to the data presented above, the majority of the land in the four districts in the project area is used for paddy field for about 56% of the total land.

7.6.7. Education and Skill Base

- **Population by Education**

According to Director General of Rural Development (1982), education level assessment criteria are based on the number of people who graduated from elementary school on up. By that measure, the level of education can be divided into three categories, namely:

1. Low education, if the number of people who graduated from primary school upwards amounts to less than or equal to 30 percent of the population.
2. Medium education, when the number of people who graduated from primary school upwards amounts to 30-60 percent of the population.
3. Higher education, where the number of people who graduated from elementary school upwards amounts to more than 60 percent of the population.

At the location of the planned development activities of Tolo I Wind Farm Project, education level of the population varies from people who never went to school (illiterate), did not complete primary school, completed primary school, to junior high, high school, and higher.

- **Education Facilities**

Table 7-33 Education Facilities in Study Area

District and Village	Elementary School (SD)			Junior High School (SMP)			Senior High School (SMA)		
	Schools	Students	Teachers	Schools	Students	Teachers	Schools	Students	Teachers
Binamu District	32	3,664	504	10	2,673	262	13	3,719	346
Empoang Village	3	1,223	60	3	1,122	94	3	192	55
Empoang North Village	2	172	27	0	0	0	0	0	0
Turatea District	22	3,785	319	7	1,080	131	2	446	158
East Kayuloe Village	1	165	12	0	0	0	0	0	0
West Kayuloe Village	3	332	32	1	90	14	0	0	0
Bontomatene Village	2	350	28	0	0	0	0	0	0
Pa'rasangan Beru Village	2	287	29	1	102	13	0	0	0
Batang District	16	2,749	221	2	386	34	1	626	40
Maccini Baji Village	3	448	44	1	294	20	0	0	0

District and Village	Elementary School (SD)			Junior High School (SMP)			Senior High School (SMA)		
	Schools	Students	Teachers	Schools	Students	Teachers	Schools	Students	Teachers
Arungkeke District	14	2,419	198	2	598	44	2	257	51
Kalumpang Loe Village	2	314	30	0	0	0	0	0	0
Jeneponto Regency	288	46,171	1,747	74	13,481	711	21	7,210	615

Source: BPS Districts Binamu, Turatea, Batang and Arungkeke Districts in Figures, 2015

7.6.8. Societal Organization

From the primary data gathered, the farmers group is the prominent societal organization in the Jeneponto region and accounts for more than 86% of the total respondents. This is in line with the types of livelihood, which are dominated by farmers and residents working in agriculture. The remaining population is divided into four other organizations. The second most populous is the Petani Pemakai Air (P3A) or irrigation farmers association with almost 5% of the interviewees, Then an equal number of people remain in the Badan Permusyawaratan Desa (BPD) and Koperasi Management at about 3.3%. The least number of people join the Karang Taruna or Youth Group as their societal organization of choices which consists of about 1.6%.

7.6.9. Norms and Cultural Aspects

- **Socio-cultural**

The social norms that have been handed down or developed by the Makassarese residents and in-migrants around the Tolo I Wind Farm Project site in Binamu, Turatea, Batang, and Arungkeke Districts include customs, social processes, attitudes, and perceptions. Based on field observations, people who live permanently or work in the site region generally are natives of Jeneponto (Makassar tribe) as well as in-migrants. The everyday languages used in this region are the native language (Jeneponto) and Indonesian. Therefore, relations between locals and immigrants have led to intensive and dynamic social process within community social system around the planned Wind Farm site.

- **Customs**

In Makassar tribal cultures, a number of values and concepts have great effect on behavior and social interaction. These values are: the meaning of *Tau* (people); meaning of *Sirik* (self-esteem); meaning of *Pacce* (compassion), meaning of *Pangngalik* (respect), and the meaning of *Panganga-dakkang* (customs).

Some fragments of customs developed in Makassar tribal communities in the past and are still alive, although not carried out in accordance with customary *adat*. Custom fragments are related to home, dress, etiquette, communication, traditional ceremonies such as marriage ceremonies and funerals, and are closely related to trust in the social system. Customs prevailing in Makassar tribal social system "*Panganga-dakk”ng*" include norms and standards for behavior in everyday life. Social stratification is traditionally a cultural heritage from the ancestors in Makassar tribal communities.

In the social system, the tribal community in Jeneponto Makassarese consists of three social strata, *Karaeng* the upper class or nobility, *Daeng*, the middle classes, and *To Samara* in the lower class. In Makassar, tribal social structure and stratification have adjusted to the changing socio-economic conditions.

Some values that initiate the formation of tribal culture Makassar were created to honor the ancestors as the foundation stone of culture. This value is transferred from generation to generation with advice and messages. The advice is contained in *lontara-lontara* (Brahmic script) palm leaf documents called "*Pas"ng*". "*Pas"ng*" means a will that is maintained, which emphasizes the necessity of abstinence. People who maintain it will always be respected in society, whereas those who do not heed will bear enormous social sanction. Customs that have been handed down by citizens of Jeneponto Makassar tribes and the in-migrant population in the study area are a culture that has been crystallized in social life for residents. These habits are carried out in the form of community activities such as traditional marriage ceremonies, Quran graduations, Prophet Muham'ad's Birthday, circumcisions, and funerals. Habits determine a good day for weddings, as well as for starting work in the plantations / fields, building houses, and building places of worship; there are habits for starting a business.

A cultural value that has been a lifeline in Jeneponto society is *Siri Napacce* (self-esteem). This enjoins people to always uphold Jeneponto character, independence, democracy, honesty, assertiveness, fighting for truth and justice, and partnership upheld in everyday social life. Indigenous culture very strongly controls social life and generally is very close to the religious norms, although each region has its customs and procedures for different activities, but remains united with the values upheld by all

- **Social process**

Social interaction and communication that exists among residents around the Project site in Kelurahan Empoang and North Empoang, Binamu District; East Kayuloe, West Kayuloe, Bontomatene, and Parasangan Beru Loe Villages, Turatea District; Maccini Baji Village, Batang District; and Kalumpang Loe Village, Arungkeke District have manifested in form of social integration. Social processes that occur have lasted since the beginning, that cause the assimilation process (adjustment of attitudes and behaviors) between the citizens, and the acculturation in the community.

The creation of accommodation between residents in rural and urban villages through various activities undertaken by mutual cooperation and through various meetings conducted among residents. Various activities such as cleaning up the environment, road improvements, culverts, religious structures (mosques, prayer rooms, and other places of worship), cleaning or beautifying the village for the celebration of national days, as well as security guards (*siskamling*) and religious activities such as teaching, are carried out by groups of people in every mosque in the village. These are undertaken by the PKK, the Assembly Taqlim, mosque youth, and other youth groups. These activities are media for interaction and communication between citizens.

In addition, the role of various social institutions that exist in the villages in the site region are BPD (Village Deliberaton Agency) or LPMK (Community Development Institution at Village level), religious leaders, traditional leaders, and community leaders, and encourage community participation in various development activities in the villages. Similarly, they

encourage interaction and intensive communication between citizens. Social integration of citizens in the study area is an acculturation process, with migrants participating.

From the primary data collected by direct interview, the majority of the people, more then 96% of the interviewees, still implement the societal norms in their daily lives. Within those norms, the most common activity exercised is the marital norms which account for more than 62% of the population that agree with them. The next most common activity norms are building houses and funerals with the same persentage at 11.5%. The circumcision norm is the next common norm to be enacted by the people in the Jeneponto region, where 10.2% still utilize it.

7.6.10. Religion

100% of communities in Turatea, Batang, and Arungkeke Districts are Muslim, while 99.85% of communities in Binamu District are Muslim, with the rest Catholics and Protestants. The number of worship places within the study area is presented in the **Table 7-34.**

Table 7-34 Worship Facilities in Study Area

No.	Districts	Worship Place			
		Mosque	Mushala/ Mosque	Small	Other
1	Binamu	72	53		-
2	Turatea	50	22		-
3	Batang	32	12		-
4	Arungkeke	30	14		-
	Total	184	101		-

7.6.11. Cultural Heritage

Cultural and Archaeological Sites

Cultural and archeology sites are historical relics and objects or historic buildings that are protected and maintained by the state or the regional government because they have priceless historical value, as with old mosques, temples, fortifications, traditional houses, tombs of kings, the tombs of heros, and other historical objects.

The results of field surveys indicate that in the planned Tolo I Wind Farm Project site region in Empoang and North Empoang Kelurahans, Binamu District; East Kayuloe, West Kayuloe, Bontomatene, and Parasangan Beru Village, Turatea District; Maccini Baji Village, Batang District; and Kalumpang Loe Village, Arungkeke District; Jeneponto Regency, there are no cultural relics and objects--historic buildings or sites in the form of cultural and archaeological sites. However, there are some groundwater wells that are deemed sacred. One well is located close to the main road at Kayuloe Timur village and the other well is located also close to the main road at Kalumpang Loe village. The planned development of the Tolo I Wind Farm Project will not interfere with these sacred features. Access to these sacred wells will not be restricted, especially during construction, as these wells are located outside the construction area.

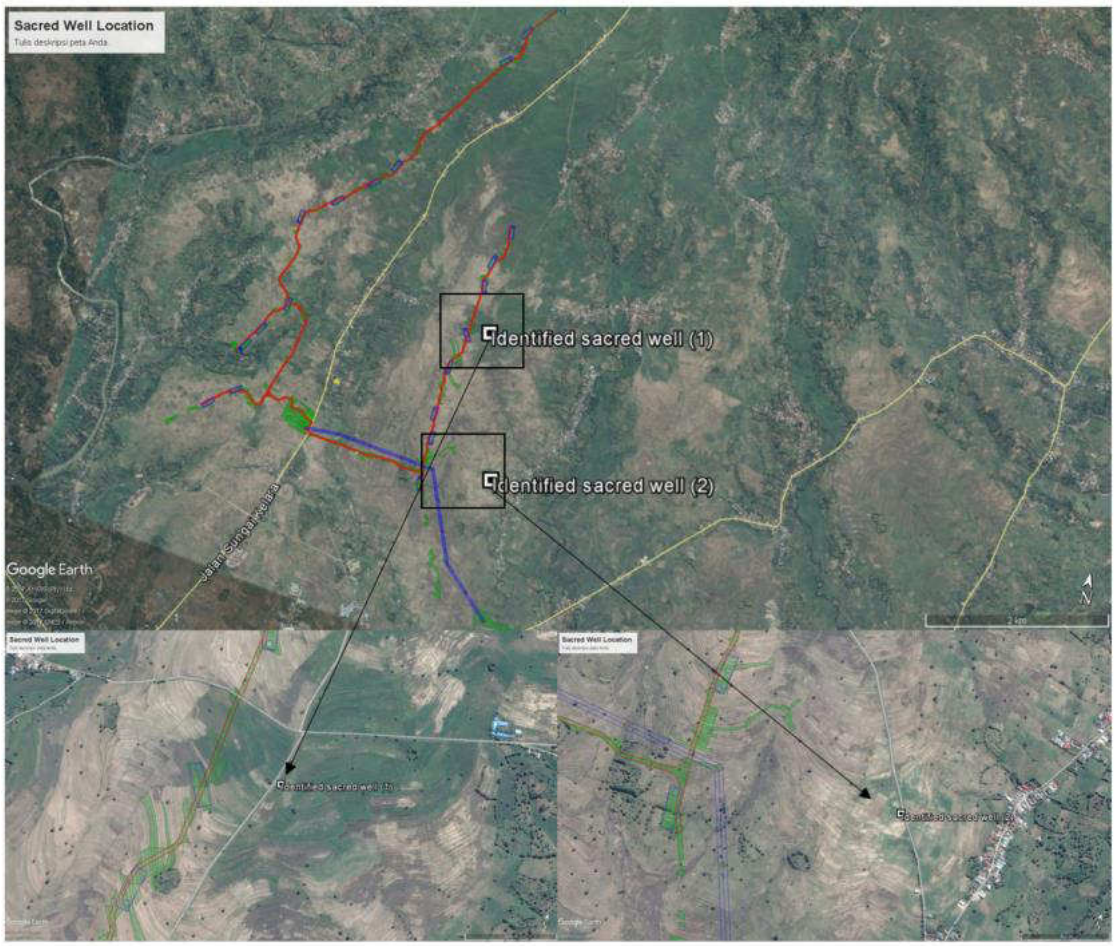


Figure 7-31 Location of the Sacred Wells

7.6.12. Public Health

- **Environmental Health and Public Health**

Public health is a condition of physical and psychological endurance of a community in a particular area, the implementation and the interaction between behaviors that becomes a mirror of the habits of life, and forms the quality of environmental health. Environmental health is a condition of the various environmental media (air, water, soil, food, humans, and disease vectors) that are reflected in the physical, biological, chemical, and environmental quality parameters that affect public health.

To illustrate the potential magnitude of the impact and relevance (associations) between environmental parameters with people who are exposed, the approach is based on the Analysis of Impact on Environmental Health, which describes the measurement conditions at the source, emission/ambient factors, public exposure (biomarkers), and the effects of interactions (prevalence and the incidence of the disease, the incidence of poisoning, and accidents).

In the preparation of Terms of Reference for the Environmental Impact Assessment (KA-ANDAL) for the Tolo I Wind Farm Project power plant construction, the scoping process has been carried out that aims to determine the limits of the problems in identifying and evaluating

potential impacts in order to obtain an overview of the significant impacts. Things that are considered in the scoping study of the public health aspects of this include:

- Predicted environmental parameters affected by the development plan and the effects on health
- Identification of potential impacts, done through an assessment of the environmental parameters (physical, biological, social) and likely to be a range of issues relating to public health.
- Assessment of physical environmental parameters, primarily aimed at matters relating to the potential spread of pollutants in the environment (water, air, and food vectors). To make this assessment requires measuring the parameters of environmental media including of water quality and air quality around the site in accordance with the outcome of the scoping process at each stage of the action plan.

- Process and potential for exposure

Assessment of the exposure pathways that may occur (in the future) is carried from the source, via transport media, to points of exposure, exposure means, and the population exposed / receptors. Assessment is also important for the dynamics (transport mechanism) of pollutants such as gas, liquid, or particles in a medium (environmental) and their dispersion.

Sources include the overall plan of activities that have impacts either directly or indirectly on public health. For example, the public health impact that may occur as a result of environmental degradation in the form of rising levels / concentrations of dust (particulate matter) in air due to construction activities or mobilization of material.

Air is the medium for transport of particulate matter pollutants, the measurement of air quality in terms of parameters such as particulate matter at the points of exposure / contact with the population, especially the affected communities. Therefore the mechanism / means of dust exposure to humans is mainly through the respiratory tract (inhalation) without ruling out by means of direct contact on food / drinks and passing through the digestive tract (oral), then the calculation is for Risks to Environmental Health for each type of intake either by breathing (inhalation) or gastrointestinal (oral ingestion).

This assessment is carried out for each phase of activity, which includes pre-construction, construction, operation, and post-operation in accordance with the results of scoping and forecasts of hypothetical significant impacts.

- **Potential magnitude of impacts of diseases (morbidity and mortality)**

Epidemiological analyses are carried out using the existing reports of health care institutions (*Puskesmas* or Public Health Agency) to measure morbidity ((diseases) and mortality (deaths) by certain cause in the community. If deemed necessary, epidemiological studies can be carried out to examine the incidence and prevalence due to project development activities. As an illustration of the initial patterns / baseline associated with morbidity, following is tabulated a list of the ten (10) major diseases in *Puskesmas* Binamu, Bontom'te'ne, and Bululoe in 2015 (**Table 7-35**).

Table 7-35 Data of Ten Main Diseases in *Puskesmas* in District Binamu, Jeneponto Regency 2015

No.	ICD Code	Type of Disease	Total Incidence	Percentage (%)
1	J–0 - J01 J–5 - J06	Other upper respiratory tract acute infections	2,413	25.02
2	J10 – J11	Influenza	1,579	16.37
3	L20 – L30	Dermatitis and eczema	1,231	12.77
4	M05	Rheumatism	769	7.97
5	K29.0	Gastritis	699	7.25
6	A09.1	Diarrhea & gastroenteritis caused by specific infection (colitis infection)	654	6.78
7	I10	Essential hypertension (primary)	605	6.27
8	R51	Headache	568	5.89
9	M79	Other soft tissue disorders	567	5.88
10	R50	Unexplained fever	558	5.79
		Total	9,643	100.00

Source: SP2TP *Puskesmas* Binamu, 2015

Table 7-36 Data of Ten Main Diseases in *Puskesmas* Bontomate'ne, District Turatea, Jeneponto Regency 2015

No.	ICD Code	Type of Disease	Total	Percentage (%)
1	J–0 - J01 J–5 - J06	Other upper respiratory tract acute infections	4,275	22.46
2	J45	Asthma	1,947	10.23
3	M13	Other Artritis	1,940	10.19
4	K29.0	Gastritis	1,913	10.05
5	I10	Essential hypertension (primary)	1,833	9.63
6	L20 – L30	Dermatitis and eczema	1,662	8.73
7	R51	Headache	1,567	8.23
8	D64.9	Other unspecific Anemia	1,322	6.95
9	L00 – L08	Infections of skin and subcutaneous tissue / Ploderma	1,312	6.89
10	H00 – H01, H–0 - H13, H33, H–9 - H50, H54, H–5 - H59	Other eye diseases	1,261	6.63
		Total	19,032	100.00

Source: SP2TP *Puskesmas* Bontomate'ne, 2015

Table 7-37 Data of Ten Main Diseases in *Puskesmas* Bululoe, District Turatea, Jeneponto Regency 2015

No.	ICD Code	Type of Disease	Total	Percentage (%)
1	I10	Essential hypertension (primary)	2,742	16.76
2	V02.1	Wounds caused by accident	2,580	15.77
3	M79	Other soft tissue disorders	2,488	15.21
4	J10 – J11	Influenza	1,711	10.46
5	K29.0	Gastritis	1,453	8.88
6	J–0 - J01 J–5 - J06	Other upper respiratory tract acute infections	1,301	7.95
7	R05	Cough	1,210	7.39
8	L20 – L30	Dermatitis and eczema	1,032	6.31
9	L00 – L08	Infections of skin and subcutaneous tissue / Ploderma	998	6.10
10	R66	Symptoms and other common signs	848	5.18
		Total	16,363	100.00

Source: SP2TP *Puskesmas* Bontomate'ne, 2015

Health resources

Health facilities and infrastructure located around the Project site are viewed primarily in relation to the ratio of the number of facilities to population, and the adequacy of health workers. It is important to provide an overview of aspects of health care as one of the factors that contribute to the health status of the communities around the Project site.

Table 7-38 Total Health Care Human Resources According to *Puskesmas* Jeneponto

No.	Type of Health Workers	*Puskesmas*		
		Binamu	Bontom'te'ne	Bululoe
1	General Practitioners	4	0	0
2	Dentist	1	1	1
3	Public Health	0	2	1
4	Environmental Health	1	0	2
5	Nutritionist	3	1	0
6	Midwife	3	5	3

7	Nurse	4	3	9
8	Dental Nurse	2	1	1
9	Assistant Pharmacist	2	1	0
10	Non Medical HR	6	4	0
	Total	26	18	17

Source: Healthcare Human Resources Jeneponto Regency, 2016

Table 7-39 Total Health Care Human Resources in Study Area

District and Village	Doctor				Nurse	Midwife	Traditional Birth Attendant (TBA)
	Specialist	Dentist	General Practitioner	Total			
Binamu	-	3	6	9	N/A	52	28
Empoang Village	-	1	2	3	N/A	7	2
North Empoang Village	-	-	-	-	-	4	2
Turatea	-	2	1	3	6	7	21
East Kayuloe Village	-	-	-	-	-	-	1
West Kayuloe Village	-	-	-	-	-	1	1
Bontomatene Village	-	1	1	2	1	1	1
Pa'rasangan Beru	-	-	-	-	-	1	1
Batang	-	1	1	2	10	11	13
Maccini Baji Village	-	-	-	-	-	-	1
Arungkeke	-	-	1	1	10	15	17
Kalumpang Loe Village	-	-	-	-	-	2	3
Jeneponto Regency	-	14	34	48	224	83	N/A

Source: Binamu, Turatea, Batang, Arungkeke and Jeneponto in Figures 2015

Based on the information presented above, the Project is in the opinion that the health facility for the local community is considered adequate to accommodate the public health services in the area.

- **Access to Health Facilities**

The existence of health facilities near residential areas will determine the success of efforts to control / prevent disease and at the same time also influence the spread of the disease in an area. In locations around the Project development plan there is one health facility, the Bittuang *Puskesmas* (health center) that provides medical services to the surrounding community. In the health care effort, every village is also served by Auxiliary *Puskesmas* (*pustu*) or health posts (*poskesdes*). Access to health facilities has been found adequate, with road access and public transport links that can be utilized by the community.

Table 7-40 Public Health Facilities

District and Village	Hospital	Public Health Center (Puskesmas)	Additional Public Health Center (Pustu)	Posyandu	Drug Store	Poskedes
Binamu	1	3	4	43	15	4
Empoang Village	0	1	0	5	12	0
North Empoang Village	0	0	1	5	0	0
Turatea	0	2	11	51	0	0
East Kayuloe Village	0	0	1	2	0	0
West Kayuloe Village	0	0	1	5	0	0
Bontomatene Village	0	1	0	6	0	0
Pa'rasangan Beru	0	0	1	2	0	0
Batang	1	1	3	26	0	2
Maccini Baji Village	0	0	1	5		1
Arungkeke	0	1	1	28	0	6
Kalumpang Loe Village	0	0	0	4	0	1
Jeneponto Regency	1	18	55	484	N/A	52

Source: Binamu, Turatea, Batang, Arungkeke, and Jeneponto in Figures 2015

Table 7-41 Number of Health Facilities in Jeneponto 2015

Health Facility Type	Total
Hospital	1
Puskesmas/PHC	18
Pustu	56
Posyandu/IHC	469

Source: Jeneponto Regency Regional Statistics, 2015

7.6.13. Housing and Sanitation

- **Environmental Sanitation Conditions**

Valuation of the number and scope of environmental health facilities provides an overview of environmental sanitation conditions of an area. Environmental sanitation, good or bad, will affect the public health status of a region. Aspects of basic environmental sanitation observed include the number and scope of clean water sources, family toilets, SPALs, and trash disposal.

According to Statistical Bureau data and primary data collection, it was observed that communities around the Project area generally use clean water from dug wells for bathing and washing and gallon water for drinking water. Some of them utilize clean water from PDAM (local water company). Meanwhile, solidwaste and wastewater management has not been the main concern for communities

Table 7-42 Overview of Domestic Wastewater Services Coverage by Kecamatan and Village in Jeneponto

No	District/Village Name	Open Defecation	Unacceptable Facilities	Acceptable Facilities					
			Onsite System						Offsite System
			Individual			Communal Based			Neighborhood / Centralized
		(KK)	Shared Pit, Unsafe Septic Tank (KK)	Family Latrine with Safe Septic Tank (KK)	Public Toilet / Shared Latrines (KK)	Public Toilet++ (KK)	Communal WWTP (KK)	Communal Septic Tank (KK)	Household Connections (KK)
	Binamu District	**3,946**	**3,189**	**8,878**	**1,323**	**0**	**0**	**23**	**0**
1	Biringkassi	339	217	577	86	0	0	0	0
2	Pabiringa	572	379	1,035	154	0	0	0	0
3	Panaikang	223	154	380	57	0	0	0	0
4	Monro-Monro	195	154	467	70	0	0	0	0
5	Sidenre	273	178	547	82	0	0	0	0
6	South Empoang	301	357	739	110	0	0	0	0
7	Empoang	339	642	1,259	188	0	0	23	0
8	Balangtoa	203	269	739	110	0	0	0	0
9	Balang	262	289	808	120	0	0	0	0
10	Balangberu	313	165	587	87	0	0	0	0
11	Bontoa	261	41	473	70	0	0	0	0
12	Sapanang	367	112	654	97	0	0	0	0
13	North Empoang	298	231	613	91	0	0	0	0
	Kelara District	**2,751**	**1,960**	**4,472**	**335**	**0**	**0**	**0**	**0**
1	Tolo	423	538	883	66	0	0	0	0
2	West Tolo	232	246	497	37	0	0	0	0
3	South Tolo	390	260	579	43	0	0	0	0
4	Bontolebang	175	108	300	23	0	0	0	0
5	Samataring	166	100	256	19	0	0	0	0
6	Bontonompo	139	74	177	13	0	0	0	0

No	District/Village Name	Open Defecation	Unacceptable Facilities	Acceptable Facilities				
			Onsite System					Offsite System
			Individual			Communal Based		Neighborhood / Centralized
		(KK)	Shared Pit, Unsafe Septic Tank (KK)	Family Latrine with Safe Septic Tank (KK)	Public Toilet / Shared Latrines (KK)	Public Toilet++ (KK)	Communal WWTP (KK)	Communal Septic Tank (KK)	Household Connections (KK)
7	Gantarang	296	144	286	21	0	0	0	0
8	Tombo-Tomboio	173	43	260	20	0	0	0	0
9	East Tolo	429	181	631	47	0	0	0	0
10	North Tolo	328	265	603	45	0	0	0	0
	Turatea District	**3,438**	**2,200**	**5,077**	**381**	**0**	**0**	**0**	**0**
1	Jombe	250	77	404	30	0	0	0	0
2	West Kayuloe	292	171	436	33	0	0	0	0
3	East Kayuloe	107	109	205	15	0	0	0	0
4	Bungungloe	256	233	524	39	0	0	0	0
5	Bontomatene	388	284	627	47	0	0	0	0
6	Tanjonga	283	177	309	23	0	0	0	0
7	Bululoe	626	306	769	58	0	0	0	0
8	Mangempong	336	207	453	34	0	0	0	0
9	Langkura	251	217	424	32	0	0	0	0
10	Paitana	477	313	684	51	0	0	0	0
11	Parasangang Beru	172	105	242	18	0	0	0	0

Source: Jeneponto Sanitation White Book 2014.

Table 7-43 Waste Management System by District and Village in Jeneponto

No	District /Village Name	Total Population	Coverage Volume								Uncovered	
			Waste Generation		3R		Management Institution		Landfill			
		(People)	(m^3)	(%)	(m^3)	(%)	(m^3)	(%)	(m^3)	(%)	(m^3)	
	Binamu District	13,426							109.5		293.30	
1	Biringkassi	880	0	0	0	0	0	0	-	100	26.40	
2	Pabiringa	1,568	0	0	0	0	0	0	-	100	47.04	
3	Panaikang	591	0	0	0	0	0	0	-	100	17.73	
4	Monro-Monro	691	0	0	0	0	0	34	7	66	13.68	
5	Sidenre	810	0	0	0	0	0	41	10	59	14.33	
6	South Empoang	1,209	0	0	0	0	0	52	18.9	48	17.41	
7	Empoang	2,116	0	0	0	0	0	77	48.9	23	14.60	
8	Balangtoa	1,118	0	0	0	0	0	27	9.1	73	24.49	
9	Balang	1,218	0	0	0	0	0	23	8.4	77	28.13	
10	Balangberu	840	0	0	0	0	0	29	7.3	71	17.89	
11	Bontoa	584	0	0	0	0	0	0	-	100	17.53	
12	Sapanang	864	0	0	0	0	0	0	-	100	25.91	
13	North Empoang	938	0	0	0	0	0	0	-	100	28.14	
	Kelara District	6,772									203.20	
1	Tolo	1,491	0	0	0	0	0	0	0	100	44.72	
2	West Tolo	781	0	0	0	0	0	0	0	100	23.42	
3	South Tolo	883	0	0	0	0	0	0	0	100	26.48	
4	Bontolebang	431	0	0	0	0	0	0	0	100	12.92	
5	Samataring	375	0	0	0	0	0	0	0	100	11.25	
6	Bontonompo	265	0	0	0	0	0	0	0	100	7.94	
7	Gantarang	454	0	0	0	0	0	0	0	100	13.61	
8	Tombo-Tomboio	322	0	0	0	0	0	0	0	100	9.67	
9	East Tolo	859	0	0	0	0	0	0	0	100	25.77	
10	North Tolo	913	0	0	0	0	0	0	0	100	27.39	

No	District /Village Name	Total Population	Coverage Volume								Uncovered
			Waste Generation		3R		Management Institution		Landfill		
		(People)	(m^3)	(%)	(m^3)	(%)	(m^3)	(%)	(m^3)	(%)	(m^3)
	Turatea District	7,664									171.60
1	Jombe	512	0	0	0	0	0	0	0	100	15.35
2	West Kayuloe	640	0	0	0	0	0	0	0	100	19.19
3	East Kayuloe	330	0	0	0	0	0	0	0	100	9.89
4	Bungungloe	797	0	0	0	0	0	0	0	100	23.90
5	Bontomatene	961	0	0	0	0	0	0	0	100	28.84
6	Tanjonga	509	0	0	0	0	0	0	0	100	15.27
7	Bululoe	1,133	0	0	0	0	0	0	0	100	33.98
8	Mangempong	694	0	0	0	0	0	0	0	100	20.83
9	Langkura	673	0	0	0	0	0	0	0	100	20.20
10	Paitana	1,052	0	0	0	0	0	0	0	100	31.55
11	Parasangang Beru	365	0	0	0	0	0	0	0	100	10.94

Source: Jeneponto Sanitation White Book 2014.

Settlement Conditions

According to observation result, there are still many community settlements that do not have health care facilities, such as clean water supply, latrines/family latrines, Wastewater Disposal System (SPAL), and waste management as well as ventilation and lighting and which are not considered healthy. Lack of sanitation coverage can trigger the development of diseases such as diarrhea, dysentery, abdominal typhoid, skin allergies, skin diseases, and itching (*pruritis dermatitis*), and others. These diseases are classified as environmental health issues.

Settlement Density

Settlement Density is a measure of the residential house density in a residential area. When the construction was carried out at a high density per unit of area, then the condition is called over-crowded or high density. With the extremely crowded conditions, an explosion of infectious diseases, in a relatively brief time, causes widespread outbreaks (epidemics), as occur with dengue and diarrheal diseases. The spread of the disease will be faster when vectors nest and breed around settlements, especially in crowded slums.

Residential Density

Crowded housing conditions with numerous occupants in each structure is very conducive to the spread of some infectious diseases, either directly or through an intermediary / congenital vector. According to site observation result, each house around the Project site is occupied by several families with number of 10 – 15 people. If just one family member is sick, then it won't take long time that the disease will be transmitted to other family members (propagated infection).

Accessibility to health facilities

The existence of health facilities near the settlements also determine the success of disease control efforts and prevention as well as affect the spread of disease in an area. At the location around the project development plan there is one health facility that is Jeneponto Health Center (Puskesmas) which provides health services to the surrounding community. In the effort of health service in every village also served by smaller health center (Pustu) or Poskesdes. These health facilities are accessible through adequate public transportation routes that can be utilized by the community.

According to the information provided on health and sanitation conditions, as per the above data, it is concluded that there are still gap of health facilities and needs to be improved, therefore this information may useful to determined future community development program for the Project.

CHAPTER 8
SCOPING OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

A process for identifying and evaluating the environmental and social risks and impacts of the Project is established and maintained, principally through this ESIA, regulatory Amdal, and IFC requirements. The scope includes the Project zone of influence: the facility footprint, and significant impacts outside the footprint (e.g., transportation), including cumulative impacts. Risks and impacts in the Project's area of influence that result from a third party's actions will be addressed where the Project has control or influence. In assessing risks and impacts, the Project incorporated and considered the following:

- Risks and impacts associated with primary supply chains.
- Findings and conclusions of related and applicable plans, studies, and assessment as prepared by relevant government authorities or other parties relating to the Project area of influence. These include master economic development plans, country or regional plans, feasibility studies, alternatives analyses, and cumulative, regional, sectoral, or strategic environmental assessments where relevant.
- Outcomes from the external engagement process with affected stakeholders.

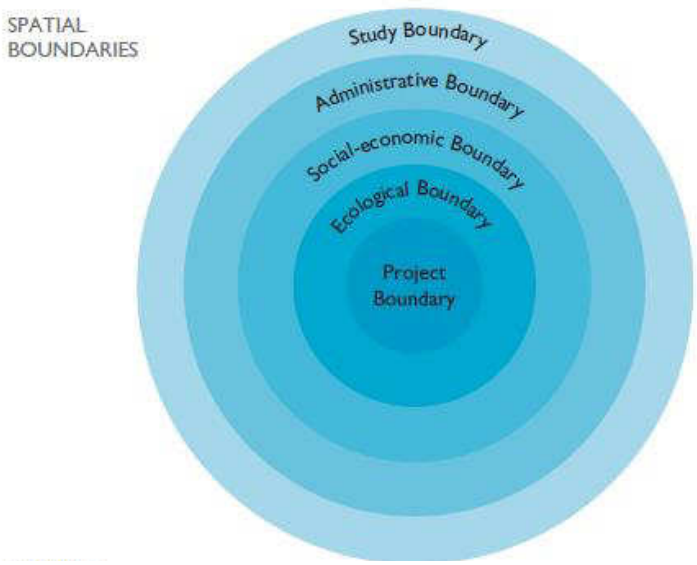
8.1 Area of Influence

This ESIA is concerned with environmental and social impacts associated with the wind farm and associated facilities occupying an area of about 50 ha. (No other associated facilities have been identified.) It also includes the surrounding region that is affected and impacted by transportation, supply chain (e.g. concrete aggregates during construction), and other aspects of the Project.

The area of influence is assumed to be as shown in Figure 8-2 from the sources of impacts the principal of which is noise, shadow flicker and visual impacts.

8.2 Study Boundaries

Environmental assessment is first of all site-based. The obvious study area is the Project area itself, which comprises all areas expected to undergo physical changes due to Project activities. In the case of this Project, the Project area consists of actual wind tower sites and the foot print of supporting facilities and structures. Since impacts extend beyond the areas of physical changes, the geographic boundary of the environmental assessment study is larger than the actual Project area. It is based, among other considerations, on the natural landscape, such as watershed area or specific types of ecosystem, downwind 'air-shed' area, and on social and administrative. **Figure 8-1** illustrates the various study boundaries in increasing spatial dimension that applied to this environmental assessment.



Sources: Amdal, 2015

Figure 8-1 Environmental Impact Assessment-–Spatial Boundaries Illustrated

The actual study boundary is the combination of Project boundary, ecological boundary, social boundary, and administrative boundary. The ESIA study area boundaries for this Project are as shown on **Figure 8-2,** and discussed in the following sections.

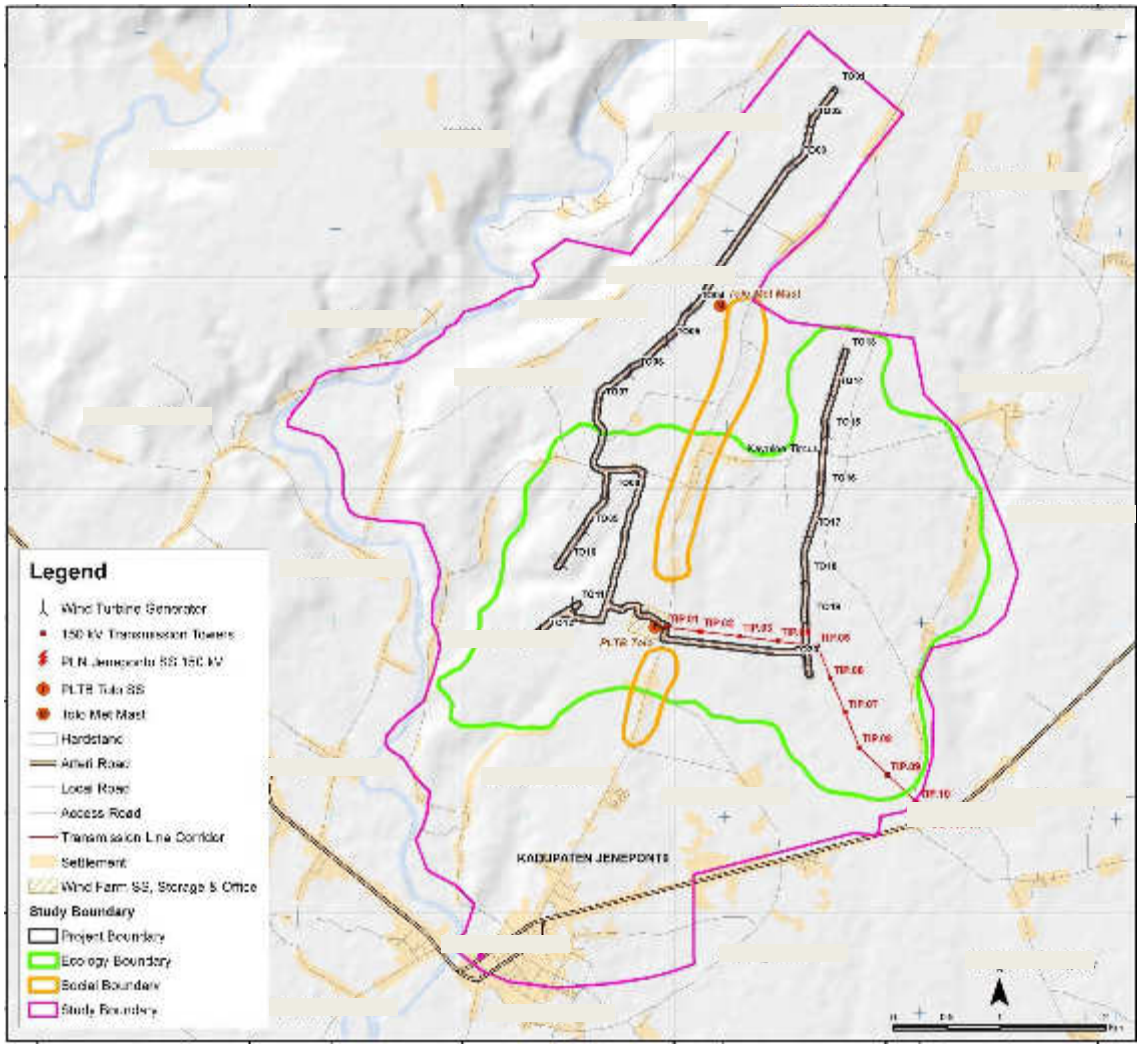


Figure 8-2 Study Area Boundaries

Project Boundary

The Project boundary includes all areas of direct physical changes–the 'footprint' of the Project, totalling to about 50 ha.

Ecological Boundary

The ecological boundary encompasses all areas in which environmental impacts, including indirect impacts, may occur. The ecological boundary is determined based on the impact distribution within the water and air components. Initial noise and shadow flicker modelling indicates that the point of maximum infringement may reach a distance of 500 m.

Social Boundary

The socio-economic boundary includes all communities potentially affected by the Project. The Project area and the area of potential environmental physical and biological impacts always fall within the Social Boundary.

The Social Boundary includes the region surrounding the Project where various social interactions will take place, certain social standards and values prevail (including a social system and structure), and where community members are likely to be affected by Project activities, directly or indirectly.

The social boundary in this study is shown in **Figure 8-2**.

Administrative Boundary

Administrative boundaries include the Empoang Village and North Empoang Village Binamu sub-district; East Kayuloe Village, West Kayuloe Village, Bontomatene Village and Parasangan Beru Village, Turatea sub-district; Maccini Baji village, Batang District; and Kalumpangloe Village, Arungkeke subdistrict, Jeneponto Regency (**Figure 8-2**).

8.3 Scoping Methodology

An ESIA requires primary and secondary data. Primary data are obtained from direct observations and field measurements, laboratory analyses, questionnaires, and in-depth interviews. Secondary data (e.g., spatial management map, administration map, topographical map, land use map, statistical data, and rainfall data) are obtained from a variety of sources such as published environmental studies, government institutions, and the internet. Collected data, which are mainly baseline information, enable the analysis of interactions between the Project and host environment as illustrated in **Figure 8-3**. Impact screening occurs in three stages:

- *Stage 1: Identifying Potential Impacts.* The outcome of this stage is a listing of all potential environmental and social impacts associated with the Project;
- *Stage 2: Evaluating Potential Impacts*. The outcome of this stage is a screening and prioritization of impacts as significant and non-significant. A Pre-screening Checklist was used to identify potential areas of concerns at an early stage of project development:
    - Is the project in an area that is protected, has special biological sensitivity, habitat for designated species, valuable or scarce resources and for which there are not specific management plans and procedures in place?

- Will the project affect an area with indigenous peoples, historical, archaeological or cultural sites for which there are not specific management plans and procedures in place?
- Does the project have the potential to impact public health?
- Does the project have the potential to disrupt community infrastructure or result in physical or economic relocation?
- Are there known or likely stakeholder concerns about the project that cannot be fully addressed by existing engagement strategies?
- Are there any action items or next steps that need to be taken to mitigate potential environmental, health or social impacts that remain undefined and/or undocumented?

The subsequent preliminary evaluation of potential Project-related Environmental, Social and Health Impacts was conducted in an internal workshop based on a range of questions addressing the following subject matters:

- Waste management
- Hazardous materials
- Air quality
- Water quality and hydrology
- Biodiversity
- Natural resources
- Natural hazards
- Land and marine use
- Noise and light
- Public health
- Social and cultural resources
- Public services and recreation
- Population, housing and employment
- Utilities and service systems

- *Stage 3: Detailed Evaluation of Hypothetical Significant Impacts*. The outcome of this stage is an in-depth assessment of the potentially significant impacts identified in Stage 2.

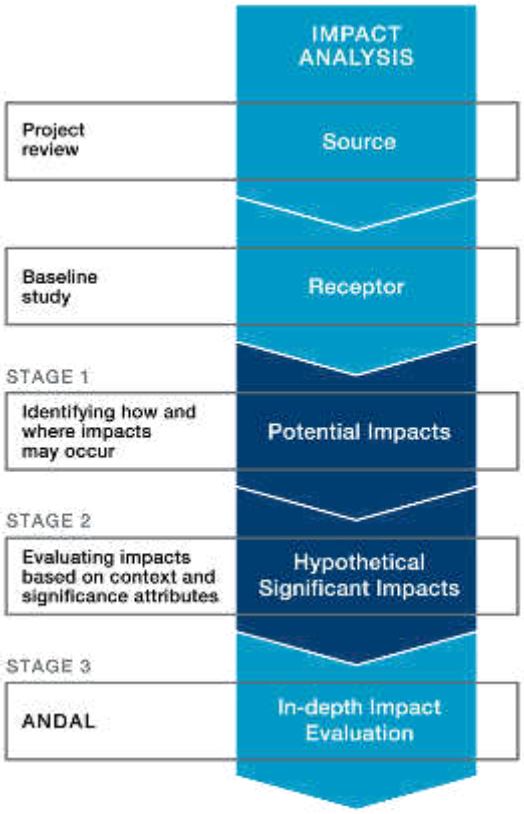


Figure 8-3 Project Impact Scoping Process

Scoping determines the extent to which a project will interact with environmental or social elements. Through this exercise, the priorities and extent of baseline studies and assessments are determined. IFC Guidelines require that this stage is the start of interaction with local communities, to determine the key issues that need to be addressed, to ensure that impacts to the community and any sensitive receptors will be defined as part of the ESHIA process. It is important to understand the values that the local community places upon environmental resources that may be impacted by the project.

Under Indonesian regulations, an Amdal has been prepared for Tolo Wind Farm Project, as well as UKL-UPL for Tolo Transmission Line Project.[3] The scoping exercise for this ESIA largely comprised a review and updating of an initial Amdal (National-level EIA) for the project that was prepared for submission under Indonesian Legislation. This scoping exercise comprised:

- Review of the project description to understand the nature and components of the structures and activities of the proposed project;
- Discussions with Equis/ PT Energi Bayu Jeneponto team to further understand nature and scale of the proposed works;

[3] The UKL-UPL for transmission line is equivalent to an international “mini EIA” which has considered the Lender’s requirement.

- Additional baseline data collection and analysis of data obtained, particularly noise 48 hours measurement, bat and bird survey, and field observation to collect supporting data for potential sensitive receptors and visual impact assessment;
- Conduct impact assessment and evaluation of potential impacts using robust criteria (sensitivity, magnitude and significance); and
- Review and updated mitigation measures to produce Environmental and Social Mitigation Plan.

8.4 Method for Impact Identification and Evaluation

Section 8.4 summarizes the impact identification and evaluation methods used in this ESIA.

Impact Identification

The Identification of potential impacts in this ESIA is done using the Impact Identification Matrix. This provides a comprehensive schedule of all impacts potentially associated with Project development when considering Project description, activities, and environmental setting. The Impact Identification Matrix is a qualitative environmental impact assessment method consisting of a matrix with columns representing the various Project activities (**Table 8-1)** and rows representing the various environmental components to be considered (**Table 8-1**). The intersections or cells are filled in to indicate that a particular Project activity has the potential to affect a specific environmental component. At the initial stage, the Impact Identification Matrix provides a high level estimation of how and where impacts may occur. The following Table presents the entire set of potential impacts associated with developing the Project before and after impact prioritization and refinement (i.e., Stages 1 and 2).

Table 8-1 Identification Matrix— Potentially Significant Impacts (from Amdal 2016)

Environmental Components		Project Components / Parameters	Pre-Construction Phase		Construction Phase										Operational Phase			Post Operation Phase	
			Preliminary Survey and Licensing Process	Land Acquisition	Acceptance and Mobilization of Labor	Base Camp Construction and Operation	Mobilization of Equipment and Materials	Land Clearing	Construction of Road	Construction of Foundation and GTA Tower	Transportation and Assembly of Turbine Components	Construction of SUTM 20 kV and Transmission Line 150 kV	Construction and Maintenance of Building	Clearing and Restoration of Construction Used Land	Acceptance of Labor	Wind Farm Operation	Wind Farm Maintenance	Demolition of Main Facilities and Land Rehabilitation	Demobilitation of Labor
			1	2	1	2	3	4	5	6	7	8	9	10	1	2	3	1	2
Geophysical - Chemical	Micro Climate	Temperature																	
	Air Quality	CO, SO2, NO2, Particulate (TSP)					x	x	x		x		x	x				x	
	Noise and Vibration	Noise and Vibration Level					x	x	x		x		x			x		x	
	Transportation	Land Accessibility					x		x		x	x							
		Road Damage					x				x								
		Traffic Accident									x	x							
	Shadow Flicker															x			
	Hydrology/ Soil	Surface Flow and Erosion				x		x	x	x			x						
	Surface Water Quality/ Irrigation	TSS, TDS, pH, BOD, DO and COD				x		x	x	x			x	x			x		
	Building Damage	Building Damage Level									x								
	Aesthetics	Waste Generation				x											x		
Biology	Flora	Species and Diversity					x	x			x								
	Fauna	Species and Diversity					x	x			x					x			
	Water Biota	Species, Abundance and Diversity				x		x	x	x			x	x			x		
Socio Economy Culture	Socio Economy	Work Opportunity			x										x				
		Business Opportunity			x										x				
		Income			x	x		x	x	x			x	x	x		x		x
		Rice and *Palawija* Production				x		x	x	x			x	x			x		
	Socio Culture	Community Perception	x	x	x										x				x
		Community Anxiety	x	x	x										x				x
		Social Conflict			x										x				
Public Health	Public Health	Pattern and Prevalence of Disease				x	x	x	x		x		x	x			x	x	

Note:

X Predicted Impact

Impact Evaluation

The Project was screened against various aspects of the following parameters, for construction, operations, and decommissioning stages:

- Natural Resources (air, water, land, biodiversity);
- Demography, Economy, and Social and Cultural Resources (including livelihoods, customs, housing, welfare (e.g., public health));
- Public Services (transportation, public infrastructure, utilities, and services);
- Waste generation (hazardous and non-hazardous); and
- Natural Hazards.

When assessing direct and indirect impacts, the following are considered:

- Number of people affected from planned activities;
- Area affected;
- Intensity and duration of impact;
- Other environmental components affected;
- Nature of cumulative impacts;
- Reversibility of impacts; and
- Other criteria in accordance with science and technology.

While a proposed development may have a large impact in terms of magnitude, the effects may not significantly affect the environment as a whole. A variety of methods help determine whether a Project activity produces significant impacts or non-significant impacts. The outcome of impact evaluation in Stage 2 results in a refined set of important impacts, i.e., the Hypothetical Significant Impacts. During the impact assessment, these impacts are evaluated and studied.

The following approaches can be tailored and scaled for use in any step in the impact evaluation, though the more complex and costly methods are used only in Stage 3 (impact assessment) (**Figure 8-4**).

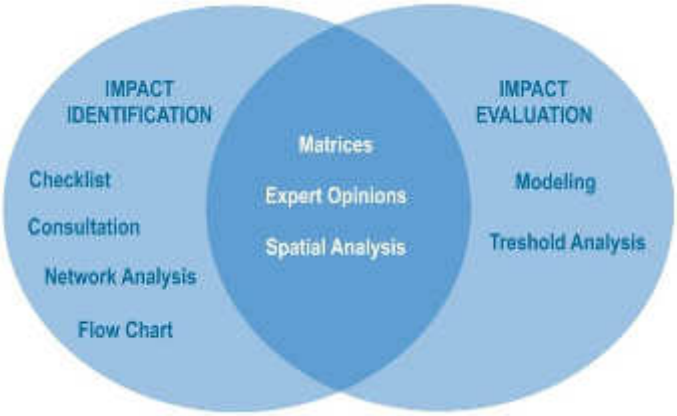


Figure 8-4 Methods and Tools for Identifying and Evaluating Impacts

- *Mathematical Modelling*: Standard mathematical models, either analytical or numerical, are used to predict the magnitude of impacts: noise and shadow flicker assessment in this ESIA is based on DNV GL's WindFarmer noise and shadow flicker modelling modules.

- *Overlay Mapping*: Overlay mapping, preferably done by Geographic Information System (GIS), assists in identifying the geographic extent of impacts and can assist in identifying where cumulative impacts and impact interactions may occur (the assessment in this ESIA is based on ARCGIS 9.1 system).
- *Threshold Analysis*: The boundary of significant impact distribution can be determined using threshold analysis. Threshold analysis is based on the assumption that thresholds exist in most ecological systems, specifying limits in an environmental medium (predominantly but not to limited to air and water) that must not be exceeded, or levels of environmental quality that must be maintained. Prime examples of environmental threshold limits are ambient environmental standards set by the GoI defining the degree of environmental quality that must be maintained in an environmental resource to support its continued beneficial human use.
- *Analogy Method*: Prediction by analogy is where environmental impacts are predicted by direct comparison or extrapolation from similar activities at existing industries. Conclusions may be adjusted to accommodate different conditions at the site of the proposed activity. The analogy between an existing activity and a new Project depends on the extent to which both activities and both sites are similar. Predictions based on comparable experiences are always preferred to estimates with no basis in direct observations. While there are no operational wind farms in Indonesia as of March 2017 EBJ operates a number of wind farms and the Project benefits from its experience in operating in the Philippines.
- *Professional Judgment*: Professional judgment always forms an intrinsic part of environmental assessment. No matter what method is applied for identifying and evaluating impacts, it is not possible to conduct an environmental assessment without relying on expert opinions. Many impacts cannot be adequately predicted by numerical methods or by analogy. Such impacts can be judged by experienced professionals who have been involved in similar studies.

In order to define the significance of impacts, impacts evaluation process is described as follows. To consider the different context between environmental and social impacts, the methodology for impact evaluation process is described separated. The same approach has been undertaken as for the environmental impacts, however, for social impacts, the terminologies are modified to consider the different context.

Methodology for Environmental Impacts Evaluation

In evaluating the significance or importance of impacts, several factors are taken into consideration. These include an assessment of the project component and its effect on the existing environment as a baseline and the potentially affected sensitive receptors. The impact is then assessed based on its potential severity and magnitude. The steps involved in evaluating the significance of impacts are summarized in the Figure below and key steps described in more detail in the following sections.

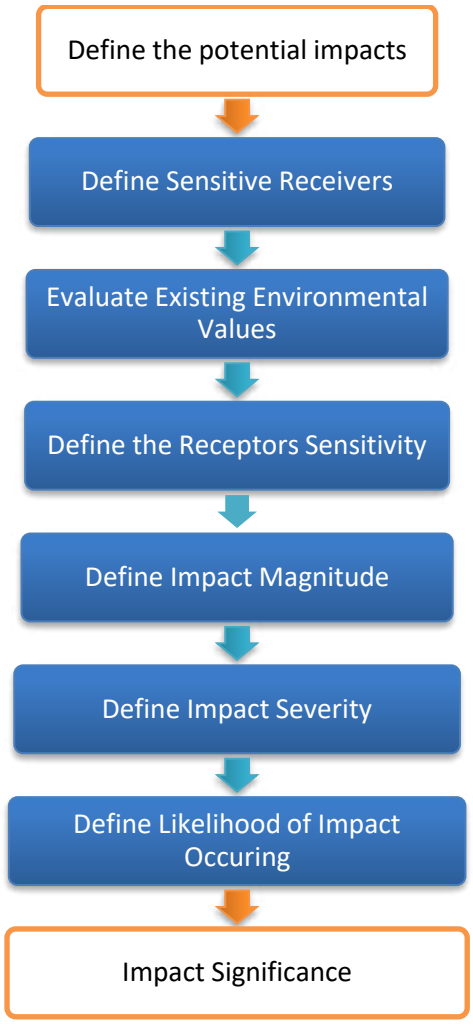


Figure 8-5 Impact Assessment Process

- **Define Potential Impacts**

  All activities associated with the proposed project are identified and potential impacts resulting from these activities listed.

- **Define Sensitive Receivers**

  The criteria used to assess the sensitivity of the receiving environment include:

  Abundance:

  Rarity: *does the impacted receptor comprise a rare environmental resource (such as an endangered species or habitat);*

  Size or extent: *What is the size or extent of a resource that would be affected by a particular impact?*

  Adaptability:

  Resilience: *what is the ability of the particular environmental or social element to withstand the change? (for instance social/health impacts may have different outcomes of a very old or very young members of the community);*

Ability to recover: *what is the potential to recover from the impact, how complete will recovery be and how long will it take?*;

State:

Degree of disturbance: is the state of the environmental or social element in its natural condition, or has it been disturbed by other activities in the past?;

Uniqueness: is the particular environmental condition unique, or is it fairly commonplace?, What is the potential to replicate the situation by way of offset or compensation?;

Establishment: how well-established is this particular environmental/social condition, is its future tenuous or is it likely to persist?

Value:

Implicit value: how important is it to retain particular environmental/social condition, in the context of its interrelationship with the broader environment? Would the loss of this particular environmental/social condition lead to further breakdown of the existing environment?

Recognised value: has the environmental condition been recognised in some formal sense, such as a declaration of a conservation area?

- **Define Impact Magnitude**

Impact magnitude is a function of a range of considerations including:

Impact Scale: the scale of the change that is induced, such as the percentage of resource that might be lost, the predicted change in the level of a pollutant, or a quantitative measure of losses or benefits to the community;

Impact duration: time period over which the impact is expected to last;

Impact extent: the geographical extent of environmental change, or the degree to which social impact may reach into the immediate, surrounding, or even general community;

Legal and guideline compliance: the status of the impact in relation to regulations or prevailing legislation, comparison of the predicted outcome with recognised standards and guidelines the relevant to the project, its location and context.

Wherever possible, impact magnitude should be described in quantitative terms, based on numerical values, representing regulatory limits, project standards or guidelines, or the number of people that have the potential to be impacted. However in some instances it is necessary to take a more qualitative approach in the definition of some outcomes, either because quantitative estimates are not possible, or because numerical evaluations are not relevant (this is particularly true of some of the social elements, such as community perception). Based on this quantitative or qualitative assessment, impact magnitude can be categorised as follows:

High: Major alteration of existing environment that is likely to be irreversible or will result in the loss of that environmental for a period of time.

Medium: An alteration to the existing environment that will modify its current status, but will not stop its role in the environment or is easily reversed.

Low: An alteration to the existing environment but few sensitive receptor or a change that will be transient.

Slight: Measurable but no real change to environmental.

No Change: Usually for mitigated outcome.

- **Define Impact Severity**

The severity of each impact is then determined by comparing impact magnitude against the sensitivity of the receptor in the impact significance matrix provided in the Table below.

Table 8-2 Determining the Severity of Impact

		Sensitivity of Receptor				
		Low	**Low-Medium**	**Medium**	**Medium-High**	**High**
Impact Magnitude	**No Change**	Slight	Slight	Slight	Slight	Slight
	Slight	Slight	Slight	Low	Low	Low
	Low	Slight	Low	Medium	Medium	Medium
	Medium	Low	Medium	High	High	High
	High	Medium	High	High	Critical	Critical

- **Likelihood of Occurrence**

For unplanned events or extreme situations, the likelihood that the particular event, impact or outcome will occur can be ascribed a qualitative probability, as per the categories defined in the Table below.

Table 8-3 Likelihood Category

Likelihood	Definition
Extremely Unlikely	The event is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances (i.e., the event is generally never heard of in industry).
Unlikely	The event is unlikely but may occur at some time during normal operating conditions (i.e., the event is heard of in industry).
Low Likelihood	The event is likely to occur at some time during normal operating conditions (i.e., incident has occurred in the company before)
Medium Likelihood	The event is very likely to occur during normal operating conditions, (i.e., the event occurs several times per year in the company).
High Likelihood/ Inevitable	The event will occur during normal operating conditions (is inevitable), (i.e., the event happens several times per year at a location).

Likelihood is estimated on the basis of experience and available evidence that such an outcome has occurred in other similar projects. Impacts resulting from routine or planned events (normal operations) are classified as having a high likelihood of occurrence.

- **Evaluation of Significance**

For the purposes of ascribing significance to the impacts in Tolo Wind Farm Project environmental impact assessments, the terminology that has been adopted is described in the Table below.

Table 8-4 Terminology for Impact Significance

Significance	Definition
Positive Impact	An impact that is considered to represent an improvement on the baseline or introduces a new desirable factor
Negligible Impact	Magnitude of change is comparable to natural variation
Minor Impact	Detectable but is not significant
Moderate Impact	Significant, amenable to mitigation, should be mitigated where practicable
Major Impact	Significant; amenable to mitigation; must be mitigated
Critical Impact	Intolerable; not amenable to mitigation; alternatives must be identified – Project Stopper

It must be noted that critical impacts are not acceptable for planned operations, and can only be tolerated in the instance of unplanned or incidental events, and only then when the likelihood of occurrence has been reduced through project planning to least low or unlikely. For unplanned events or impacts to which probability of occurrence may be ascribed, severity of the impact needs to be considered in conjunction with the likelihood of its occurrence as described in the Table below.

Table 8-5 Determining the Significance of Impacts

		Impact Likelihood				
		Extremely Unlikely	**Unlikely**	**Low Likelihood**	**Medium Likelihood**	**High Likelihood/ Inevitable**
Impact Severity	**Slight**	Negligible	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Negligible	Negligible	Negligible - Minor	Minor
	Medium	Negligible	Minor	Minor	Minor-moderate	Moderate
	High	Minor	Minor-moderate	Moderate	Major	Major
	Critical	Minor-moderate	Moderate - Major	Major	Major	Critical

Impacts assessed as Negligible or Minor typically require no additional management or mitigation, because either the magnitude of the impact is sufficiently small nor the receptor sensitivity is sufficiently low, and adequate controls are included in the project design. Negligible

and minor impacts of therefore deemed to be insignificant, and do not require any further remedial action.

Impacts that are evaluated to be moderate or major require the implementation of further management or mitigation measures. Moderate to major impacts are therefore considered to be significant. For potentially major impacts the object of mitigation is to reduce the residual risk to a moderate level.

In the development of mitigation measures to reduce moderate impact, the emphasis is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable. It will not always be practical to reduce moderate impact to minor ones in consideration of the cost effectiveness of project.

Impacts whose residual risk is evaluated as critical since they cannot be managed mitigated, and therefore demand selection of alternatives to eliminate the potential for their occurrence. They cannot be contemplated as part of the normal operation of the project, and can only be considered if project design has taken every possible step to reduce the probability of occurrence to as low as possible.

Methodology for Social Impacts Evaluation

For the assessment of social the same approach has been undertaken as for the environmental impacts; however the terminologies are modified to consider the different context. So rather than refer to potential impacts of having a graded scale of significance (any social/health issue is of major significance to some or many parties), the term urgency is used to indicate the prioritization process that is necessary in dealing with community and social issues.

Impact Severity/Magnitude for various social concerns has been evaluated as per Table below.

Table 8-6 Assessments of the Magnitude of Social and Health Impacts

Impact Severity/ Magnitude	Community Displacement	Social And Public Amenity	Community Health
High	Will require involuntary physical displacement or relocation of any individuals.	Likely to impact a large number of people (greater than 25% of the community) and will impair current lifestyles or customs.	Any member of the community will be injured or suffer health impacts if an impact were to occur.
Medium	For physical displacement – only applies to mitigated outcomes where relocation will not preserve lifestyles and values.	Likely to impact on group of people (less than 25% of the community) and will impair current lifestyles or customs.	Potential health impacts on sensitive groups in the community that can be avoided.
Low	For physical displacement – only applies to mitigated outcomes where relocation will preserve lifestyles but may not satisfy cultural needs.	Likely to impact one or a few individuals and will impair current lifestyles or customs.	Does not apply.

Impact Severity/ Magnitude	Community Displacement	Social And Public Amenity	Community Health
Slight	For physical displacement – only applies to mitigated outcomes where relocation will preserve lifestyles but may not satisfy cultural needs.	Will challenge the perceptions and may cause unease that will need to be clarified amongst a group within the community (>25% of the community).	Does not apply.
Positive Impact	An outcome that will derive an economic benefit to the community.	The provision of community amenity or amenities that have previously been unavailable.	An outcome that can be expected to improve community health.

Then the urgency can be determined as described in Table below.

Table 8-7 Determining the Urgency of Social and Health Impacts

		Impact Likelihood				
		Extremely Unlikely	**Unlikely**	**Low Likelihood**	**Medium Likelihood**	**High Likelihood/ Inevitable (Planned Event)**
Impact Severity/ Magnitude	**Slight**	Negligible	Negligible	Negligible	Negligible	Minor
	Low	Negligible	Negligible	Minor	Minor	Minor
	Medium	Negligible	Minor	Moderate	Moderate	Major
	High	Minor	Moderate	Major	Major	Critical

8.5 Identified Significant Impacts of Project Activities

The Project's potentially significant environmental and social risks and impacts are identified and are presented in the Leopold matrix (**Table 8-1**) and in the Amdal documents. These impacts are assessed in **Section 10**.

8.6 Residual impacts

In this Project avoidance of impacts is the preferred option. The next best options in order of preference are: minimization, restoration/ remediation, and compensation or offset (**Figure 8-6**). Where identified risks and impacts cannot be avoided (residual impacts), a management plan is prepared containing mitigation measures to ensure the Project will operate in compliance with applicable laws and regulations and meet the requirements of IFC Performance Standards 1 through 8 as contained in the ESMS.

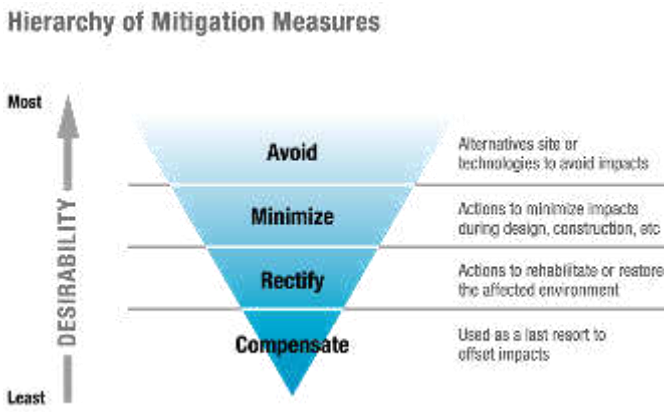


Figure 8-6 Hierarchy of Mitigation Measures

The acceptability of residual impacts in this Project is based on the following.

- Statutory and Policy Requirements – The Project is designed to meet all applicable regulatory requirements, and Good International Industry Practices.
- Protection of Public Health - Avoiding public health impacts is deeply embedded into Project design.
- Economic Considerations - Economic considerations influence the provision of costs to mitigate a Project impact over and above those that are provided.
- Reputation Risk - Reputation risks are important. The reputation risk includes both local and international reputation risk, as well as strained stakeholder relations. Reputation risk is of major concern for EBJ as the Company pursues business interests in different parts of the world. Negative publicity in one country can hinder Project development in another one. EBJ also recognizes that reputation risk may influence the capability to raise Project funding on the financial market.

CHAPTER 9
INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

Chapter 9 provides an overview of information disclosure, consultation, and participation related to the wind farm development, from stakeholder analysis over disclosure information and consultation to ongoing community feedback and grievance mechanism. **Appendix 8** provides a summary of past information disclosure, consultation, and participation.

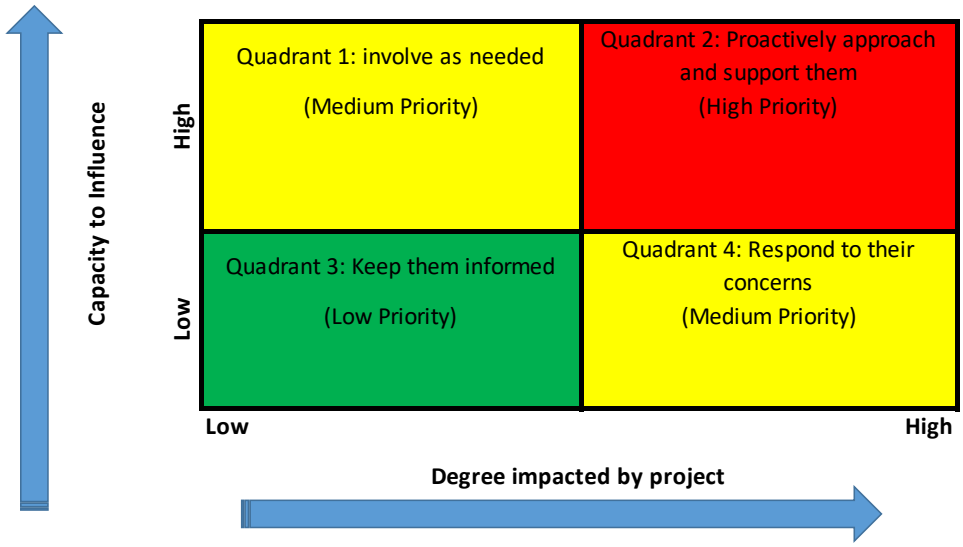
9.1 Stakeholder Analysis and Engagement

The Project is committed to proactively engage with main stakeholders before and during construction and operations. Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for successful management of the wind farm's environmental and social impacts. It is an ongoing process that involves varying degrees of the following:

- Stakeholder analysis (influence and interest) and planning;
- Disclosure and dissemination of information;
- Consultation and participation;
- Grievance management; and
- On going reporting to and engagement with affected stakeholders.

The nature, frequency, and level of effort of stakeholder engagement for the Project are scaled and commensurate with the limited social and environmental risks and impacts of the Project (**Figure 9-1**). The Project is committed to disclosing appropriate information about the Project to enable affected stakeholders to understand the risks, impacts, and opportunities of the Project by providing information on the:

- Purpose, nature and scale of the Project;
- Duration of proposed Project activities;
- Risks to and potential impacts on such stakeholders and relevant mitigation measures;
- Stakeholder engagement procedure;
- Grievance mechanism; and
- Identification of opportunities for employment and the supply of goods and services (especially during construction), including information about how to apply and access.



Source: EBJ

Figure 9-1 Stakeholder Categorization

The Project has undertaken consultation in a manner that provides affected stakeholders with opportunities to express their views on Project risks, impacts, and mitigation measures, allowing the Project to consider and respond to them. From the start of the Project, engagement has been documented and follows a two-way process that meets the following principles:

- Begins early in the process of identification of environmental and social risks and impacts and continues on an ongoing basis as risks and impacts arise;
- Provides information that is relevant, transparent, objective, meaningful, and easily accessible and understandable (e.g., culturally appropriate, local language(s), tailored, simple format);
- Focuses on engagement on those directly affected (as opposed to those not directly affected) and takes special steps to address disadvantaged or vulnerable groups;
- Is free of external manipulation, interference, coercion, or intimidation; and
- Enables meaningful participation by those affected.

The Project recognizes that Informed Consultation and Participation involving a more in-depth exchange of views and information and an organized and iterative consultation is required if potentially significant adverse impacts are identified. In the analysis of risks and impacts and through the engagement of stakeholders it was determined that the Project will not produce such adverse impacts. Nonetheless, stakeholder input will be used in Project decision-making and also inform the Project's mitigation measures and sharing of development benefits and opportunities.

The project's Stakeholder Engagement Procedure (**Table 9-1**) provides a structured, disciplined and integrated process for systematically meeting the engagement objectives above. External Relations is responsible for the execution and resourcing of the procedure, specifically to:

- Prepare for Stakeholder Engagement: Identify stakeholders, consider their issues, assess their influence and interest and document in a Stakeholder Engagement Procedure. This

exercise is updated continually, based on changing project conditions and external stakeholder perceptions.

- Conduct Stakeholder Engagement, following the Procedure (see **Table 9-1**).
- Analyze Stakeholder Results
    - After engaging stakeholders, analyze stakeholder results and appropriately incorporate stakeholder feedback into project planning and operations.
    - Provide feedback to the stakeholders on how their views and concerns have been addressed (for example, stakeholder input is considered but not necessarily adopted). The feedback is transparent and timely and stakeholders' responses to the feedback received are monitored and documented.
- Review the Stakeholder Engagement Procedure and update as necessary, to improve engagement effectiveness.

The scope of the Stakeholder Engagement Procedure encompasses the operational footprint (i.e. zone of influence, both direct and indirect), including the facility and region. Stakeholders are broadly defined as individuals or groups who can affect, or are affected by, or have a legitimate interest in the company's performance

Table 9-1 presents the universe of potential stakeholders, recognizing that potential stakeholders will change over the life of the Project.

Table 9-1 Stakeholder Engagement Plan

REDAYAENERGI

Doc Number	:
Doc Title	: Stakeholder Engagement Plan

PT ENERGI BAYU JENEPONTO
TOLO WIND FARM PROJECT

No.	Name of person	Stakeholder Category (See SEP Categorization sheet)	Interest/Issue	Method of Engagement	Disclosure Information	Information needed to be obtained	PIC
1	Direct affected community within project area	Q2	Noise, shadow flicker, visual impact, groundwater issue; storm water runoff and village flooding; exacerbation of arthropod-borne disease due to water ponding; recruitment issue	- Ensure that the community leader represents the village;	- Result of Noise, shadow flicker, visual impact study and monitoring information - Disclose of the recruitment information according to the required skill to the community leader	- Possible solution to reduce the impact - Community education background, number of unemployment.	EBJ CLO(s)
				- Grievance mechanism and robust response to concerns expressed and complaints of impacts to the village and its activities and needs;			
				- Bi-annual meetings with Community leader			
				- Annual perception survey			
2	Local farmer that previously cultivated crops on proposed project site	Q2	Economic loss, land issue, safety issue, negative impact to the viability of crops cultivation and harvest; security issue.	- Grievance mechanism and robust response to concerns expressed and complaints of personal impacts and his activities and needs; - Bi-annual or more frequent meetings with Community leader based upon the quantity and severity of issues	- Clarity of land status (ability to cultivate land with requirements)	- Information from local Land Agency on the cost for compensation	EBJ CLO(s)
				- Annual perception survey	- Compensation for the cultivated land impacted by construction and operations		
3	Local farmer association	Q4	Diminishing of Surface water due to construction activity; storm water runoff and village flooding; siltation of farming fields	- Grievance mechanism and robust response to concerns expressed and complaints of personal impacts and his activities and needs;	- Total amount of water use during the construction	- Surface water availability within the project area that used by farmer	EBJ CLO(s)
				- Biannual or more frequent meetings with affected local farmer groups based upon the quantity and severity of issues	- Provision of deep well or pump for irrigation;		
					- Catchment and siltation ponds for storm water runoff to avoid impacts to farming lands		
4	Local environmental/social/labor NGO	Q1	Environmental/social/labor performance	- Biannual meetings with local representatives and as demand requires	- Progress on ESHS-MS performance and ESHS-MS action plans	- NGO Background	WG
				- Regular updates on concerned areas through email		- Intent of the NGO	
						- Funding	
5	Regency government	Q1	Flow of revenue benefit, permits, compliance to regional regulations.	- Periodic reporting as required on project compliance	- Commitment to Environmental, Social, Health and Safety performance improvement	- Comprehensive knowledge of relevant regulations	WG
				- Quarterly phone calls and as demand requires			
				- Sharing of collected statistics and gfraphs illustrating lost time accident frequency and severity rates;			
6	Regional government	Q1	Flow of revenue benefit, permits, compliance to regional regulations.	- Periodic reporting as required on project compliance	- Commitment to Environmental, Social, Health and Safety performance improvement	- Comprehensive knowledge of relevant regulations	SM,AN
				- Quarterly phone calls and as demand requires			
7	State Electricity Company	Q1	PPA agreement, technical permits.	- Monthly phone call and as demand requires, meeting and presentation as applicable.	- Project development progress	- Wind Energy related regulation	MD,Andri
8	Local manpower Agency	Q3	Concern on workers' wages, local hire and working condition	- Periodic reporting as required on labor requirements.	- Minimum wage of working being fulfilled	- Local minimum wage	WG
					- No child labor statement and evidence	- Local number of skilled and unskilled worker.	
					- Total of local employees at EBJ		

Source: EBJ

Table 9-2 Stakeholders

Government/Regulatory Authorities
Indonesian Investment Board
Various central government authorities (e.g. Department of Mines and Energy)
Authorities responsible for environmental pollution control (for example noise)
Authorities responsible for the protection of natural resources (for example, birds and bats), cultural heritage, and the landscape (for example, aesthetics)
Government departments responsible for agriculture, energy, forestry, fisheries, etc., whose interests may be affected by the Project
Health and safety authorities
Land use control, planning, and zoning authorities
Communities, Ethnic/Regional Federations, and NGOs
Landowners and residents
General members of the local and wider public – Wind energy is new to Indonesia and the Project will likely attract much attention
Elected representatives and community figures, such as religious leaders or teachers
Local community groups, resident groups, etc.
Groups representing users of the environment (for example, farmers)
Local, national, and international environmental and social interest groups (for example, NGOs)
Other Interested Parties
Local employers and business associations, such as chambers of commerce, trade associations, etc.
Employee organizations, such as trades unions
Research institutes, universities, and other centers of expertise (e.g. local university that assisted in the environmental assessment of the Project)

Stakeholder engagement during the Environmental Impact Assessment is based on the Minister of Environment Regulation No. 17 of 2012.

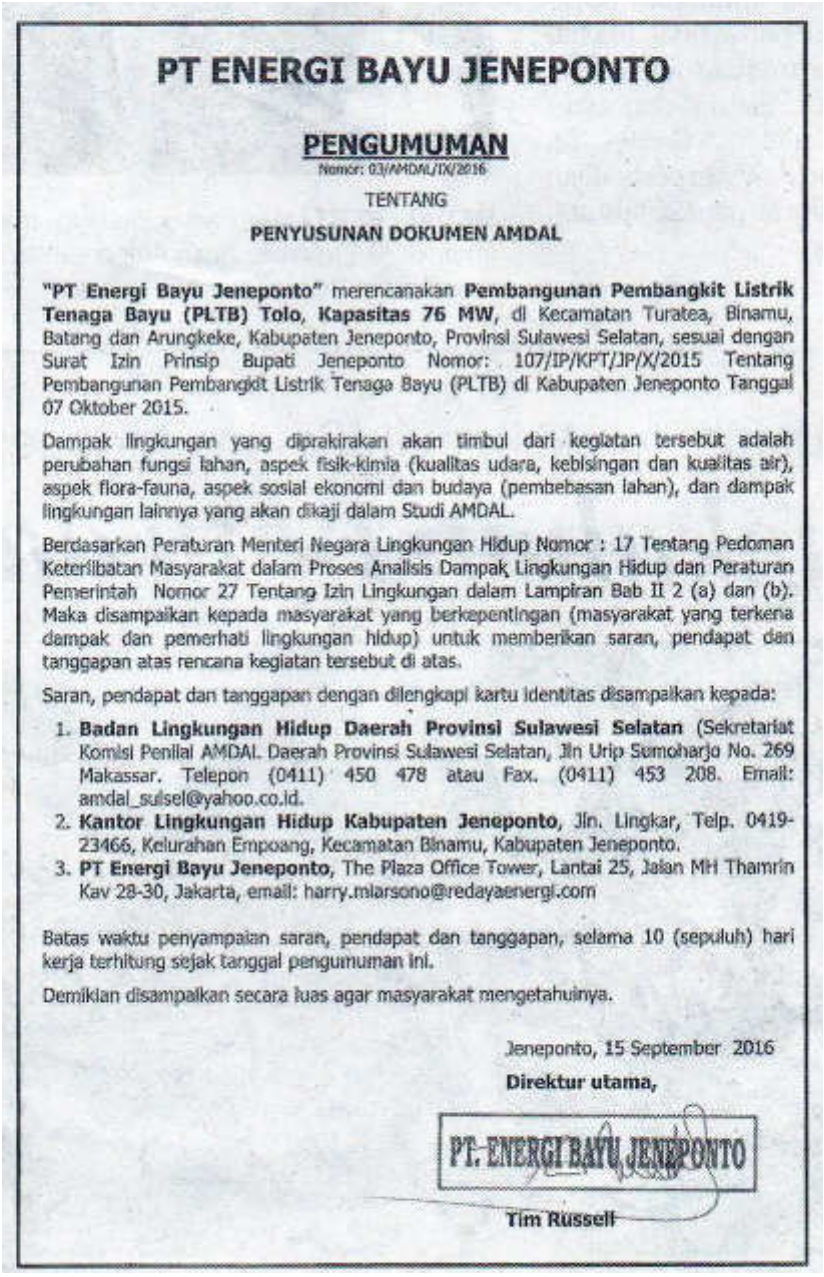
9.2 Disclosure of Information and Consultation

The following project information has been prepared:

- Brochures, posters or flyers prepared to visually explain the project;
- Press releases and media kits; and
- Announcements, published in local newspapers as well as on the information boards in the affected villages.

Project announcement has been made through the "Fajar" newspaper on Saturday, February 27, 2016. Project information dissemination and public consultation was carried out on April 7, 2016, in the Office Meeting Hall of Turatea Sub-district, Jeneponto District (**Figure 9-2**).

Figure 9-2 Public Consultation Meeting 7 April 2016



PT ENERGI BAYU JENEPONTO

PENGUMUMAN

Nomor: 03/AMDAL/IX/2016

TENTANG

PENYUSUNAN DOKUMEN AMDAL

"PT Energi Bayu Jeneponto" merencanakan **Pembangunan Pembangkit Listrik Tenaga Bayu (PLTB) Tolo, Kapasitas 76 MW,** di Kecamatan Turatea, Binamu, Batang dan Arungkeke, Kabupaten Jeneponto, Provinsi Sulawesi Selatan, sesuai dengan Surat Izin Prinsip Bupati Jeneponto Nomor: 107/IP/KPT/JP/X/2015 Tentang Pembangunan Pembangkit Listrik Tenaga Bayu (PLTB) di Kabupaten Jeneponto Tanggal 07 Oktober 2015.

Dampak lingkungan yang diprakirakan akan timbul dari kegiatan tersebut adalah perubahan fungsi lahan, aspek fisik-kimia (kualitas udara, kebisingan dan kualitas air), aspek flora-fauna, aspek sosial ekonomi dan budaya (pembebasan lahan), dan dampak lingkungan lainnya yang akan dikaji dalam Studi AMDAL.

Berdasarkan Peraturan Menteri Negara Lingkungan Hidup Nomor : 17 Tentang Pedoman Keterlibatan Masyarakat dalam Proses Analisis Dampak Lingkungan Hidup dan Peraturan Pemerintah Nomor 27 Tentang Izin Lingkungan dalam Lampiran Bab II 2 (a) dan (b). Maka disampaikan kepada masyarakat yang berkepentingan (masyarakat yang terkena dampak dan pemerhati lingkungan hidup) untuk memberikan saran, pendapat dan tanggapan atas rencana kegiatan tersebut di atas.

Saran, pendapat dan tanggapan dengan dilengkapi kartu identitas disampaikan kepada:

1. **Badan Lingkungan Hidup Daerah Provinsi Sulawesi Selatan** (Sekretariat Komisi Penilai AMDAL Daerah Provinsi Sulawesi Selatan, Jln Urip Sumoharjo No. 269 Makassar. Telepon (0411) 450 478 atau Fax. (0411) 453 208. Email: amdal_sulsel@yahoo.co.id.
2. **Kantor Lingkungan Hidup Kabupaten Jeneponto**, Jln. Lingkar, Telp. 0419-23466, Kelurahan Empoang, Kecamatan Binamu, Kabupaten Jeneponto.
3. **PT Energi Bayu Jeneponto**, The Plaza Office Tower, Lantai 25, Jalan MH Thamrin Kav 28-30, Jakarta, email: harry.mlarsono@redayaenergi.com

Batas waktu penyampaian saran, pendapat dan tanggapan, selama 10 (sepuluh) hari kerja terhitung sejak tanggal pengumuman ini.

Demikian disampaikan secara luas agar masyarakat mengetahuinya.

Jeneponto, 15 September 2016

Direktur utama,

PT. ENERGI BAYU JENEPONTO

Tim Russell

Figure 9-3 Public Announcement

In connection with the change in the planned power station capacity from 54.9 MW to 76 MW and the change in power station location (moved from the Binamu Sub-District, Turatea Sub-District and Kelara Sub-District to the Binamu Sub-District, Turatea Sub-District, Batang Sub-District and Arungkeke Sub-District) a second announcement was made in the "Fajar" newspaper on Friday, 16 September 2016 followed by second socialization and public consultation for the Batang Sub-District and the Arungkeke Sub-District (Thursday, 28 September 2016 at the Batang Sub-District Office meeting hall, Jeneponto District).

Public consultation meetings addressed the following aspects:

- Provide an explanation to the people who will be affected by the development activities plan by PT Energi Bayu Jeneponto;

- Provide an explanation to the people who will be affected by the negative and positive impacts that will arise as a result of the development activities plan by PT Energi Bayu Jeneponto.
- Provide an explanation to the people who will be affected by the management measures positive and negative impacts that will arise as a result of the development activities plan by PT Energi Bayu Jeneponto.
- Compile advice, opinion and community feedback as a reference in determining the environmental management strategies are feasible.

The first public consultation conducted on April 7, 2016 was attended by about 50 people from Binamu, Turatea and Kelara District (List of attendees as attached in Appendix 8). Advice, opinion and community feedback during the first Public Consultation centered on the following:

- Investors should coordinate with local authorities before conducting and involve village authorities in each of the activities.
- Establish good communication with local authorities in each construction activities location.
- Local communities are expected to benefit from the development activities, such as electricity supply from power station or that surrounding community members could be workers during the construction.
- Acquisition of land to be discussed properly, so that land acquisition does not cause any harm to society or raise social conflicts in society.
- The company must have a commitment to involve the local community in development activities of Tolo I Wind Farm Project.
- CSR Program for the surrounding community, when the plant is already in operation, should be implemented in a transparent manner.

The second public consultation conducted on September 28, 2016 was attended by about 39 people from Binamu, Turatea, Batang and Arungkeke District (List of attendees as attached in Appendix 8). Advice, opinion and community feedback during the second Public Consultation centered on the following:

- The Proponent (PT Energi Bayu Jeneponto) is expected to make a written statement that said it would recruit local labor as much as 60-70% of the workforce will be accepted ranging from the construction phase to the operational phase of activities.
- The Proponent to prepare a statement to address all negative impact so that they don't harm the surrounding community.
- The Proponent will be responsible for all the damage to roads, irrigation and homes and other facilities caused by construction activities of Tolo I Wind Farm Project.
- There will be an inventory of public land and affected land. Meeting with land owners should involve local government.
- The process of land acquisition will be done directly between the Proponent and community land owners with the help of land aggregator.

9.3 Ongoing Community Feedback

The Project will commit to ongoing community feedback as soon as the Project enters the construction phase.

9.4 Grievance Mechanism

The Project maintains a straight-forward Grievance Mechanism that will be communicated to adjacent villages as soon as the Project enters the construction phase (**Appendix 4**).

CHAPTER 10
ASSESSMENT OF ANTICIPATED ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

Potentially significant impacts are contained in the **Section 1**. Scoping of these significant impacts is outlined in **Table 8-1**. Chapter 10 details the assessment of the main impacts associated with the Project and elaborates on various IFC PS requirements: biodiversity; land acquisition and economic displacement; cultural heritage; and Indigenous Peoples.

10.1 Project Benefits

Key project benefits as stated in Section 1.1 are as follows:

- Contribution to the GoI's 35 GW additional capacity by 2019 program by producing 72 MW of wind energy;
- contribution to GoI's 23% renewable energy target;
- introduction of new technologies for electricity generation to Indonesia;
- support to the South Sulawesi electrical system; and by doing so
- Contribution to the development of the local economy.

Additional benefits will be in providing temporary employment for local and regional semiskilled and unskilled workers during the construction phase. Permanent employment for a smaller number of workers, some of whom will be local, will be available during the likely 30-year operational phase. Business opportunities for local suppliers of food, goods, and services will exist during construction and to a much lesser extent during operation of the wind power station.

10.2 Planning Phase

The Planning Phase includes land acquisition activities, site studies and surveys, feasibility and design studies, and various planning activities for the construction and operation phases.

Land Acquisition and Economic Displacement

Land acquisition has been carried out on land zoned on land zone agriculture area, thus avoiding impacts and permitting issues involved in using State Forest Land.

Consultation with landowners and local government representatives has been conducted prior to land acquisition.

Socio-economic baseline data of land selling households and analysis is conducted as part of this process to identified the poverty and vulnerability status among peoples whose land affected.

Land acquisition is based on a 'willing buyer, willing seller' basis. Compensation of land owners and land users is based on the mutual agreement and on estimates by land / agriculture / livestock valuation experts. Compensation are at market rates, even when official rates issued by the Regional Government are lower.

The Project Proponent is aware that cash compensation may provide short-term cash benefits to landowners, but at the cost of long-term reduction of household income. The Project Proponent's community development programs are designed to assist villagers affected by land acquisition in maintaining or increasing their household income.

According to the explanation above, impact rating for land acquisition and economic displacement is summarized in the following table.

Impact	Land acquisition and economic displacement				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Cultural Heritage

Field surveys to date indicate that the Project location contain no tangible cultural relics or objects, that is historic buildings or sitesor paleontologic, , cultural, or archaeological sites. However, there are some groundwater wells that are deemed sacred[4]. The planned development of the Tolo I wind farm will not interfere with these or any other sacred features.

Given the relatively small and temporary construction force there is also no indication that the Project would affect intangible cultural heritage values. While there are no known culture heritage the project proponent has prepare chance find procedure (**Appendix 7**).

Based on the consideration above, impact rating for cultural heritage aspect is summarized in the following table.

[4] is generally the state of being perceive by community around this area as associated with spiritual aspects.

Impact	Cultural Heritage				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Community Perception

Land acquisition and perceived negative impacts during the planning phase may cause a negative community perception. The Project maintains continuous dialogue with host communities, and to date there is few evidence of negative feedback or complaints from host communities. A formal grievance mechanism has been put in place to address any future discord as it may arise.

According to the consideration above, the impact rating for community perception is summarized as follows.

Impact	Community Perception				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High

Impact	Community Perception				
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Indigenous Peoples

IFC PS 7 uses the term 'Indigenous Peoples (IP)' in a generic sense to refer to a distinct social and cultural group possessing the following characteristics in varying degrees:

- Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
- Distinct language or dialect, often different from the official language or languages of the country or region in which they reside;
- Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories; and
- Customary cultural, economic, social, or political institutions are separate from those of the mainstream society or culture.

In Indonesia, more so than in most nations, determining a rigid identification formula for IP presents difficulties. An assessment of social impacts and consultation process is usually needed to determine if IFC PS 7 applies to a particular project based on characteristics listed in IFC PS 7 and Indonesian legislation.

Indonesia has a population of approximately 250 million. The government recognizes 1,128 ethnic groups; the fifteen largest ethnic groups account for almost 85% of total Indonesian citizens (Aris Ananta et al. 2015).

As described in the social baseline discussion in Chapter 7 IP characteristics are possessed to some degree by the Jenoponto inhabitants. They are members of an ethnic cultural group; how distinct this group is can be questioned in terms of how different it is from other Makassarese peoples (IFC PS 7 - Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others and Customary cultural, economic, social, or political institutions are separate from those of the mainstream society or culture). The Makassar language is the main regional language of South Sulawesi Province. All adults with even an elementary education also speak, and are literate in the National language Bahasa Indonesia (IFC PS 7 - Distinct language or dialect, often different from the official language or languages of the country or region in which they reside) . While attached to the ancestral territory in the southernmost portion of South Sulawesi and its natural resources, their customary cultural, economic, social, and political institutions are not separate from those of the mainstream society in Sulawesi, and to a large extent are not separate or distinct from those of Indonesia as a whole (IFC PS 7 - Collective attachment to geographically distinct habitats or ancestral territories in the project area and to

the natural resources in these habitats and territories). The Jenoponto inhabitants are not isolated and enjoy easy road access to Makassar, the largest city on Sulawesi Island, and the fifth largest city in Indonesia.

The Constitutional Court in May 2013 affirmed the Constitutional Rights of Indigenous Peoples to their land and territories including their collective rights over customary forest. Indonesia is also a signatory to the UN Declaration on the Rights of Indigenous Peoples (UNDRIP). That said the Government of Indonesia also recognizes that the concept of Indigenous Peoples is not applicable to as almost all Indonesians (with the exception of the ethnic Chinese) are indigenous and thus entitled to the same rights.

The Ministry of Social Affairs identifies some indigenous communities as 'komunitas adat terpencil' (geographically-isolated indigenous communities) rather than Indigenous Peoples, based on six characteristics: (1) small, closed homogenous groups; (2) kinship-based social institutions; (3) geographic remoteness in areas difficult for outsiders to access; (4) possessing simple technology; (5) high dependence on the environment and natural resources; and (6) limited access to social, economic, and political services (Presidential Decree No. 111 of 1999).

'Isolated vulnerable peoples' is the term used officially by the Indonesian Government to describe groups that have the characteristics of 'Indigenous Peoples' as used in OP/BP 4.10 or IFC PS 7. The term 'Isolated Vulnerable Peoples' arguably provides a better reflection of the intent of IFC PS 7 in the context of this Project.

The Jenoponto inhabitants do not find themselves facing distinct disadvantages, as they are not a minority but are mainstream society in the Project area. The Jenoponto inhabitants are also not isolated. Thus, while 'indigenous', as all *pribumi* Indonesians are indigenous, the local residents do not meet the criteria for IFC Performance Standard 7. There are thus no impacts on Indigenous Peoples within this defined sense, in the Planning Phase or subsequent phases of the Project.

Furthermore, in order to fully comply with IFC PS and ADB SPS, Indigenous People screening assessment has been conducted (presented in **Appendix 15**). The result shows that there is no indigenous community identified in the Project area.

According to the consideration above, the impact rating for indigenous peoples is summarized as follows.

Impact	Indigenous Peoples				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
	No change	Slight	Low	Medium	High

Impact	Indigenous Peoples				
Impact Magnitude					
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

10.3 Construction Phase

In most Windfarm Projects, most of the significant impacts, both negative and positive, occur during the Construction Phase.

Impacts on Land Use

The Project area and surroundings are utilized for a variety of land-usage, such as mixed farms and pasture, fields, forests, and smallholder "gardens" (*kebun*) among others. Pasture and dry land agriculture fields occupy the largest portion of land, followed by wet rice ("paddy") fields. Land use is dominantly pasture and paddy fields in Binamu and Batang Districts; and paddy fields in Turatea and Arungkeke Districts. Farming communities in Jeneponto Regency have a great interest in cultivating rain-fed rice fields with water availability being the main limiting factor.

Project roads will pass through developed irrigated land, rain-fed paddies, and mixed farms, with turbines and foundations planned for construction within this setting. With the limited land take (estimated 50 hectares), and given that after construction (and to some extent during), former land owners may continue to farm and graze on acquired land that is not actually devoted to structures, there will be little change in regional land use. The wind farm will simply diversify the landscape in a limited area.

According to the consideration above, the impact rating on land use change is summarized as follows.

Impact	Land Use Change				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual

Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Water Use and Quality

Construction activities potentially impact surface water due to runoff with high turbidity, accidental spill of hydrocarbons, and due to water use for the concrete plant.

Surface water erosion is an ongoing natural phenomenon. It can be accelerated or intensified if either the natural slope angle is increased, if the vegetative ground cover is removed or the surface is disturbed. Construction activities do all these.

Potential targets of significant erosion are any areas with changes to natural topography (e.g. development of laydown areas), and any cleared land surface. Access roads, including road embankments and road cuts and fills, and spoil piles are especially susceptible to erosion.

The two key principles of water erosion management are to sustain soil cover and hence to fence off erosion (erosion controls), and to control water quality through the reduction of sediment loads if erosion occurs (sediment controls). The first principle is a priority, since prevention is always better than cure.

Erosion management will be part of construction design and construction water management. Consideration is given to the hydrological and geologic attributes of the Project area. For example, revegetation of temporarily disturbed areas as soon as possible minimizes the extent of disturbed land at any one time, significantly reducing total erosion.

Erosion and sediment controls will be planned and designed as a sequence of components that incorporates the following five potential measures (**Figure 10-1**): (1) minimizing land disturbance; (2) managing run-on to disturbed areas; (3) managing drainage within disturbed areas; (4) managing ground cover; and (5) managing runoff and sediment existing disturbed areas. These are listed in priority order, as the aim is to favour preventative measures, minimizing the need for corrective measures and repairs.

Erosion control and management of runoff during construction is well understood, and will be an environmental performance criteria for the selected EPC Contractor.

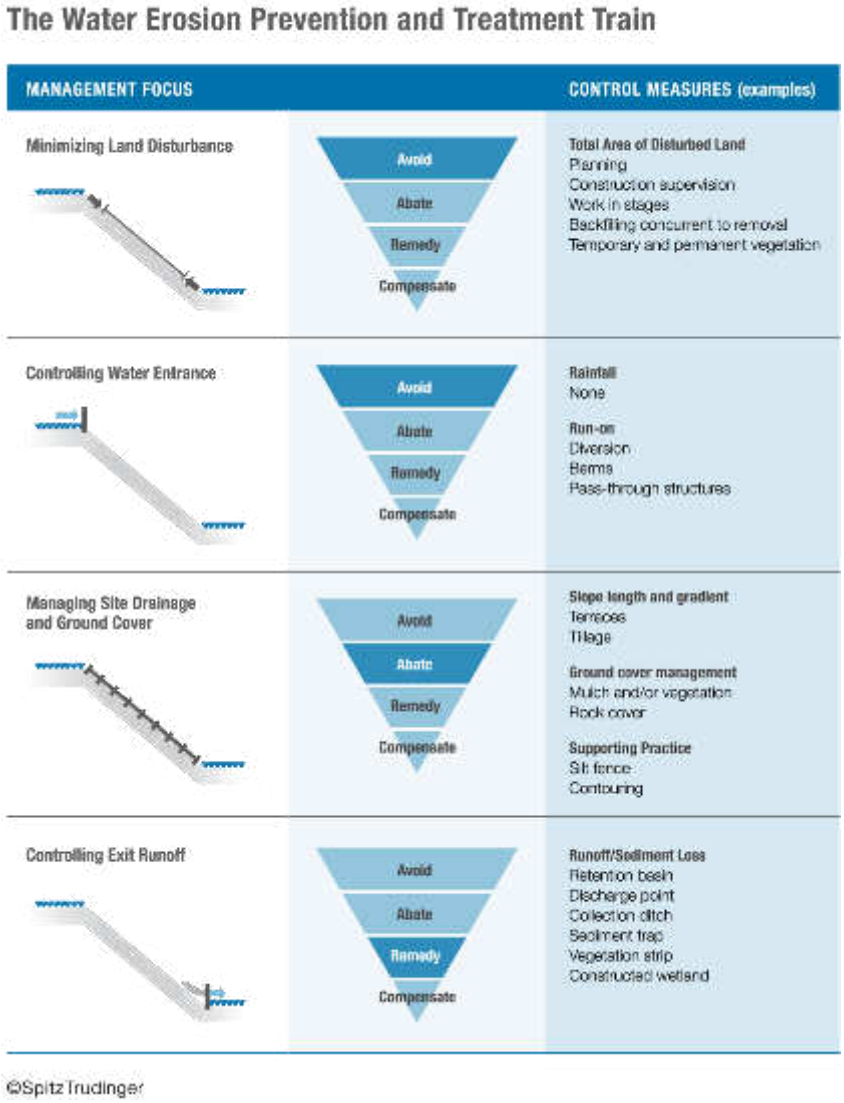


Figure 10-1 The Water Erosion Prevention and Treatment Train

Onsite fuel requirement during construction will be met by tanker trucks. Onsite storage of fuels will be limited to daily requirements and an onsite storage tank of a maximum capacity of 20,000 liters will be provided under due safety and security conditions for daily on-going activities. The onsite delivery of fuel or lubricant will be at designated location that will have an impervious base, with a dyke around to contain spills in case an accidental spill occurs.

It is believed that with careful monitoring of water quality, combined with standard operating procedures for handling hydrocarbons and wastewater during the Construction Phase, impacts of contamination of both surface water and groundwater resources can be avoided. These management and monitoring efforts will continue through the Operation Phase, when risks to water resources will be much lower.

Water for the concrete plant is sourced from groundwater. Hydrogeological investigations indicate that the yield of the aquifer sufficients to meet water demand.

According to the consideration above, the impact rating for water use and quality is summarized as follows.

Impact	Water Use and Quality				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Ambient Air Quality

There will be a potential impact on air quality due to onsite construction activities. The likely emissions from construction activities would include the following:

- Fugitive dust emissions from site clearing, digging, filling, and material handling;
- Fugitive dust emissions from road transportation;
- Vehicular emissions; and
- Emissions from operation of energy power diesel generations for construction purposes.

During the subsequent Operation Phase, impacts on air quality will of discontinue.

The impacts on air quality can be measured through monitoring of changes in air quality parameters such as SO_2, NO_2, CO, NH_3, Pb, and TSP/PS_{10}/$PS_{2,5}$ in accordance with GOI and local government requirements.

The risk of dust generation is increased by loss of vegetative cover, a loose, dry and smooth soil surface, large barren areas, equipment movement and strong winds. In construction, the most familiar result of dust generation is the receipt of complaints from community members living near the construction area. For them, air borne dust will be predominantly a visual nuisance; long-term exposure to construction dust and associated health impacts will not occur.

Clearly, dust is more an issue for construction activities in seasonally dry areas. Dust controls will focus on (1) stabilizing exposed surfaces and (2) minimizing activities that potentially suspend dust particles. For heavily trafficked areas such as access roads to active construction areas and for disturbed areas (e.g. land clearing areas), wet suppression (watering), gravel or asphalt surfacing, and wash bays areas at the entrance and exit to the project site will be employed as dust control measures as practical.

Stabilization of disturbed sites upon completion of earthworks will be also important. Disturbed land areas will be stabilized through revegetation. Although the main objective of revegetation is to reduce water erosion, reducing wind erosion will be also important.

Due to this condition, the impact rating for ambient air quality is summarized as follows.

Impact	Ambient Air Quality				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Noise

Throughout Construction all reasonable attempts will be made to comply with Minister of Environment Decree No 48/MENLH/11/1996 on Noise Standards for residential and natural areas and with local regulatory requirements (South Sulawesi Governor Regulation No. 69 of 2010. Measurements in April 2016 indicate that the pre-Project ambient noise levels in the Project area are at 45dB(A) or greater, below the threshold standard for settlement areas but high enough to make additive noise an issue.

Construction activities are generally in a fair distance to residential areas. While construction noise will be generated noise level will reduce to relevant guidance values at the nearest receptors.

Due to this condition, the noise impact rating is summarized as follows.

Impact	Noise				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Biodiversity and Habitat

The project area is in well-developed agricultural land (**Figure 10-2**) with little impact on biodiversity or natural habitat.

Figure 10-2 Aerial Photo of the Tolo I Wind Project

According to the consideration above, the impact rating for biodiversity and habitat is summarized as follows.

Impact	Biodiversity and Habitat				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable

Impact	Biodiversity and Habitat				
Significance	Negligible	Minor	Moderate	Major	Critical

Workforce Impacts on Host Communities

The Construction Phase workforce is estimated to reach about 180 workers at its peak, with a significant portion of unskilled labor recruited locally. Labor and workforce recruited from outside will be accommodated in a designated construction camp. Both measures, together with the relatively small workforce, will greatly reduce the social impacts on host communities from the presence of workers from outside the region.

According to the consideration above, the impact rating for workforce impacts and host communities are summarized as follows.

Impact	Workforce impacts on host communities				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Traffic and Transportation

As stated elsewhere wind tower parts are large and heavy and some of the components will require transportation using special permits. Due to the heavy nature of wind tower components, an evaluation of the transport route has been undertaken. The Project will ensure that all wind tower components are transported in appropriate vehicles that adhere to the axle load limits. Special purpose vehicles will be used to transport larger and heavier components.

As wind turbine projects are uncommon in Indonesia, the sheer size of the components will arouse significant interest by other road users. Secondly, the special purpose vehicles will move carefully and slowly to ensure that the wind turbine components are not damaged during transportation. This could cause traffic jams along the transportation corridor.

The wind turbine components will be transported under security and escorts during specific times of the day. The transport process will be undertaken in accordance with the Traffic Act and other relevant road laws in Indonesia.

The appointed EPC Contractor will undertake a detailed transport survey of the route between Makassar and the project site and conduct a route hazard survey. The EPC Contractor will be required to provide professional and safe abnormal load escorts for road safety purposes involving special purpose vehicles. High visibility colors or warning signs/lights will be used during the transportation of the wind turbines to the project site. The local police will be engaged for provision of traffic safety while the wind turbine components are being transported to the project site, and so will be BBJN (Balai Besar Jalan Nasional Wilayah XIII, as the road owner and Transportation Agencies along Makassar, Gowa, Takalar and Jeneponto.

Trucks and construction vehicles in the Project area will only be permitted to use the construction access roads and required to operate at specified speeds.

According to the consideration above, the impact rating of traffic and transportation is summarized as follows.

Impact	Traffic and Transportation				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

10.4 Operation Phase

Impacts of wind farms during operation are few and limited, largely related to noise generation, shadow flicker, impacts on birds and bats, and visual impacts. DNV GL's WindFarmer noise and shadow modelling modules are used to assess impact according to industry best practice guidelines and comply with regional requirements.

Noise

Wind turbines produce noise through a number of different mechanisms, which can be roughly grouped into mechanical and aerodynamic sources. The major mechanical components include the generator, and yaw motors, each of which produce their own characteristic sounds. Other mechanical systems, such as fans and hydraulic motors, can also contribute to the overall acoustic emissions. Mechanical noise is radiated by the surface of the turbine and from openings in the nacelle housing, The interaction of air and the turbine blades produces aerodynamic noise through a variety of processes as air passes over and past the blades (*Source: "Environmental, Health, and Safety Guidelines Wind Energy" World Bank Group, August 7, 2015*).

In the PLN Power Purchase Agreement (PPA) Noise Regulations, the on-land limit for ground level noise from all generating capacity when operating in steady state conditions must comply with the requirements of PLN Standards SPLN 46-1:1981 and SPLN 46-2-2:1982. Noise levels shall be the quieter of:

(1) No more than 70 dB(A) by day (6:00 to 22:00) and no more than 60dB(A) by night (22:00 to 06:00) at a distance of one meter from the base of each WTG tower, or

(2) At a distance of 300 meters from the base of the WTG tower, the noise levels shall be no more than 60 dB(A) by day (6:00 to 22:00) and no more than 55dB(A) by night (22:00 to 06:00).

As shown in the baseline environment discussion, daytime noise levels in the Project area were within the standards of Minister of Environment Decree No 48 of 1996 for settlement areas; but they were high enough that additional noise sources could enable reaching the threshold.

The process of siting the WTG, and modelling of noise and shadow flicker is as follows:

Figure 10-3 Use High Resolution Imagery to Identify Constraints

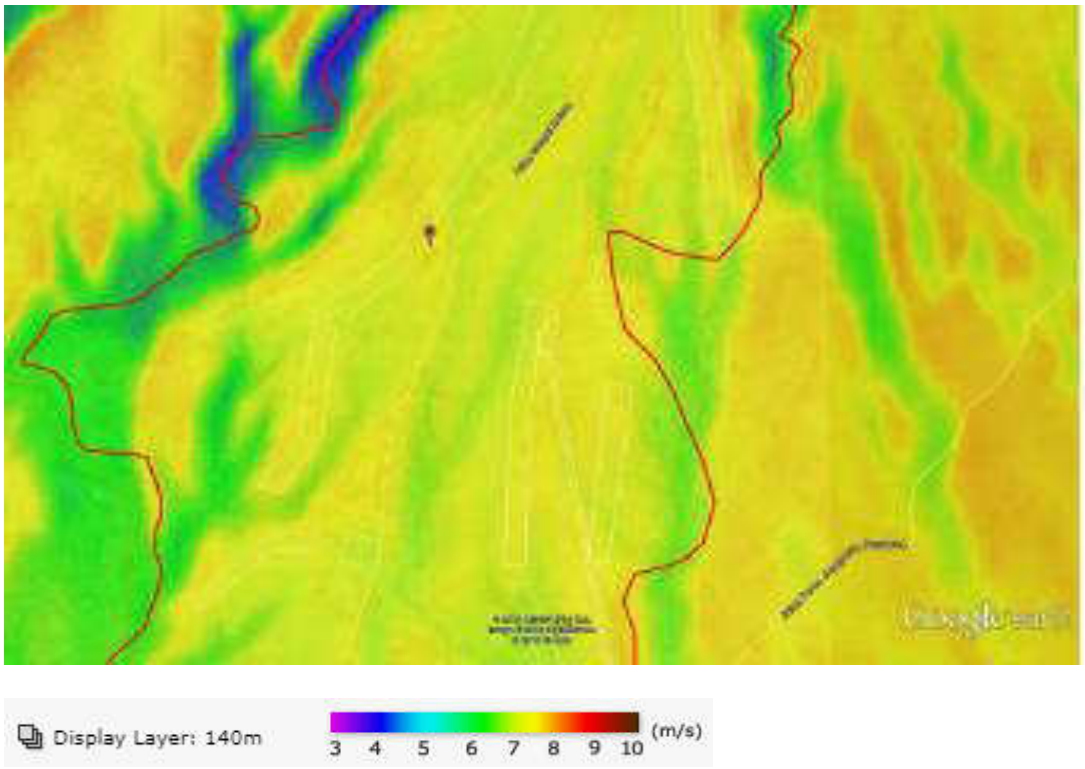


Figure 10-4 Overlay Permitted Corridors on Wind Map

Figure 10-5 Overlay Permitted Corridors on High Resolution Imagery and High Resolution 2.5m Contours

Note: Black circles show setback radius of each turbine

Figure 10-6 Use High Resolution Imagery and Contours to Define Setbacks

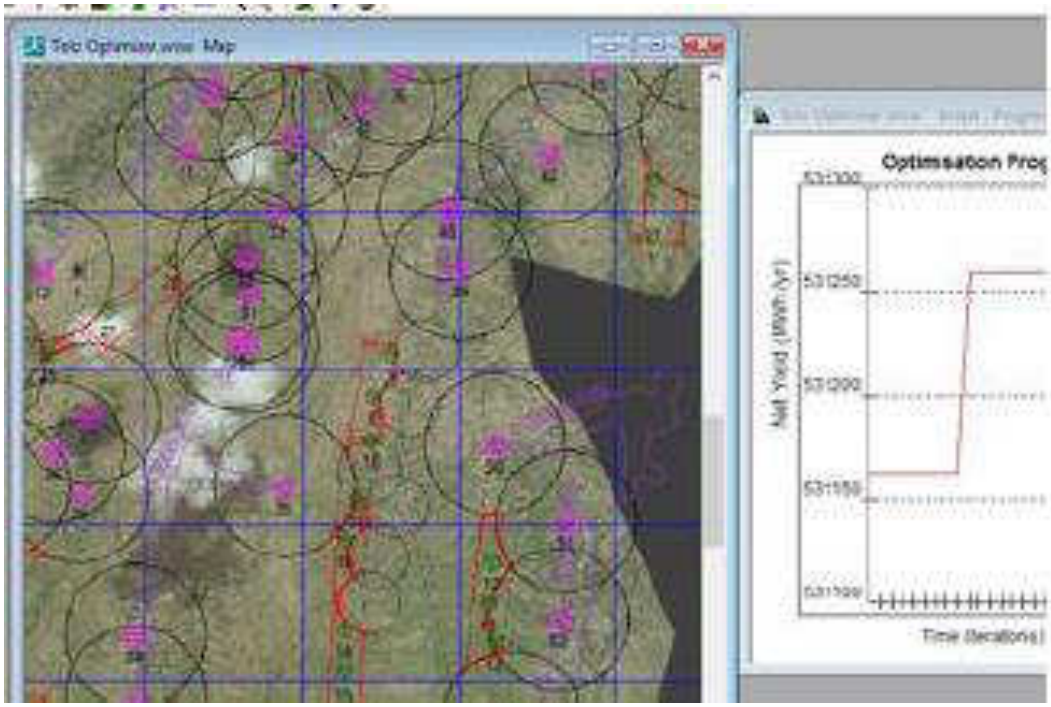


Figure 10-7 Use WindFarmer to Optimise Layout for Max Energy Using Suitable Spacing

Note: Red contours represent the shadow spread

Figure 10-8 Use Optimized Layout to Undertake Shadow Flicker Analysis and Overlay Results on High Resolution Imagery

Figure 10-9 Use Optimized Layout to Undertake Noise Impact Analysis and Overlay Results on High Resolution Imagery

Note: Black and white circles are example of turbine spot

Figure 10-10 Remove/Move Turbine Positions to Mitigate Shadow Flicker and Noise Impact to Conform to World Bank Group Guidelines

Modelling suggests that

- Layout is compliant with PPA Regulation of 50 dB(A);
- Layout is compliant with South Sulawesi Governor Regulation No. 69/2010 of 55 dB(A) at residential areas; and
- Layout is largely compliant with World Bank Guideline of 55 dB(A) at resident with the worst case noise level at the closest receptor of 41 dB(A).

The direct measurements at certain receptors point to background noise levels of up to 51.7 dB(A), still below the World Bank Guideline of 55 dB(A) (day time) and 45 dB(A) (night time) for this ESIA.

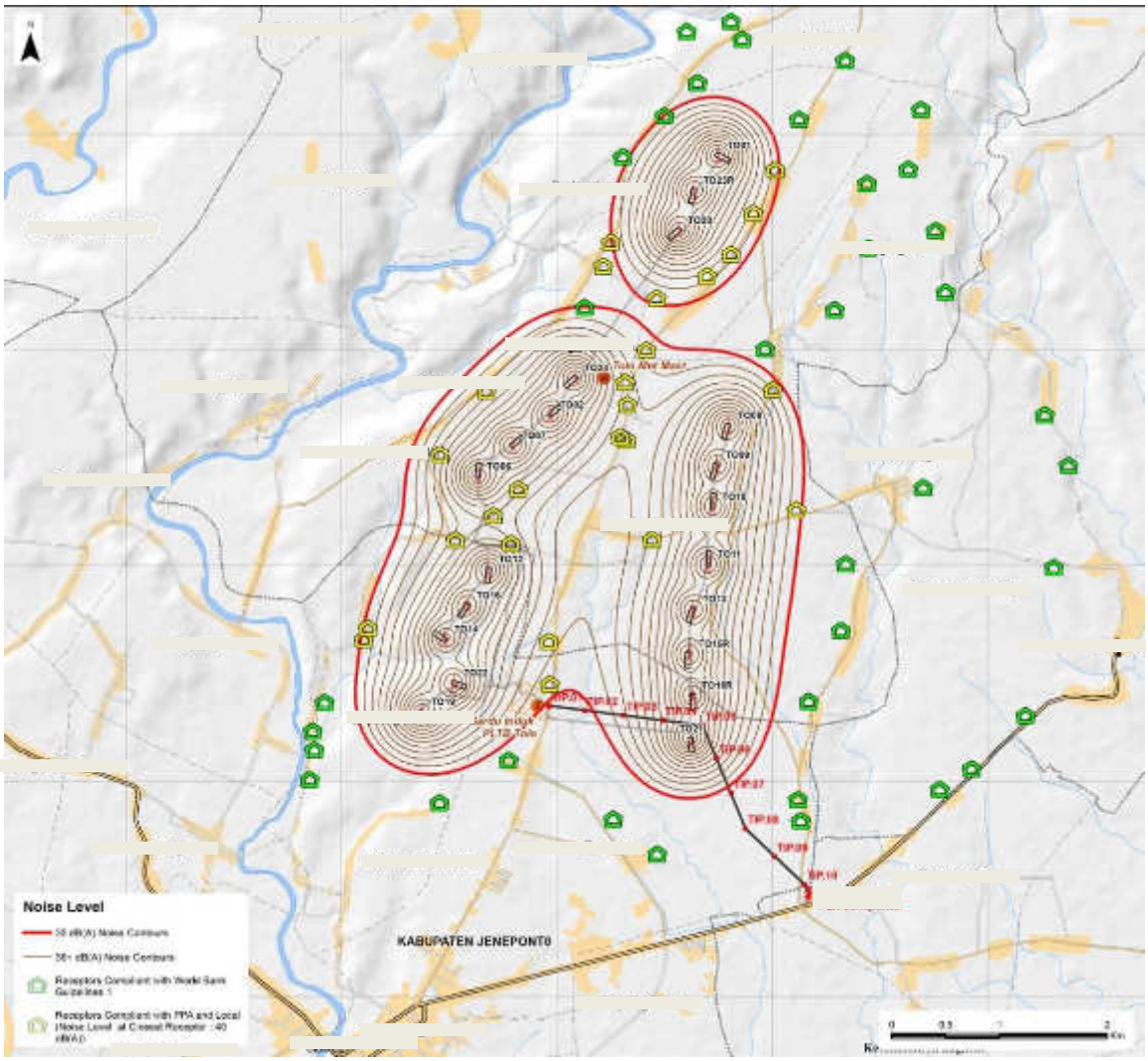


Figure 10-11 Turbine Layout with Assessed Noise Levels from Turbines with Sensitive Receptors

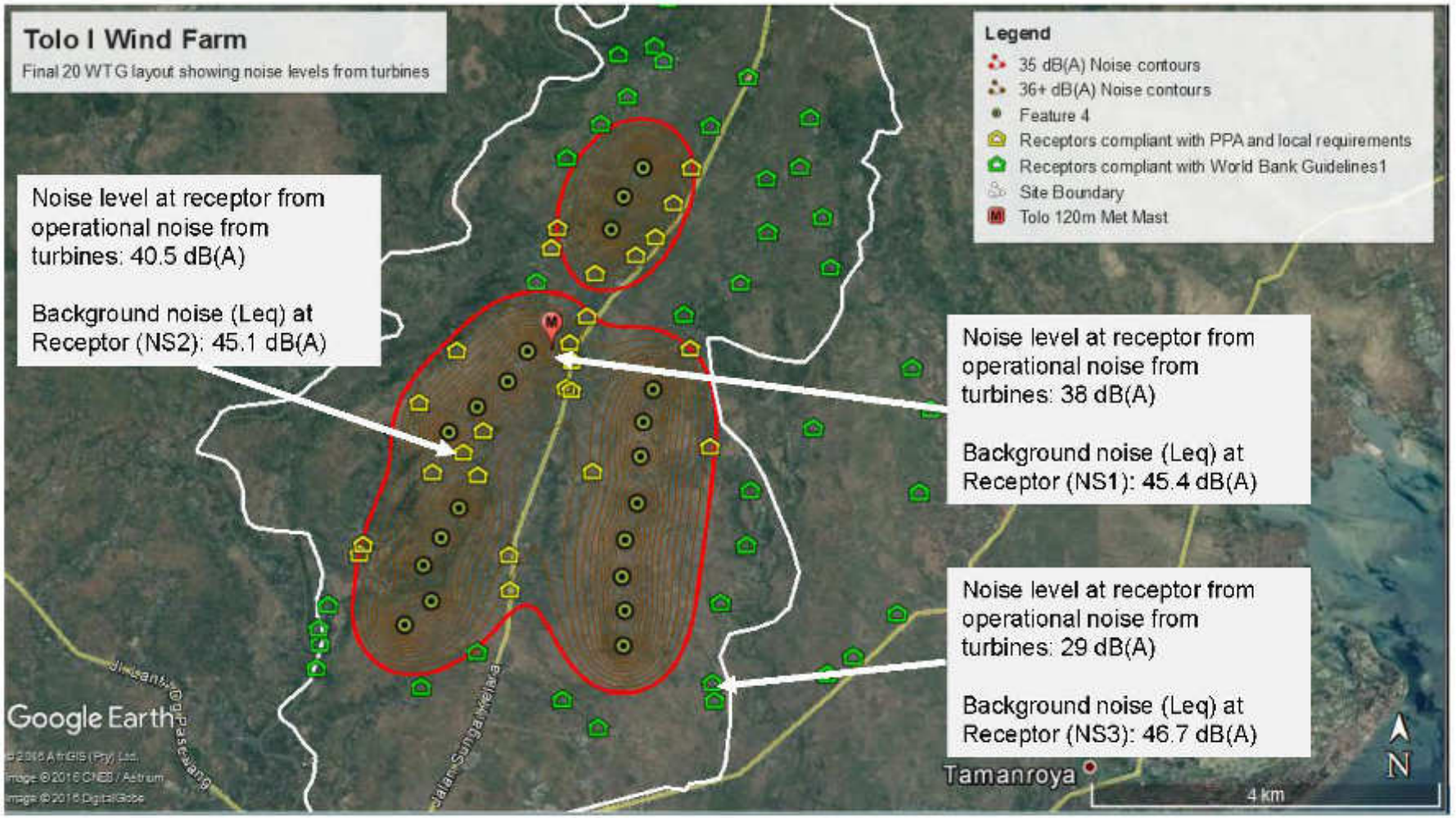


Figure 10-12 Turbine Layout with Assessed Noise Levels from Turbines with Sensitive Receptors (Continued)

According to the consideration above, the impact rating of noise during operational phase is summarized as follows.

Impact	Noise				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Shadow Flicker

Shadow flicker are simulated for the worst-case and the realistic case.

Worst Case

In order to assess compliance with the IFC EHS guidelines, shadow flicker is modelled and predicted based on an astronomical worst-case scenario, which is defined as follows:

- There is continual sunshine and permanently cloudless skies from sunrise to sunset.
- There is sufficient wind for continually rotating turbine blades.
- Rotor is perpendicular to the incident direction of the sunlight.
- Sun angles less than 3 degrees above the horizon level are disregarded (due to likelihood for vegetation and building screening).
- Distances between the rotor plane and the tower axis are negligible.
- Light refraction in the atmosphere is not considered.

This ESIA made use of the aforementioned astronomical worst-case scenario to model and predict shadow flicker from each turbine on identified receptors from high resolution up-to-date satellite imagery.

Shadow flicker assessment concludes that the layout is largely compliant with World Bank Guidelines of no more than 30 hours/year of shadow flicker at receptors. 11 out of 57 groups of receptors have shadow flicker greater than the World Bank Guideline with 10 out of the 11 with shadow flicker levels of 40 to 90 hours/year. The worst case shadow flicker at closest receptor to layout is 140 hours/year.

Realistic Case

In addition, the realistic case been asses as follows.

- Cloud cover of 28% results in a 28% reduction of shadow flicker impact,
- Wind turbines rotating for 84% of the year, results in a 16% reduction of shadow flicker impact,
- 10 out of 57 groups of receptors will now have shadow flicker levels of 30-54 hours/year,
- Worst case shadow flicker at closest receptor to layout is now 84 hours/year.

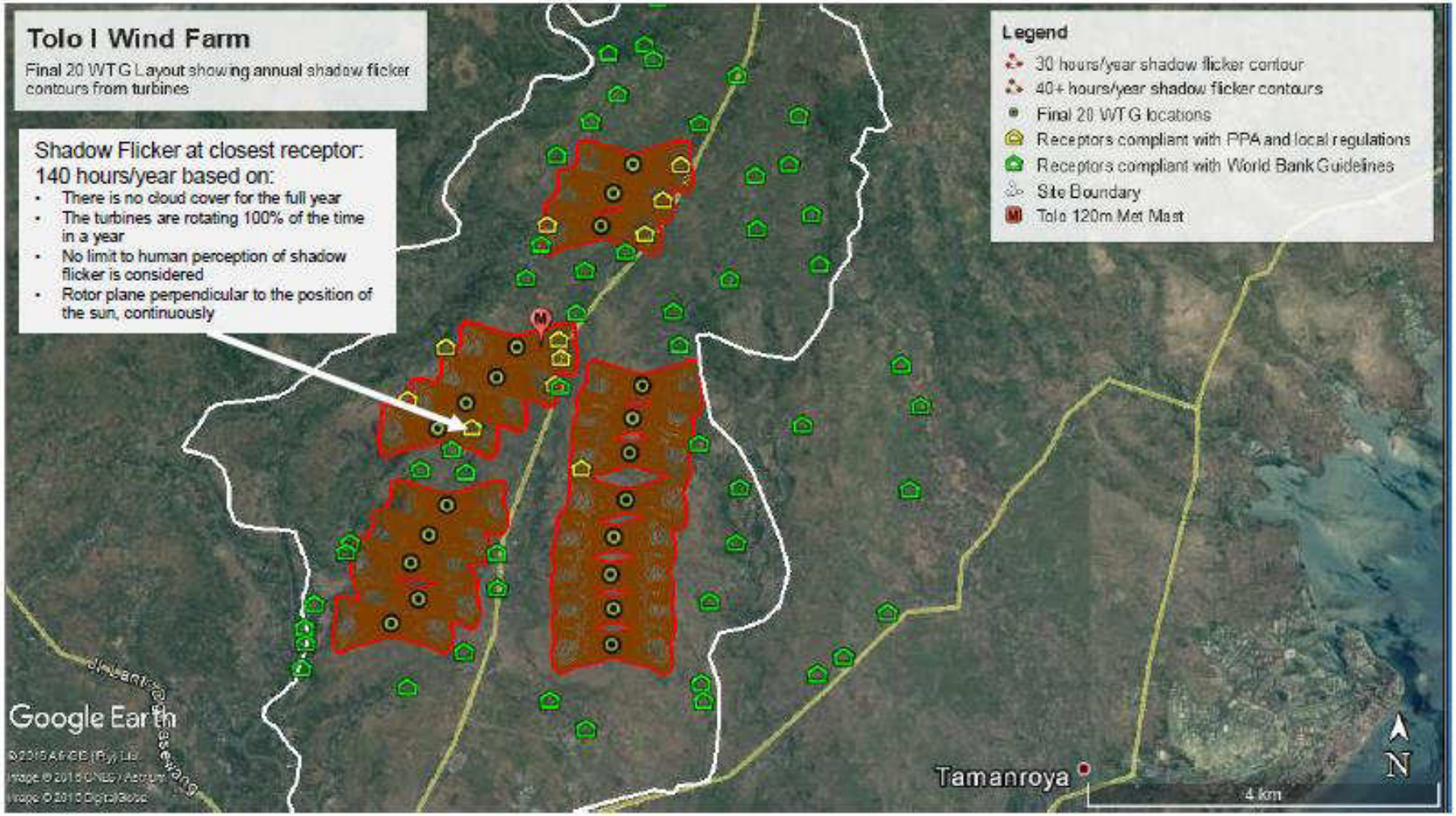


Figure 10-13 Final 20 Turbine Layout with Shadow Flicker Map –Worst Case Modelling

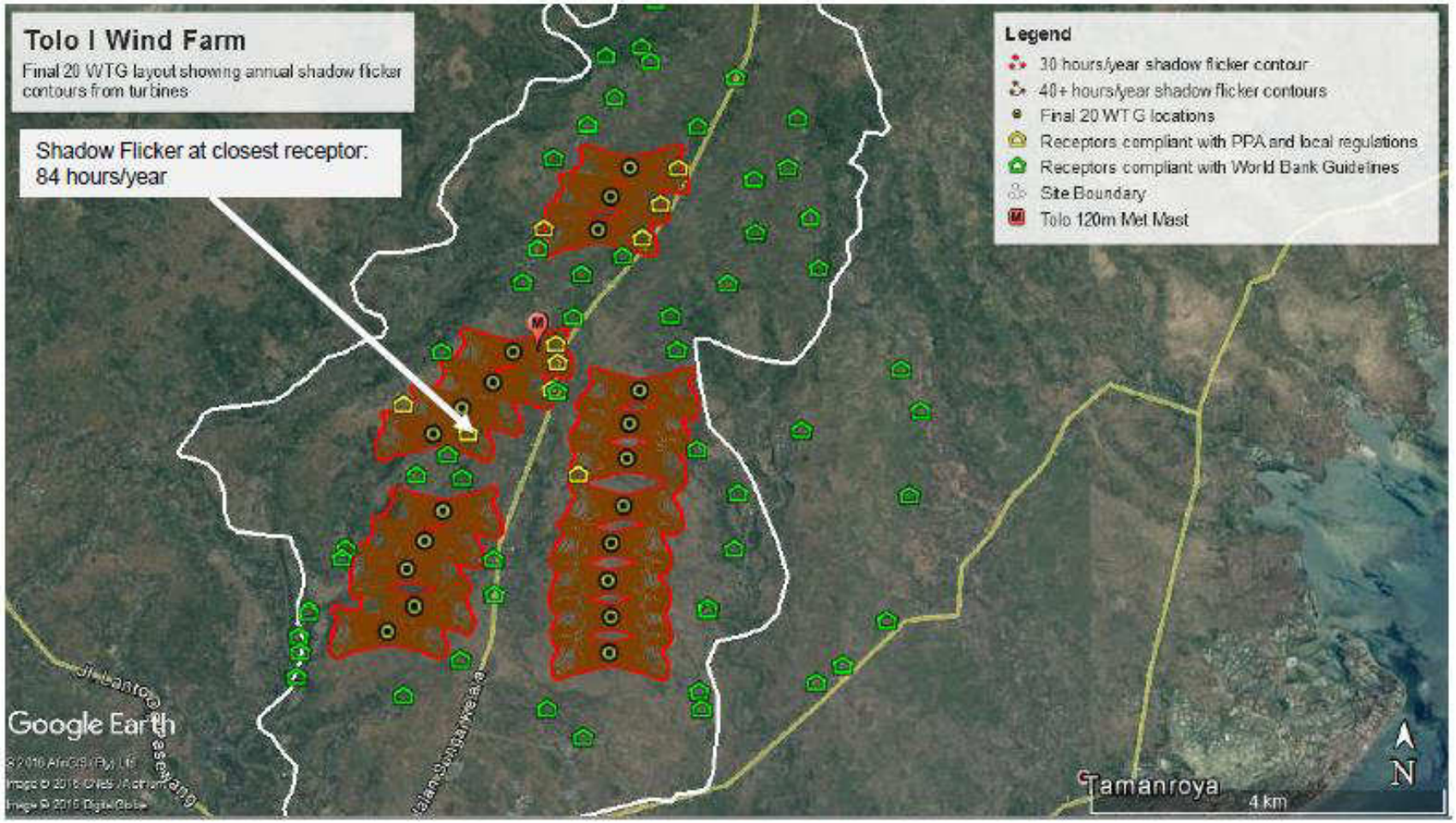


Figure 10-14 Final 20 Turbine Layout with Shadow Flicker Map –Realistic Modelling

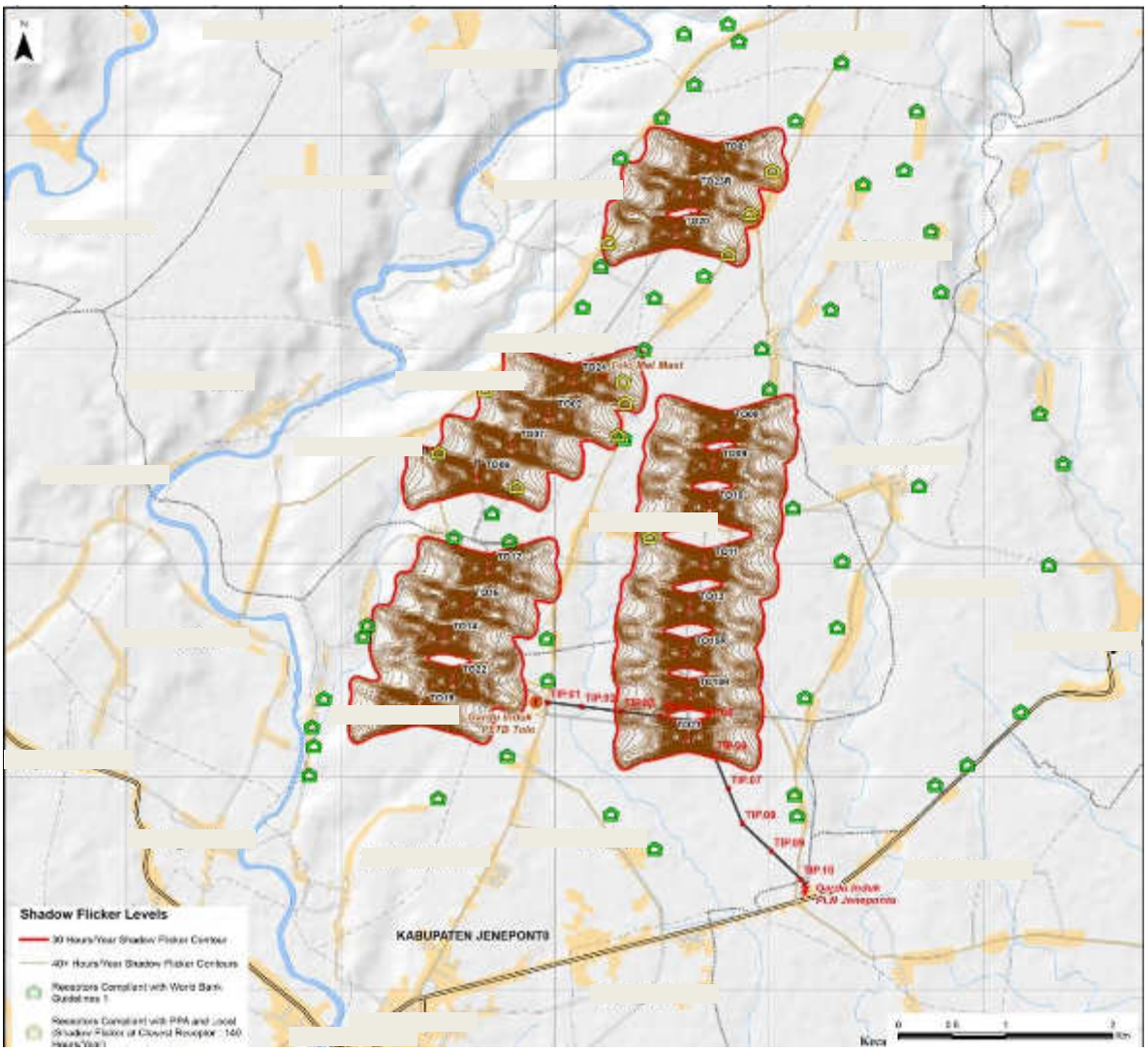


Figure 10-15 Turbine Layout with Assessed Shadow Flicker Levels from Turbines with Sensitive Receptors

While shadow flicker assessment indicates an exceedance of the recommended maximum duration, it is reasonable to assume that the worst case scenario underlying the calculation will be not reached:

- *There is continual sunshine and permanently cloudless skies from sunrise to sunset* - As with many areas of Indonesia, Jeneponto Kabupaten experiences a dry and wet season. From December to March the northerly winds contain abundant water vapor coming from Asia and the Pacific Ocean facilitating the rainy season. Two transitional periods occur each year in April-May and October-November. By definition the rainy season implies cloud cover. Furthermore the Hasanuddin Airport meteorological station, with 22 years of record, shows an annual average daily global solar radiation of 18.2 Mj/m2 (megajoules per square meter). Global solar radiation is the sum of direct and indirect sunshine reaching the ground at the Makassar airport. On average over 22 years, only March, August, September,

October, and November exceeded the average. May, June, and July were below 17 Mj/m2. Thus, only in March and August through November does a site in South Sulawesi approach the all-day continuous sunshine assumption.

- *There is sufficient wind for continually rotating turbine blades.* - The minimum wind velocity for turning commercial wind turbines' rotors is about 3 m/s (cut-in wind). In reality, wind at hub height does not always blow at or above the cut in wind speed 24/7. Thus, it is clear that 'sufficient wind for continually rotating turbine blades 24/7' is the least realistic assumption used.
- *Rotor is perpendicular to the incident direction of the sunlight* – Wind direction is predominantly from south-east to north-west, or vice versa.

According to the consideration above, the impact rating of shadow flicker is summarized as follows.

Impact	Shadow Flicker				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Landscape and Visual Impacts

IFC's Environmental, Health, and Safety Guidelines for Wind Energy (August 7, 2015) paragraphs 11 through 16 address Landscape and Visual Impacts, as follows: 'Depending on the location, a wind energy facility may have an impact on viewscapes, especially if visible from or located near residential areas or tourism sites. Visual impacts associated with wind energy projects typically

concern the installed and operational turbines themselves (e.g., color, height, and number of turbines)'.

Impacts may also arise in relation to operational wind facilities' interactions with the character of the surrounding landscape. Impacts on Legally Protected and Internationally Recognized Areas of importance to biodiversity and cultural heritage features are likely not issues for the Tolo site. Maps, satellite images, and photographs from key viewpoints may be used to inform both the assessment and the consultation processes. Avoidance and minimization measures to address landscape and visual impacts are largely associated with the siting and layout of wind turbine towers and associated infrastructure, such as meteorological towers, access roads, and substations.

Consideration is given to turbine layout, size, and scale in relation to the surrounding landscape character and surrounding visual receptors (e.g., residential properties, users of recreational areas/routes). Consideration is also given to the proximity of turbines to settlements, residential areas, and other visual receptors to minimize visual impacts and impacts on residential amenity, where possible. All relevant viewing angles are considered when selecting turbine locations, including viewpoints from nearby settlements.

Other factors that can minimize visual impacts:

- Incorporate community input into wind energy facility layout and siting.
- Maintain a uniform size and design of turbines (e.g., type of turbine and tower, as well as height).
- Adhere to country-specific standards for marking turbines, including aviation/navigational and environmental requirements (see Community Health and Safety section below), where available, and as exist.
- Minimize presence of ancillary structures on the site by minimizing site infrastructure; including the number of roads, as well as by burying collector system power lines, avoiding stockpiling of excavated material or construction debris, and removing inoperative turbines.
- Erosion measures will be implemented and cleared land will be promptly re-vegetated with local seed stock of native species.
- Finishing the turbine and transmission towers with a natural earth shade between green and brown so that these features are less conspicuous at a distance. .

Figure 10-16 Layout with Potential Receptors, has been produced from a recent satellite image with the currently planned wind farm layout superimposed. As can be seen, the turbines are to be arranged in a generally north-south, linear, roughly 5-km-long configuration, with the transmission line crossing roughly southeast to west. Surface drainage, roads, and human settlements also tend to be aligned north-south or south to northeast, generally paralleling the turbine plan. The nearest village centers are generally within 1 to 1.5 km in all directions from the planned turbine array, mostly to the east and west. Maccinj Baji is the nearest village to the east, East Kayuloe only about 500 meters to the west. Part of Empoang Village is less than 300 meters to the south of the transmission line and most of this settlement will clearly see the line to the north and northeast.

Virtually most of the land used is rain-fed wet rice fields, which are dry scrub-grassland about half the year. While not complely flat, there is very little local relief, so the turbine and transmission towers will be visible for some distance by hundreds of residents. **Figure 10-12** is based on the same image as **Figure 10-13,** tilted to provide an oblique view, with turbine and high voltage tower depictions superimposed. This confirms the wind farm will be a highly visible presence in the visual landscapeWhether it is objectionable to the local residents is largely a matter of personal tastes and preferences; it can be considered at best a positive change signifying the region and the country are advancing into a more developed era.

Visual impacts will remain as residual effects of the wind farm regardless of management and mitigation measures applied.

According to the consideration above, the impact rating of landscape and visual impacts is summarized as follows.

Impact	**Landscape and visual impacts**				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

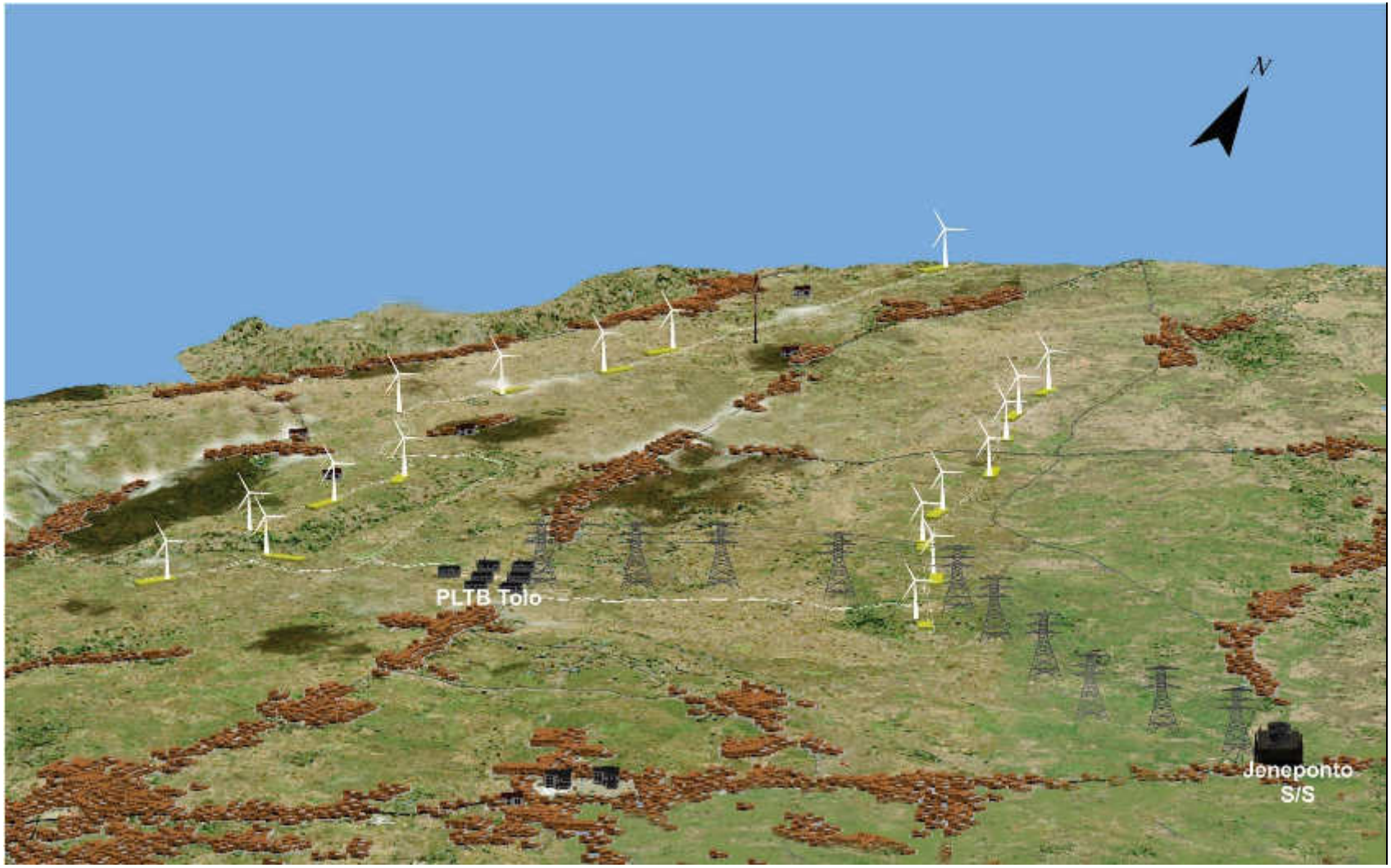


Figure 10-16 Visual Impacts Illustrated

Birds and Bats

The main threat posed by the wind turbines on avifauna is collision with the rotors during the operational phase. Bird mortality impacts during the construction phase are minimal and therefore not assessed. Direct mortality or lethal injury of birds may result from collisions with rotors and associated structures such as power lines and meteorological masts.

A number of factors influence bird mortality at wind farms. These factors relate to bird species, numbers and behaviour, weather conditions and topography and the nature of the wind farm itself, including the use of lighting if applicable.

The study recorded 29 species of birds of 20 families, of which 9 species are protected species under Indonesia Regulation. Observation data shows most of the findings are terrestrial and shrub birds. This species has low flying paths, less than 20 meters from the ground. Of animals in the study area, the group Aves (birds) are the animals most commonly found, while other groups are uncommon, other than human-domesticated animals. Of the bat and bird species identified in Section 7.5, all are classified IUCN conservation status “least concern.” Of the 29 bird species identified at the site, 9 are protected species under Law No 7 of 1999. None of the four bat species identified at the site are protected under Law No 7 of 1999 . Endemic species of birds and bats have not been identified to date in the site region.

The survey recorded five species of bats of two families, capturing four species of Pteropodidae and a species of Vespertilionidae. Based on literature reviews and habitat mapping, bat habitats can fall under two categories, insectivorous bats prefer paddy fields and dry-land agriculture as their main area for foraging and dry-land agriculture for roosting habitat. The insectivore bat recorded was the Flute-nosed Bat.

Landscape features can potentially channel birds towards certain areas influencing their flights and foraging behaviour. There no specific landscape characteristics at the Project area that would suggest potential channelling of birds towards the wind turbines. There are also no know caves in the larger project region that house colonies of bats.

The number of turbines in a wind farm also influences the risk of collision with more collision expected in areas with more turbines. Lighting of turbines and other infrastructure have the potential to attract birds especially night migrants and nocturnal species thereby increasing the risk of collision with turbines. In this Project there is no lighting of wind turbines, hence eliminating the risk of attracting nocturnal avian species.

The risk is expected to be greater on or near areas regularly used by large numbers of feeding or roosting birds or on migratory flyways or local flight paths, especially where the turbines intercept these. Interviews with local community members suggest that there are no large flocks of migratory birds at a particular season. Large birds with poor manoeuvrability (such as ducks and geese) will be at greater risk of collision with structures; these birds do not exist at the project area.

There is a likely risk of collision with structures when visibility is poor due to fog or rain although this effect will be to some extent offset by lower levels of flight activity in such conditions. The Project area as most part of Indonesia is not known for ‘foggy’ conditions.

Thus, while the wind turbines conceivably may cause increased mortality among the bat and bird populations in the site area, this is unlikely to be a significant biodiversity issue, though it may disrupt local ecology.

Figure 10-17 *Cynopterus sphinx,* Netted at the Site

According to the consideration above, the impact rating on birds and bats is summarized as follows.

Impact	Birds and bats				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High

Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Community, Health, Safety, Security

Issues of community Health, Safety and Security during the operation phase of the project are largely related to the blade throw incident due to rotor failure, aviation disruption, electromagnetic interference on telecommunication system, limited public access.

Blade Throw – Risk associated with blade throw can be considered negligible in the Tolo I Wind Energy Project due to the equatorial climatic condition of the Project area where risk of ice accumulation on blades are highly unlikely.

Aviation Impacts - The Tolo I Project proponent will adhere to country-specific standards for marking turbines, including aviation/navigational markings. WTG will be painted in white to light grey (non glossy) providing a good compromise between visibility and aviation safety and potential visual impacts. An obstruction light compliant with SNI 03-7051-2004 will also be installed on top of each turbine nacelle to comply with, The Jeneponto region is not on major civil aviation routes and aviation impacts are unllikely.

Electromagnetic Interference - A wind turbine can act as both a transmitter and receiver of electromagnetic interference. The nature of the potential impacts depends primarily on the location of the wind turbine relative to the transmitter and receiver, characteristics of the rotor blades, signal frequency receiver characteristics, and radio wave propagation characteristics in the local atmosphere. Given the rural setting and the distance of wind turbines to the nearest settlements it is reasonable to conclude that electromagnetic interference will not be of major concern. According to the consideration above, the impact rating on community, health, safety and security is summarized as follows.

Impact	**Community, health, safety and security**				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
	Slight	Low	Medium	High	Very High

Impact	Community, health, safety and security				
Impact Severity					
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Public Access

Any public rights of way located within and close to the wind energy facility site will be identified prior to construction in an effort to establish any measures that may be required to ensure the safety of their users. Any prevention and mitigation measures will be conducted as applicable regarding this issues which include the construction of fences and gate at the site facilities and providing the applicable warning sign.

According to the consideration above, the impact rating on public access is summarized as follows.

Impact	Public Access				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Cumulative and Transboundary Impacts

The Project is located in a rural setting, and there are no significant Project emissions to air or water. Cumulative and/or transboundary impacts do not exist.

10.5. Decommissioning

The wind farm site, after having remained in operation for the lifecycle, estimated at 30 years will not lose its value as a wind power generation system. Its performance would on the other hand enhance the value of the site as a wind farm. This would demand upgrading rather than scrapping the plant and equipment or abandoning the site. Scrapping the site is therefore not envisaged. However if at the end of the Project life, the operational permit is not transferred or renewed, then the wind energy structures will be disassembled, moved, and reused elsewhere.

Demolition

Turbines will be dismantled, loaded on trucks, and moved from the location to be sold as scarp. The surface elements of foundations will be demolished and the materials from the process transferred to a dump site at a location that will be determined later.

According to the consideration above, the impact rating of demolition activities is summarized as follows.

Impact	Demolition				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Site Rehabilitation

The former tower sites will be flat areas that are rehabilitated. In the Post Operation Phase; remaining subsurface turbine foundations will be covered with soil and foundation pit sites will be rehabilitated, backfilled with soil, and replanted with vegetation. The access roads may be left intact, if local people desire to use them. If not, they too will be dismantled and the land returned to its original condition.

According to the consideration above, the impact rating of site rehabilitation is summarized as follows.

Impact	Site rehabilitation				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Secondary	Indirect	Cumulative	Residual
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	Global		
Impact Magnitude	No change	Slight	Low	Medium	High
Receptor Sensitivity	Low	Low-Medium	Medium	Medium-High	High
Impact Severity	Slight	Low	Medium	High	Very High
Likelihood	Extremely unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood / Inevitable
Significance	Negligible	Minor	Moderate	Major	Critical

Table 10 -1 Summary of Impact Evaluation

No	Activity and/ or Impacts	Impacts Magnitude	Sensitivity of Receptor	Impact Severity	Impact Likelihood of Occurence	Impact Significancy/ Urgency
A	**PLANNING PHASE**					
1	Land Acquisition and Economic Displacement	Low	Low - Medium	Low	High Likelihood/ Inevitable	Minor
2	Cultural Heritage	Low	N/A	N/A	Unlikely	Negligible
3	Community Perception	Medium	N/A	N/A	High Likelihood/ Inevitable	Major

No	Activity and/ or Impacts	Impacts Magnitude	Sensitivity of Receptor	Impact Severity	Impact Likelihood of Occurence	Impact Significancy/ Urgency
4	Indigenous Peoples	Low	N/A	N/A	Extremely Unlikely	Negligible
B	**CONSTRUCTION PHASE**					
1	Impacts on Land Use	Low	Medium	Medium	High Likelihood/ Inevitable	Moderate
2	Water Use and Quality	Medium	Low	Low	Medium Likelihood	Negligible – Minor
3	Ambient Air Quality	Low	Medium	Medium	Medium Likelihood	Minor-Moderate
4	Noise	Low	Medium	Medium	Medium Likelihood	Minor-Moderate
5	Biodiversity and Habitat	Low	Low	Slight	Low Likelihood	Negligible
6	Workforce Impacts on Host Communities	Medium	N/A	N/A	High Likelihood/ Inevitable	Major
7	Traffic and Transportation	Medium	Low-Medium	Medium	Medium Likelihood	Moderate
C	**OPERATION PHASE**					
1	Noise	Low	Low-Medium	Low	Low Likelihood	Negligible
2	Shadow Flicker	Medium	Medium	High	High Likelihood/ Inevitable	Major
3	Landscape and Visual Impacts	Low	Medium	Medium	High Likelihood/ Inevitable	Moderate
4	Birds and Bats	Medium	Low	Low	Medium Likelihood	Negligible-Minor
5	Community Health, Safety and Security	Low	Low-Medium	Low	Unlikely	Negligible
6	Public Access	Low	Low-Medium	Low	Low-Likelihood	Negligible
D	**DECOMMISSIONING**					
1	Demolition	Low	Low-Medium	Low	High Likelihood/ Inevitable	Minor
2	Site Rehabilitation	Low	Medium	Medium	High Likelihood/ Inevitable	Moderate

CHAPTER 11
ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

Mitigation and monitoring measures for potentially significant impacts are detailed in the ESMP. The ESMP designates responsible authorities and identifies relevant project documents that support execution of the ESMP. The ESMP is comprised of the following tables: Table 11-1 for planning phase, **Table 11-2** for construction phase, **Table 11-3** for operation phase and Decommissioning is addressed in the final Section.

Environmental, Social, Health & Safety Management System (ESHS-MS) has been developed. This document is intended to govern the interaction of each management sytem document. The document can be found in Appendix 1. Furthermore, the site specific Construction Health, Environmental and Social Management Plan (CHESMP) can be accessed through this link

.

11.1 Planning

Table 11-1 Planning

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
Community Negative Perception and Community disharmony due to Survey and Permitting Activities	Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village).	Number of community grievances	Provide clear project information/plan to community and other Project stakeholders through project socialization Close coordination with related government Agencies and other stakeholders	Binamu District Empoang and North Empoang Village Turatea District: Kayuloe East and Kayuloe West Village Batang District: Maccini Baji Village Arungkeke District: Kalumpang Loe village	1 time before field activity		AMDAL (RKL/RPL) UKL/UPL Grievance Mechanism
Community Negative Perception and Community disharmony due to Land Acquistion	Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District (Maccini Baji Village); and	Number of community grievance	Provide clear explanation on the land acquisiton process, Compensation and eligibility to avoid wrong perception and community disharmony Implement Grievance Mechanism and maintain its records (including name,	Binamu District Empoang and North Empoang Village Turatea District: East Kayuloe and West Kayuloe Village Batang District: Maccini Baji Village	Frequent socialization as necessary		AMDAL (RKL/RPL) UKL/UPL

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
	Arungkeke District (Kalumpang Loe Village)		grievance/concern, date, and the resolution and any other related information) Close coordination with BPN (Land agency), heads of villages, district head and other local governmental agencies	Arungkeke District: Kalumpang Loe village			

11.2 Construction

Table 11-2 Construction

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
Job opportunity and business opportunity	Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)	Number of local workers employed by the project follow the requirements stated in AMDAL document	Prioritize qualified local residents to be recruited by the project. Provide insurance and social security as per local regulation (at the minimum all worker shall be covered by BPJS insurance) Give the local community opportunity to do informal businesses (such as shop around the project location as long as theya are within safe perimeter and not disturb the project activities) Close coordination with local village heads, local youth leaders (karang	Worker database at the Project office location	Every time job openings announced	Project Management	AMDAL (RKL/RPL) UKL/UPL Grievance Mechanism

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
			taruna) on the job openings				
Degradation of local air quality due to emissions and dust generation	Workers Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District(East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages) ; Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)	Compliance to the Air Quality Standards as stipulated in South Sulawesi Governor Regulation Number 69 of 2010.	Provide proper enclosure for beds of all trucks transporting material at the project location Provision of good maintenance on the vehicles at the project site Provision of speed limits within the project area to prevent dust dispersion Provision of water tanker to spray the roads during dry season and install wash bays at the entrance and exit to the project site	ambient air quality sampling at 3 points based on the mobilization route; (adding those points in the TL UKL/UPL)	As per Amdal commitment (six monthly during construction period)	Project Environmental Management	AMDAL (RKL/RPL) UKL/UPL

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
Noise and Vibration	Workers Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)	Compliance to the noise and vibration standard as stipulated in the South Sulawesi Governor Regulation number 69 of 2010.	Provision of speed limit within the project location. The noise management plan includes the following measures: Wind turbines are sited to ensure minimal operational noise impact using IEC Type certified turbines with Industry Best Practice Sound Level Guarantees. Where it is deemed in project-specific circumstances that operational noise from the turbines and not background noise is causing disturbance to the community, PT EBJ will operate the turbines in reduced noise mode. Furthermore, if it is	Noise sampling at 3 points[5] based on the mobilization route;	As per Amdal commitment (six monthly during construction period)	Project Management	AMDAL (RKL/RPL) UKL/UPL

[5] The previous 3 sampling locations were for previous site plan which is then not fully suitable with the updated site plan. Therefore only 3 noise sampling points for periodic monitoring.

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
			deemed that operating turbines in reduced noise mode is still causing noise disturbance to the community, PT EBJ will explore the use of noise barriers such as trees and bushes, installing double-glass windows, or erecting walls around affected residences. If above measures prove insufficient, as a measure of last resource, PT EBJ will consider relocating affected households (if an voluntary agreement with affected households can be reached) if this measure is warranted. Provision of noise reduction device on the vehicle mufler Provision of vehicle and				

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
			heavy equipment maintenance program Provision of Grievance Mechanism				
Road damage	Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)	Number of existing roads damages as a result of project vehicle mobilization is minimal	Upgrade (if necessary) the existing road before use by the project Coordinate with local village heads or other related authorities before using the existing road. Check road conditions before the start of the hauling activities.	Existing roads used by the projects	As per Amdal commitment six monthly during construction period)	Project Management	AMDAL (RKL/RPL) UKL/UPL
Road accidents	Workers Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages);	Road accident rate at the project location	Provision of traffic management controls Provision of traffic wardens Provision of traffic signs and warning signs	Within the project location and at each intersection with the existing road/village road Along the roads used to mobilize the equipment (Makassar – Jeneponto)	Report As per Amdal commitment, Monitoring as frequently as necessary	Project Management	AMDAL (RKL/RPL)

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
	Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)						
Water runoff and Erosion	Water Quality of nearby surface water body	Water run-off and erosion are minimal	Implement silt control measures such as silt fences and silt traps. Stockpiles of excavated materials should be stored appropriately in designated areas and at a minimum distance of 10m from any nearby watercourses or drains. Control of the generation of silt laden surface water runoff will be by use of mitigation measures such as bunds, settlement ponds, silt fences, silt traps, or by covering the stockpiles with plastic sheeting. Long term stockpiles will be placed at a suitable gradient	Within Project Location, in particular to the areas of soil stockpiles/borrow pits	As per Amdal commitment (six monthly during construction period)	Project Environmental Management	AMDAL (RKL/RPL)

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
			and grass planted.				
Deteriorating Water Quality (Paddy irrigation)	Nearby irrigation channel	Compliance with water quality standards stipulated in the South Sulawesi Governor Regulation Number 69 of 2010.	Implement silt control measures such as silt fences and silt traps. Stockpiles of excavated materials should be stored appropriately in designated areas and at a minimum distance of 10m from any nearby watercourses or drains. The control of the generation of silt laden surface water runoff will be by use of mitigation measures such as bunds, settlement ponds, silt fences, silt traps, or by covering the stockpiles with plastic sheeting. Long term stockpiles will be placed at a suitable gradient and grass planted	Surface Water Quality sampling at 4 sampling points:	As per Amdal commitment (six monthly during construction period)	Project Environmental Management	AMDAL (RKL/RPL)
Terrestrial Flora and	Flora and Fauna particularly near cleared	Minimum disturbance to	Conduct land clearing and land leveling	Flora and Fauna Sampling at 4 sampling points	One time during	Project Management	AMDAL (RKL/RPL)

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
Fauna	land	Terestrial Flora and Fauna	gradually Avoid land opening close to the watershed area (River), minimum buffer area is 50 m from the bank of the river		construction		
Hazardous waste	Workers Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)	Compliance with Government Regulation Number 101 of 2014	Provision of proper temporary storage for hazardous waste Waste segregation Waste disposal by an appointed/accredited waste disposer company	At designated temporary waste storage area At waste generation points	As per Amdal commitment Monitoring: as stipulated in the TPS B3 Permit Reporting: Six-monthly report to DLH	Project Environmental Management	AMDAL (RKL/RPL)

11.3 Operation

Table 11-3 Operation

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
Noise	Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)	Compliance to the noise quality standard as stipulated in the South Sulawesi Governor Regulation number 69 of 2010.	Take frequent noise sampling to confirm the current noise condition Provide explanation to community regarding the noise distrubance effect using various media such as (brocure, booklets,etc) Implement the Grievance Mechanism Respond to Grievances registered If there is disturbance due to operational wind turbine noise then checks should be made to demonstrate that operational noise levels are no more than predicted (i.e. compliant).	Noise sampling points (as per Amdal commitment, approximately 12 sampling points which represent 10 affected villages and roads)	As per Amdal commitment Monitoring: continuous monitoring Reporting: Six-monthly report to DLH	Project Environmental Management	AMDAL (RKL/RPL) UKL/UPL Grievance Mechanism

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
Shadow Flicker	Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)	There is no detrimental impact on human health from the effects of shadow flicker	- Conduct and implement a "grievance mechanism" Technological Approach: Implement a monitoring program (using video / other forms) when necessary to respond to complaints of shadow flicker effect; ● A monitoring program should be developed to monitor the extent of shadow flicker experienced by receptors. The monitoring program should be scheduled to include monitoring during times where modelling predicts shadow flicker will be experienced. ● The Sponsor should consult directly with all households that will be affected to determine their	Nearby residential settlements where complaints are lodged	As necessary	Project Environmental Management	AMDAL (RKL/RPL) UKL/UPL

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
			preferred choice of screening. CLO to visit all houses which have been identified as having shadow flicker impact and highlight the grievance mechanism process				
Bird and Bat Mortality	Birds and Bat	Number of Bird and bat strikes/deaths due to blade rotation	At operational startup and afterwards as needed, conduct bird and bat carcass searches at area of turbine towerss to determine the existence and level of bird/bat mortality by wind turbine blades. Carcass searches should be made early in the morning to minimize the effect of scavengers (which remove carcasses). Carcasses that cannot be identified should be frozen and sent to a specialist for identification.	Around turbine towers	Reporting six-monthly As needed	Project Environmental Management	AMDAL (RKL/RPL) UKL/UPL

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
			It is suggested that this program be conducted for an experimental period after startup, and depending on results, make a decision if it is worthwhile to continue.				
Community income	Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)	Number of community residents involved in informal businesses (i.e., souvenir booth and other tourism business opportunity)	Provision of training for business or entrepreneurship Provide CSR Program	Project affected communities	Six monthly	Project Management	AMDAL (RKL/RPL) UKL/UPL
Quality of Domestic wastewater discharged from the	Water quality of the surface water bobies nearby and groundwater quality	Compliance with: Minister of Environment (MoE) decree Number No.112 of 2003 on	Follow the guidelines stipulated in the regulations	At designated Worker's camp	Continuous when camps are occupied	Project Environmental Management	AMDAL (RKL/RPL)

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
worker basecamp	Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District (Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)	Domestic Wastewater threshold limits Minister of Environment (MoE) decree Number No.111 of 2003 on Guidlines and Requirements for Domestic Wastewater Discharged to Water Bodies.	Provide septic tanks and do not discharge sewage to surface water				
Aircraft Navigation Safety	Aircraft passing near Project Area Communities of the affected villages in Binamu District (Empoang and North Empoang Villages); Turatea District (East Kayuloe, West Kayuloe, Pa'rasangan Beru, and Bontomatene Villages); Batang District	Compliance with National standards for aircraft safety on marking tall structures	Compliance with National standards for aircraft safety on marking tall structures (warning/obstruction lights, strobes) coordination with air force	Turbine and transmission towers	End of construction	Project Management	

Impact	Potential Receptors	Performance Indicator	Mitigating Measures	Location	Frequency of Monitoring	Responsible Authority	Relevant project Document
	(Maccini Baji Village); and Arungkeke District (Kalumpang Loe Village)						

11.4 Decommissioning/Postoperation

As noted in Section 10, if at the end of the Project life, the operational permit is not transferred or renewed, then the wind energy structures will be disassembled, moved, and reused elsewhere.

Demolition and equipment removal will be managed and monitored much as the construction period was. Turbines will be dismantled, loaded on trucks, and moved from the location. Management of the transport process will be much as when the project components were mobilized to site, though in reverse. The surface elements of foundations will be demolished and the materials from this process transferred to dump sites at locations that will be determined at that time..

Site Rehabilitation will be similar to site restoration after construction. The former turbine and transmission tower sites will be flat areas that are rehabilitated. Subsurface portions of turbine foundations will be covered with soil and foundation pits will be rehabilitated by backfilling with soil and replanting with vegetation. The roads connecting the turbines can be left for use by the local communities, or (conceivably) removed, rehabilitated, and replanted.

CHAPTER 12
CONCLUSIONS

Examining the activities involved in planning, constructing, operating, and decommissioning the Tolo I Wind Power Project, the characteristics of the existing natural and social environment, and the predicted impacts and management/mitigation measures to be applied, it is concluded that the Project:

- Is environmentally and socially feasible, with no severe impacts on the population or environment;
- All significant impacts can be managed or at least mitigated;
- Will assist Indonesia in meeting the needs for electricity in the southern part of Sulawesi Island;
- By using wind, a renewable energy resource, assist Indonesia in meeting targets for reducing carbon emissions; and
- Will provide local residents with benefits during construction and operation.

Appendix 1

REI ESHS-MS August 2017

Appendix 2

Equis Environmental and Social Responsibility Policy

Appendix 3

Code of Conduct

Appendix 4

Grievance Tracking and Resolution Mechanism

Appendix 5

Community Development Plan

Appendix 6

Working Conditions and Terms of Employment

Appendix 7

Chance Find Procedure

Appendix 8

Summary of Past Information Disclosure, Consultation, and Participation

Appendix 9

Baseline Study of Bird and Bat by ESC

Appendix 10

Noise Modelling Study and Summary of Results

Appendix 11

Shadow Flicker Modelling Study and Summary of Results

Appendix 12

Laboratory Results of Water Quality and Air Quality Assessment

Appendix 13

PT EBJ Environmental, Social, Health, and Safety (ESHS) Policy Statement

Appendix 14

Non-Technical Summary

Appendix 15

Indigenous People Screening Assessment

Appendix 16

UKL-UPL (Mini EIA) for 150 kV Transmission Line

Appendix 17

Terms of Reference for Extended for Bird and Bat Survey