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FINAL REPORT

PLN INDONESIA POWER

ESIA Report for Banyuwangi Ground-Mounted Solar PV Project

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Author
Vit Valianto
Agus Dwi Wahyono
Novianto Hadisuwito
Pritta Puspitasari
Riyan Niagara
Reneica Ayu Pratiwi
Arianto Anggoro
Anvina Ayunita
Yuniawan Setyadi
Ilham Pratama
Thuy Nguyen Thi Thu

Date
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Project
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E-mail
mark.wilson@afry.com

Client
PT PLN Indonesia Power

ESIA Report for Banyuwangi Ground-Mounted Solar PV Project

Wangkal Plantation in Banyuwangi Regency, East Java Province, Indonesia

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Report history

Ver.		Checked status	Sign	Approval	Sign
0	Draft Report	14/03/2024	VV	14/03/2024	MW
1	Revision Draft Report	30/08/2024	VV	30/08/2024	MW
2	Final Draft Report (addressing Lenders comments)	09/12/2024	VV	09/12/2024	MW
3	Final Draft Report (addressing ADB and AIIB Comments)	31/01/2025	AS	03/02/2025	MW
4	Final Draft Report (addressing AIIB Comments and inputs from ESIA Disclosure)	15/05/2025	AS	16/05/2025	MW
5.1	Final Draft Report (addressing Lenders comments, excluding Biodiversity comment)	11/07/2025	AS	14/07/2025	MW
5.2	(Re-submission) Final Draft Report (addressing Lenders comments, including Biodiversity update)	18/07/2025	AS	18/07/2025	MW
5.3	(Re-submission) Final Draft Report (addressing Lenders comments, including Biodiversity recent update)	22/07/2025	AS	22/07/2025	MW
5.4	(Re-submission) Final Draft Report (addressing Lenders comments, including Biodiversity recent update)	29/08/2025	AS	29/08/2025	MW
6	(Re-submission) Final Draft Report (addressing Lender's residual comments)	24/09/2025	AS	24/09/2025	MW
7	Final Report excluding preference to ADB SPS and refer to AIIB ESF only (update Final LALRP)	20/04/2026	AS	22/04/2026	MW
8	Final Repot (Addressing AIIB comments)	11/05/2026	AS	08/05/2026	MW
9	Final Lender's Approval	17/07/2026	AS	17/07/2026	MW

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Abbreviation

AC	Alternating Current
AIIB	Asian Infrastructure Investment Bank
AIS	Alien Invasive Plant Species
AMDAL	*Analisis Mengenai Dampak Lingkungan Hidup*
AMP	Asbestos Management Plan
AOI	Area of Influence
APL	*Area Penggunaan Lain* – Other uses
AZE	Alliance for Zero Extinction
BPK	*Badan Pemeriksa Keuangan*
BPS	*Badan Pusat Statistik* – Central Bureau of Statistics
CAPEX	Capital Expenditure
CLS	Core Labour Standards
COD	Commercial Operational Date
CR	Critically Endangered
DC	Direct Current
DO	Dissolved Oxygen
EAAA	Ecologically Appropriate Area of Analysis
EBA	Endemic Birds Area
EBRD	European Bank for Reconstruction and Development
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EN	Endangered
EPFI	Equator Principle Financial Institution
EP4	Equator Principle 4
ESCOPs	Environmental and Social Codes of Practice
ESEL	Environmental and Social Exclusion List
ESIA	Environmental and Social Impact Assessment
ESMPs	Environmental and Social Management Plans
ESMS	Environmental and Social Management System
ESP	Environmental and Social Policy
ESS	Environmental and Social Standards
GBVH	Gender Based Violence and Harrassment
GCL	GCL Intelligent Energy (Suzhou) Co., Ltd.
GHG	Greenhouse Gases
GIIP	Good International Industry Practice
GISD	Global Invasive Species Database
GOI	Government of Indonesia
HV	High Voltage
HVAS	High Volume Air Sampler
IBA	Important Birds and Biodiversity Area
IFC	International Finance Corporation
IMS	Integrated Management System
ILO	International Labour Organization
IP	Indigenous People

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IUCN	International Union for Conservation of Nature
KA	*Kerangka Acuan* – Terms of Reference
KBA	Key Biodiversity Area
KV	Kilo Volt
LV	Low Voltage
MEMR	Ministry of Energy and Mineral Resources
MoE	Ministry of Environmental - *Kementerian Lingkungan Hidup*
MoEF	Ministry of Environmental and Forestry - *Kementerian Lingkungan Hidup dan Kehutanan*
MoU	Memorandum of Understanding
MV	Medium Voltage
OHL	Overhead Line
PDAM	*Perusahaan Daerah Air Minum* – Local water company
PERDA	*Peraturan Daerah* – Regional Regulation
PKKPR	*Persetujuan Kesesuaian Kegiatan Pemanfaatan Ruang* - Approval of the Suitability of Space Utilization Activities
PPKH	*Persetujuan Penggunaan Kawasan Hutan* - Approval for the Use of Forest Areas
PLN	*Perusahaan Listrik Negara* – State-owned electricity company
PP	Power Plant(s)
PPA	Project Purchase Agreement
PPE	Personal Protective Equipment
PT PLN IP	*Perusahaan Terbatas Perusahaan Listrik Negara Indonesia Power*
PTPN	*Perusahaan Terbatas Perkebunan Nusantara*
PV	Photovoltaic
PVPP	Photovoltaic Power Plant
RoW	Right of Way
RUPTL	*Rencana Usaha Penyediaan Tenaga Listrik* - Electricity Supply Business Plan
SD	*Sekolah Dasar*
SEA/SH	Sexual Exploitation and Abuse, and Sexual Harassment
SMA	*Sekolah Menengah Atas*
SMP	*Sekolah Menengah Pertama*
SPPL	*Surat Pernyataan Kesanggupan Pengelolaan dan Pemantauan Lingkungan Hidup* - Statement of Capability for Environmental Management and Monitoring
TL	Transmission Line
TOR	Terms of Reference
TSP	Total Suspended Particulate
UGC	Underground Cable
UKNP	Ujung Kulon National Park
UKL-UPL	*Upaya Pengelolaan Lingkungan Hidup dan Upaya Pemantauan Lingkungan Hidup* – Environmental Management and Monitoring Efforts
VES	Visually Encounter Survey
VU	Vulnerable
WB	World Bank
WBG	World Bank Group

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WHO	World Health Organization

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Executive Summary

Indonesia is committed to a 29% reduction of its greenhouse gases (GHG) emission by 2030 with its own efforts or 41% with international support. To implement this commitment, Indonesia has issued law that sets a minimum 23% of renewable energy in energy mix by 2025 and 31% by 2050.

To accelerate the energy transition into renewable energy development, PT PLN Indonesia Power has initiated the preparation of Green Energy (*Proyek Hijaunesia*) 2023 which will develop 7 GW of green energy spread across 108 locations throughout Indonesia. The Banyuwangi ground-mounted solar PV power plants are included within this green energy projects.

PT PLN Indonesia Power is a significant player in Indonesia's energy sector, serving as a subsidiary of Indonesia's state-owned electricity company (Perusahaan Listrik Negara – PLN). The main business activity focuses on providing electricity through power generation and providing operation and maintenance services for power plants scattered throughout Indonesia.

The Projects are expected to utilize the Solar Photovoltaic (PV) plant following the solar PV quota in National Electricity Supply Business Plan or *Rencana Usaha Penyediaan Tenaga Listrik* (RUPTL) 2021-2030 for this region. The planned capacity for Banyuwangi PV PP is 100MWac with target COD is 2024[1]. **Figure 1** presents the location of the Banyuwangi Solar PV Power Plant and its surroundings.

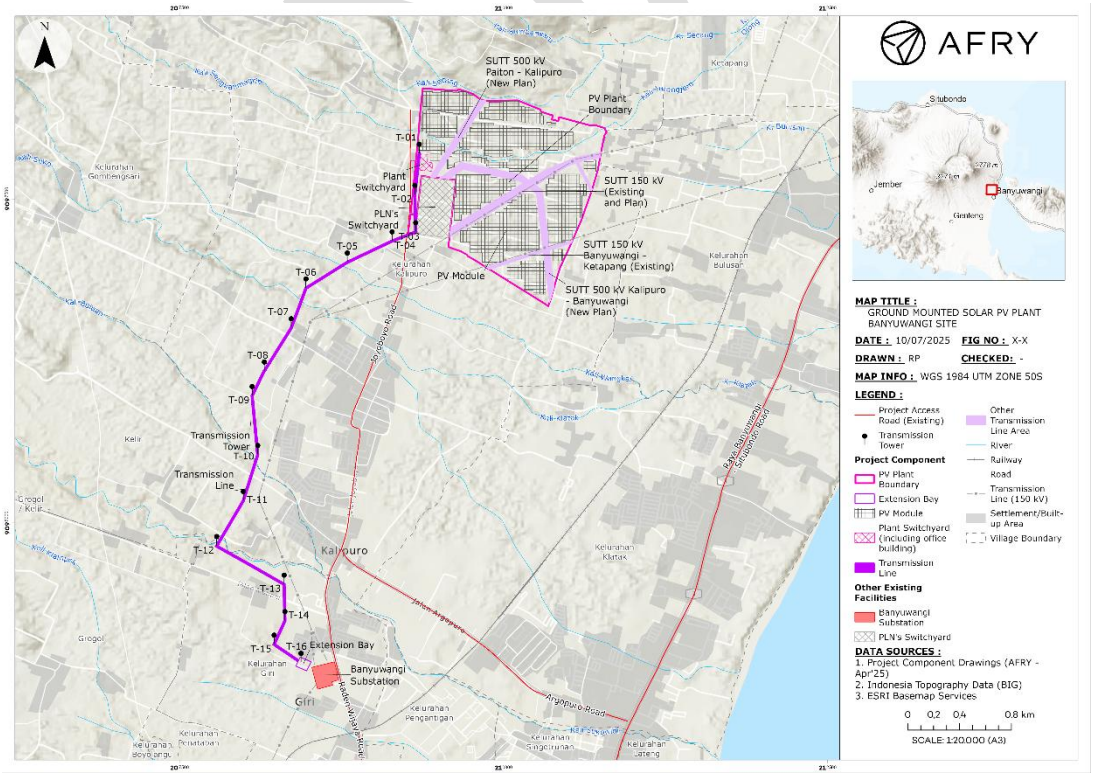


Figure 1 *Project Site Location and Surrounds*

[1] MEMR Regulation No.13, 2021

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The potential location for 131.2 MWp/100 MWac PV PP is part of the Wangkal Plantation, Kalipuro Regency, East Java Province owned by PT. PN XII with approximate land available for development of 156 hectares. The total area for PV and other facilities including Transmission Line on land area will cover approximately 166.7 ha.

This ESIA report addresses all components of the Banyuwangi Ground Mounted PV Project, including the Project site, switchyard, extension bay, transmission line, and access road.

The ESIA is prepared in parallel with the completion of the project's Feasibility Study. No previous ESIA is available for the Project. An Indonesia regulatory environmental impact assessment referred as *Analisis Mengenai Dampak Lingkungan Hidup* (AMDAL) for the Banyuwangi Ground Mounted PV activity is conducted separately by an AMDAL consultant within the same timeline of the ESIA. The AMDAL is a key requirement for acquiring an environmental approval and permitting for the Project in Indonesia.

This ESIA report was prepared to meet the requirements of Government of Indonesia (GoI) laws and regulations, the Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF) and Environmental and Social Standards (ESSs) as well as international best practice standards such as the Equator Principles, International Finance Corporation (IFC) Performance Standards (PS) and World Bank Group General EHS Guidelines.

The scope of this ESIA considers the preconstruction (i.e., site selection and land acquisition), construction, operation, and post-operation. The ESIA document provides an overview of the Project as well as a summary of key impacts and suggested management measures to align the Project with the applicable standards.

Surveys and sampling program were conducted by specialist from the ESIA team to obtain environmental and social baseline characteristics. This ESIA report presents the findings of these studies in the context of project description and assessment of potential impacts from the proposed project activities.

Overall, the assessment identified environmental and social impacts as having a Moderate to Minor negative significance, which can be effectively managed through the implementation of suitable management plans and follow-up actions. Additionally, several positive social benefits were noted during the assessment process. A summary of the environmental and social impacts classified as moderate – minor or positive are shown in **Table 1.**

Table 1 *Summary of Environmental and Social Impact and Evaluation*

Receptor	Potential Impact & Proposed Mitigation Measures	Impact Evaluation
Environmental Impacts		
Erosion, Sedimentation and Surface Water Quality	**EIA01:** Impact on Surface Water Quality due to Erosion and Sedimentation during Land Preparation and Civil Works (including access road, drainage, TL tower footing and right of way; Construction of Ground-mounted PV and Supporting Facilities).	**Moderate**

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Receptor	Potential Impact & Proposed Mitigation Measures	Impact Evaluation
	An Erosion Management Plan, together with a Material Handling Plan, shall be developed prior to the construction phase. These plans will include the establishment of temporary drainage systems, designated sediment ponds and soil disposal areas, provisions for maintaining community access, as well as permanent vegetation and maintenance measures, all of which form part of the proposed mitigation strategies.	
	EIA02: Impact on Surface Water Quality due to Wastewater Discharge during Construction Phase including Operation of Basecamp. Erosion and drainage management plans shall be prepared before the construction phase commenced, vehicle washing wastewater management plan and secondary containment and emergency plan for the wastewater treatment during emergencies should be developed as a best practice mitigation measure.	**Negligible**
	EIA03: Impact on Surface Water Quality due to Wastewater Discharge from Solar Modules Cleaning. The water resources for cleaning the solar module will be sourced from PDAM Banyuwangi, the local water supply company. Additionally, as a best practice, de-ionized water should preferably be used for cleaning, in accordance with the manufacturer's recommendation. Alternatively, rainwater may also be utilized for cleaning the solar modules.	**Negligible**
Ambient Air Quality	**EIA04**: Impact to Ambient Air Quality due to Mobilization of Equipment, Materials and Workers. An Air Quality Management Plan should be developed, which includes measures such as conduct dust/particulate matter suppression (water spraying on road), tire washing schedule and regular maintenance of vehicles as part of the proposed mitigation strategies.	**Moderate**
	EIA05: Impact on Ambient Air Quality due to Land Clearing, Civil Works and Construction of Ground-mounted PV and Supporting Facilities. An Air Quality Management Plan should be developed, incorporating measures such as vehicles speed limit and water spraying on road scheduling and regular vehicle maintenance and re-vegetation of earthworks and exposed areas to stabilize the surface as part of the proposed mitigation strategies.	**Minor**
Noise and Vibration	**EIA06:** Impact from Noise and Vibration due to Land Clearing, Civil Works and Construction of Ground-mounted PV and Supporting Facilities.	**Moderate**

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Receptor	Potential Impact & Proposed Mitigation Measures	Impact Evaluation
	A Noise and Vibration Management Plan should be developed, which includes restrictions on construction activities to daylight hours and measures to manage worker's exposure to noisy and vibrating equipment. Additionally, an effective grievance mechanism should be implemented to record and address complaints. These activities shall be a part of the proposed mitigation measures.	
	EIA07: Impact from Noise and Vibration due to Mobilization of Equipment, Materials and Workers. To develop and implement the Noise and Vibration Management Plan, along with limiting hours of operation and mobilization activities, as part of the proposed mitigation measures.	**Moderate**
Solid Waste/ Non-Hazardous Waste	**EIA08:** Solid Waste/Non-Hazardous Waste due to Land and Vegetation Clearance During Construction. Develop and implement a Waste Management Plan, including a wastewater management component, in accordance with the Project's safeguard requirements. The plan shall cover the provision of temporary waste storage facilities by type, the establishment of temporary construction facilities, and the identification of licensed third-party waste collectors. In parallel, a Contractor and Supplier Management Plan shall be developed to ensure that permitted local suppliers of civil and structural materials comply with applicable government requirements. Together, these measures form part of the proposed mitigation strategy.	**Negligible**
	EIA09: Solid Waste/Non-Hazardous Waste from Workers Activity During Construction and Operation. Develop and implement a Waste Management Plan including wastewater management component aligned with the Project's safeguards, the provision of rubbish bins according to waste types, third-party waste collector identification and providing improved septic tank system with periodic maintenance, are part of the proposed mitigation measures.	**Minor**
Hazardous Waste	**EIA10:** Hazardous Waste During Construction and Operation. Hazardous waste management will comply with Government Regulation No. 22 of 2021 on Environmental Protection, Organisation and Management. Develop and implement a Waste Management Plan, including a wastewater management component aligned with the Project's safeguards. In addition, develop and implement an Emergency Preparedness and Response	**Moderate**

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Receptor	Potential Impact & Proposed Mitigation Measures	Impact Evaluation
	Plan and an Asbestos Management Plan (AMP). The provision of project-owned hazardous waste temporary storage facilities (TPS B3) in accordance with government regulations, as well as coordination with licensed hazardous waste agencies, are integral parts of the proposed mitigation measures.	
Traffic	**EIA11:** Impact on Existing Local Public Road Condition due to Increment of Traffic Volume Associated with Mobilization Activity During Construction Phase (Project Construction Equipment and Material and Construction Workers). The ANDALALIN or Traffic Management Plan is part of AMDAL and prepared during the planning stage of a project, including approval from the Ministry of Transportation in coordination with Transportation Agency of Banyuwangi Regency, and the community of the surrounding Project area (scheduling and mobilisation), Develop and implement a Traffic Management Plan (TMP) in alignment with the ANDALALIN document and Good Practice Note for Road Safety (WB, 2019) in accordance with the Project's safeguards, including conduct regular orientation sessions for Project and/or EPC drivers focusing on ANDALALIN, stakeholder coordination, vehicle movement scheduling, and control of vehicle volumes to minimize emissions are part of the proposed mitigation measures.	**Moderate**
Greenhouse Gas (GHG) Emission	**EIA12:** Impact from Greenhouse Gas (GHG) Emission due to of Fuel Combustions during mobilization of Equipment, Materials and Workers. Ensuring the emission is minimized by regular service and maintenance and idle time limit of vehicle, are part of the proposed mitigation measures.	**Negligible**
	EIA13: Impact from Greenhouse Gas (GHG) Emission due to Land Clearing, Civil Works, and Construction of FPV and Supporting Facilities. The proposed mitigation measures include implementing best practices to minimize emission is minimized through regular servicing and maintenance of vehicles, imposing idle time limits and re-vegetating disturbed areas with local vegetation.	**Negligible**
	EIA14: Positive Impact due to Greenhouse Gas Emission Reduction from Solar PV Operations. The Solar PV Power Plant (PP) is recognized as a renewable and clean source of electricity. Unlike traditional power plants that burn fuel and emit greenhouse gases, the Solar PV PP produces no	**Positive**

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Receptor	Potential Impact & Proposed Mitigation Measures	Impact Evaluation
	emissions, effectively substituting for fuel-based power generation.	
Terrestrial Biodiversity	**EIA15:** Habitat Loss due to Construction. The proposed area for land clearing for the solar PV modules consists of sugarcane field (agricultural land habitat), which supports less biodiversity among birds, mammals, and insects compared to mix plantation habitats. As part of the mitigation measures, a Biodiversity Site Induction will be conducted together with the HSE Site Induction, and a site layout map will be provided within the designated project footprint boundary.	**Minor**
	EIA16: Habitat Modification or Fragmentation. The majority of the EAAA consists of modified habitat and no specific mitigation measures are required as long as all proposed measures to address habitat loss are properly implemented.	**Negligible**
	EIA17: Avian Fauna Mortality due to Collision and/or Electrocution. Potential avian mortality associated with the Project may occur through two main pathways: (i) collision with ground-mounted PV infrastructure, and (ii) collision and/or electrocution associated with the proposed 150 kV OHTL. The proposed mitigation as follows: The transmission line route and corridor must remain unchanged unless additional assessment confirms acceptable bird collision and electrocution risks, and any significant design modifications during detailed engineering design (DED) must trigger an updated assessment by a qualified specialist. The final alignment, tower configuration, and wire arrangements should be reviewed against survey data to identify high-risk spans particularly near key observation points, mature vegetation, agricultural areas, and locations with notable bird activity and these areas must be equipped with appropriate bird flight diverters prior to energization, installed mainly on earth wires/OPGW in line with best practice. The design must also ensure bird-safe clearances at all structures, with mitigation measures such as insulation or redesign applied where electrocution risks exist. Following energization, at least one year of systematic mortality monitoring is required, accounting for detection biases and seasonal bird activity; if mortality exceeds defined thresholds, adaptive measures such as additional diverters or extended monitoring must be implemented. Routine operations should include inspections for nesting and perching, particularly by	**Moderate**

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Receptor	Potential Impact & Proposed Mitigation Measures	Impact Evaluation
	raptors, with any necessary management actions carried out by qualified experts.	
	EIA18: Disturbance Displacement. No specific mitigation measures are required as long as all proposed measures to address habitat loss are properly implemented.	**Minor**
	EIA19: Barrier Effects due to Soar PV Arrays Installation. With the involvement of biodiversity specialist, the Project will conduct a joint pre-land clearing inspection to ensure that the Project site does not overlap with existing wildlife corridors that are part of the species' home ranges.	**Moderate**
Aquatic Biodiversity	**EIA20:** Aquatic Habitat Degradation. There is no specific proposed mitigation measure for impacts on aquatic biodiversity habitat as long as the mitigation measures for preventing negative impacts on surface water quality are properly implemented.	**Negligible**
Ecosystem Services	**EIA21:** Loss of important provisioning services. Establishing a Community Development or a CSR program in coordination with relevant local government, PTPN XII and stakeholders to support local economic and social development, along with implementing a project grievance mechanism, are key components of the proposed mitigation measures.	**Moderate**
Social Impacts		
Project Affected People due to Land Acquisition	**SIA01:** Disturbance or Impact on Socio-Economy and Livelihood of Landowner and Land User as a Result of Project Land Acquisition. Conducting a land acquisition and resettlement study to support affected communities, monitoring job losses in PTPN XII's sugarcane operations, establishing a Community Development or CSR program for local economic and social development, and implementing an accessible and efficient grievance mechanism for affected communities.	**Moderate**
Economy and Livelihood	**SIA02:** Disturbance of Impact on the Economy and Livelihood due to Project Construction and Operation. Engaging community leaders, business party and local farmers to raise awareness about the Banyuwangi Ground-mounted Solar PV Project and its benefits, establishing a grievance mechanism to address concerns about economic or livelihood disturbances, and ensuring	**Negligible**

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Receptor	Potential Impact & Proposed Mitigation Measures	Impact Evaluation
	the grievance mechanism is well-communicated, with timely investigation and resolution of issues by PT PLN Indonesia Power and EPC.	
Economy and Employment	**SIA03:** Employment and Business Opportunity during Project Land Preparation and Civil Work. Prioritizing affected people and local workers for employment, establishing a transparent recruitment process in coordination with local authorities, ensuring wages align with skill levels and labour regulations, and embedding commitments to optimize local employment and business opportunities in contract with EPC contractors and subcontractors.	**Positive**
	SIA04: Employment and Business Opportunities during the Project Workforce Recruitment during Construction and Operation of the Project. Developing a Labour Management Plan (LMP) per national and Lenders Standards, supporting local businesses through training and capacity building, ensuring compliance with labour laws and International Labour Organization (ILO) standards to prevent unethical practices, and establishing a grievance mechanism for recruitment concerns.	**Positive**
	SIA04A: Risks Related to the Recruitment and the Presence of Project Security Personnel during Construction and Operation of the Project Project to conduct security risk assessment, provide adequate trainings and awareness related to security protocols, conflict de-escalation techniques, training on local customs and norms, and to develop ERP that include procedures for security-related incidents.	**Moderate**
Public Amenities / Facilities	**SIA05:** Disturbance of Local Public Road and Public Facilities due to Increased Vehicle Movement during Mobilization of Construction Material and Heavy Equipment. Establishing a Traffic Management Plan (TMP) to ensure safety, appointing a Community Liaison Officer for stakeholder engagement and traffic consultations, maintaining communication with local authorities and PTPN XII on project progress, and implementing a grievance mechanism for addressing community concerns.	**Moderate**
Landscape and Visual	**SIA06:** Impact on Landscape and Visual Associated to Project Construction and Operation (Transmission Line and Ground Mounted Solar PV).	Construction: **Minor** Operation: **Positive**

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Receptor	Potential Impact & Proposed Mitigation Measures	Impact Evaluation
	During construction, minimize site clearing, maintain vegetation, install fencing near settlements, and ensure timely waste and equipment removal. During operation, engage local groups to promote the project as a green energy educational attraction.	
Socio-Culture	**SIA07:** Impact on Socio-Culture and Social Behaviour of Local Community as a Result of Project Construction and Operation Activities. Consulting local leaders on socio-cultural issues, coordinating with the Banyuwangi Manpower Office on local employment, ensuring cultural induction for workers, supporting local culture, providing a Stakeholder Engagement Plan, and ensuring a grievance mechanism to address socio-cultural concerns.	**Minor**
Cultural Heritage	**SIA08:** Disturbance to Cultural Heritage during the Project Construction and Operation. Consulting Wangkal Hamlet leaders to confirm burial site issues, coordinating with village leaders to avoid disturbance, and ensuring a well-socialized grievance mechanism for cultural heritage concerns.	**Minor**
Community Health	**SIA09:** Community Health Impact Associated with Dust and Air Quality as a Result of Project Construction, Material Mobilization and Land Preparation. Consulting communities on traffic and construction schedules, monitoring Acute Respiratory Infection (ARI) data, considering a health assistance CSR program, and establishing a grievance mechanism for dust and pollution concerns.	**Moderate**
	SIA10: Health Impact Associated with the Presence of Non-Local Workforce during Project Construction and Operation. Mandatory medical exams for workers, disease monitoring in surrounding communities, training on health issues, coordination with local authorities on crime and health, and a grievance mechanism for related concerns.	**Moderate**
Community Safety	**SIA11:** Impact on Community Safety Associated with Road Safety due to Increase of Traffic Volume on Existing Road due to Project Construction Equipment and Material Mobilization. Informing the community about construction schedules, scheduling heavy vehicle mobilization during off-peak hours, ensuring road safety with signs and officers, providing laydown and parking areas, ensuring vehicle compliance, managing loading and speed limits, repairing	**Moderate**

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Receptor	Potential Impact & Proposed Mitigation Measures	Impact Evaluation
	damaged roads, and offering a grievance mechanism for transportation concerns.	
Occupational Health and Safety	**SIA12:** Impact Associated with Workers/Occupational Health and Safety during Construction and Operation. Aligning worker standards with national OHS requirements, providing training and PPE, enforcing strict OHS rules in contracts, adopting a zero-tolerance approach to non-compliance, and implementing a confidential Worker Grievance Mechanism with prompt investigation.	**Moderate**
Human Rights Aspect	**SIA13:** Risks and Impact Associated with Labour Rights and Working Condition during Workforce Recruitment, Project Construction and Operation. Developing a LMP to protect workers' rights, ensuring contractor compliance, addressing labour issues with contractors, and implementing a worker grievance mechanism during recruitment.	**Moderate**
	SIA14: Gender-Based Discrimination and Violence during Construction. Developing a LMP to protect workers' rights, ensuring gender inclusion, put in place measures to address Gender-Based Violence (GBV) policies, providing safe accommodation, and involving a female office in the grievance mechanism with private reporting and support.	**Moderate**
Community Perception	**SIA15:** Change in Community Perception Throughout the Project Phases (Pre-Construction, Construction, and Operation). Disclosing project details to affected communities, engaging stakeholders, ensuring proper land compensation, implementing safety and environmental measures, and providing a well-socialized complaints mechanism.	**Moderate**

PT PLN Indonesia Power has established a Grievance Redress Mechanism (GRM) for the Banyuwangi Ground-Mounted Solar PV Project. The GRM provides project-affected communities with an accessible, transparent, and culturally appropriate channel to raise concerns related to the Project's environmental and social performance throughout the pre-construction, construction, and operational phases.

The GRM is designed to receive, register, investigate, and resolve grievances in a timely manner and at no cost to complainants. The process consists of five key steps: (i) receipt of grievances, (ii) recording and delegation, (iii) fact-finding and investigation, (iv) resolution and appeal, and (v) feedback and close-out. Complaints are managed through a centralized grievance log and addressed by the Project SPC and EPC Contractors, with support from relevant stakeholders where necessary.

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To ensure accessibility and transparency, information on complaint submission procedures, response timelines, and responsible parties will be disclosed in a language and format that can be easily understood by affected communities.

At the current stage of project development, grievances may be submitted directly to PT PLN Indonesia Power through the designated contact point:

- Contact Person : Amir Hakim
- Contact Number : +6281216918158
- Email : amir.h@plnindonesiapower.co.id
- Address : Jl. Jenderal Gatot Subroto Kavling 18, Kuningan Timur Setiabudi, South Jakarta 12950.

In addition, project affected people may access the AIIB Project-Affected People's Mechanism (PPM) if concerns cannot be satisfactorily resolved through the Project-level GRM. The PPM provides an independent mechanism for reviewing complaints related to AIIB's compliance with its Environmental and Social Policy.

Together, Project GRM and AIIB PPM provide framework for effective grievance management, stakeholder engagement, and accountability throughout the Project lifecycle.

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Ringkasan Eksekutif

Latar Belakang – Kajian dampak lingkungan dan sosial yang berstandard internasional atau Environmental and Social Impact Assessment (ESIA) untuk proyek PLTS Banyuwangi disusun secara elparallel dengan penyelesaian Studi Kelayakan proyek. Kajian dampak lingkuknngan sesuai regulasi Indonesia atau yang disebut Analisis Mengenai Dampak Lingkungan Hidup (AMDAL) sedang dalam tahap penyelesaian dan dilakukan secara terpisah oleh pihak konsultan AMDAL terpisah dalam kurun waktu yang sama dengan penyusunan ESIA.

AMDAL merupakan persyaratan utama untuk memperoleh persetujuan dan perizinan lingkungan bagi Proyek di Indonesia. Sedangkan laporan ESIA ini disusun untuk memenuhi persyaratan peraturan perundangan-undangan Pemerintah Indonesia, *Asian Infrastructure Investment Bank* (AIIB) *Environmental and Social Framework* (ESF) dan *Social Standards* (ESSs), serta standar internasional seperti *Equator Principles*, *International Finance Corporation* (IFC) *Performance Standards* (PS), dan *World Bank Group General EHS Guidelines*. Pemenuhan persyaratan internasional diatas sebagai Upaya dari proyek untuk mendapatkan pendanaan dari Bank internasional dan lembaga keuangan untuk pengembangan proyek.

Gambaran Proyek PLTS (*Ground-Mount)* Banyuwangi – Pembangkit Listrik Tenaga Surya (PLTS) *Ground-Mount* Banyuwangi direncanakan akan ditambahkan ke sistem kelistrikan Wilayah Jawa. Total kapasitas yang ditargetkan untuk Proyek ini adalah 100 MWac, sesuai dengan kuota PLTS dalam Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2021-2030 untuk Provinsi Jawa Timur. PLTS Ground-Mount Banyuwangi diharapkan dapat meningkatkan penetrasi energi terbarukan di sub-sistem Jawa Timur.

Pembangkit Listrik Tenaga Surya (PLTS) *Ground-Mount* Banyuwangi dengan kapasitas terpasang sebesar 131,2 MWp / 100 MWac akan berlokasi di Perkebunan Wangkal, Kabupaten Banyuwangi, Provinsi Jawa Timur dengan luas area yang dimanfaatkan sebesar 156 Ha. Total area untuk PV dan fasilitas lainnya termasuk Jalur Transmisi akan mencakup sekitar 164,78 ha. **Gambar 1** dibagian sebelumnya menunjukkan lokasi PLTS Banyuwangi dan area sekitarnya.

Ruang Lingkup Studi ESIA – Ruang lingkup ESIA ini mempertimbangkan pra-konstruksi (yaitu, pemilihan lokasi dan pembebasan lahan), konstruksi, operasi, dan pascaoperasi. Dokumen ESIA memberikan gambaran terkait semua komponen Proyek PLTS di Banyuwangi, termasuk lokasi Proyek, gardu induk, *extension bay*, jalur transmisi, dan jalan akses, sehingga dapat memberikan gambaran umum Proyek serta ringkasan dampak utama dan langkah-langkah pengelolaan yang disarankan untuk menyelaraskan Proyek dengan standar yang berlaku.

Ringkasan Umum Hasil Kajian Dampak Lingkungan dan Sosial Proyek PLTS Banyuwangi – Survei dan program pengambilan sampel dilaksanakan oleh para spesialis dari tim ESIA AFRY untuk memperoleh data dasar mengenai kondisi lingkungan dan sosial. Laporan ESIA ini kemudian menyajikan hasil temuan tersebut, yang disusun dalam kaitannya dengan deskripsi proyek serta penilaian terhadap potensi dampak yang mungkin timbul dari kegiatan proyek yang direncanakan.

Secara keseluruhan, hasil penilaian menunjukkan bahwa dampak lingkungan dan sosial yang teridentifikasi berada pada tingkat Sedang (Moderate) hingga Minor. Dampak-dampak tersebut dapat dikelola secara efektif melalui penerapan rencana mitigasi yang

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tepat serta tindakan lanjutan yang diperlukan. Selain itu, penilaian juga mencatat adanya sejumlah manfaat sosial yang positif. Ringkasan mengenai dampak negatif (sedang, kecil, maupun dapat diabaikan) serta dampak positif terhadap reseptor lingkungan dan sosial, termasuk mitigasi yang diusulkan disajikan dalam tabel di bawah.

Proyek juga diwajibkan melakukan pemantauan terhadap pelaksanaan tindakan mitigasi yang diusulkan. Pemantauan ini penting untuk memastikan seluruh langkah yang tercantum dalam Rencana Pengelolaan Lingkungan dan Sosial (ESMP) dijalankan secara efektif, sesuai dengan peraturan nasional dan standar internasional. Selain itu, pemantauan berfungsi sebagai sistem peringatan dini terhadap potensi masalah, mendukung pelaporan yang transparan kepada para pemangku kepentingan, serta menyediakan data untuk manajemen adaptif agar penyesuaian ESMP dapat dilakukan tepat waktu. Dengan demikian, proses pemantauan ini membantu menjaga keberlanjutan lingkungan dan sosial sepanjang siklus hidup proyek.

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Tabel 1 *Ringkasan Penilaian Dampak dan Rencana Mitigasi*

Reseptor	Dampak Potensial	Evaluasi Signifikansi Dampak	Usulan Mitigasi
Lingkungan			
Erosi, Sedimentasi, dan Kualitas Permukaan Air	**EIA01:** Dampak terhadap Kualitas permukaan air akibat erosi, sedimentasi, dan gangguan tanah ketika persiapan lahan dan pekerjaan sipil.	Sedang (*Moderate*)	Rencana Pengelolaan Erosi bersama dengan Rencana Penanganan Material perlu disiapkan sebelum tahap konstruksi, termasuk pembangunan drainase sementara, kolam sedimen/penimbunan tanah sementara, akses masyarakat, vegetasi permanen, dan pemeliharaan sebagai langkah mitigasi.
	EIA02: Dampak terhadap Kualitas permukaan air akibat pembuangan air limbah selama masa konstruksi.	Dapat diabaikan (*Negligible*)	Rencana pengelolaan erosi dan drainase harus disiapkan sebelum konstruksi dimulai, rencana pengelolaan air limbah pencucian kendaraan, serta rencana penampungan sekunder dan darurat untuk pengolahan air limbah selama keadaan darurat harus disusun sebagai langkah mitigasi praktik terbaik.
	EIA03: Dampak terhadap Kualitas permukaan air akibat pembuangan air limbah dari pembersihan modul surya.	Dapat diabaikan (*Negligible*)	Sumber air untuk membersihkan modul surya akan bersumber dari PDAM Banyuwangi, perusahaan air minum setempat. Selain itu, sebagai praktik terbaik, sebaiknya gunakan air deionisasi untuk pembersihan, sesuai dengan rekomendasi produsen. Sebagai alternatif, air hujan juga dapat dimanfaatkan untuk membersihkan modul surya.
Kualitas Udara Sekitar	**EIA04**: Dampak terhadap kualitas udara sekitar akibat mobilisasi alat berat, material, dan pekerja.	Sedang (*Moderate*)	Rencana Pengelolaan Kualitas Udara harus disusun, yang mencakup langkah-langkah seperti pengendalian debu/partikel (penyiraman air di jalan), jadwal pencucian ban, dan perawatan kendaraan secara berkala sebagai bagian dari strategi mitigasi yang diusulkan.
	EIA05: Dampak terhadap kualitas udara sekitar akibat pembukaan lahan, pekerjaan sipil, dan pembangunan proyek komponen.	Ringan (Minor)	Rencana Pengelolaan Kualitas Udara harus disusun, yang menggabungkan langkah-langkah seperti pembatasan kecepatan kendaraan dan penyiraman air di jalan, penjadwalan dan perawatan kendaraan secara berkala, serta revegetasi lahan dan area terbuka untuk menstabilkan permukaan sebagai bagian dari strategi mitigasi yang diusulkan.

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Reseptor	Dampak Potensial	Evaluasi Signifikansi Dampak	Usulan Mitigasi
Kebisingan dan Getaran	**EIA06:** Dampak terhadap kebisingan dan getaran akibat pembukaan lahan, pekerjaan sipil, dan pembangunan proyek komponen.	Sedang (*Moderate*)	Rencana Pengelolaan Kebisingan dan Getaran harus disusun, yang mencakup pembatasan aktivitas konstruksi pada siang hari dan langkah-langkah untuk mengelola paparan pekerja terhadap peralatan yang bising dan bergetar. Selain itu, mekanisme pengaduan yang efektif harus diterapkan untuk mencatat dan menangani keluhan. Kegiatan-kegiatan ini harus menjadi bagian dari langkah-langkah mitigasi yang diusulkan.
	EIA07: Dampak terhadap kebisingan dan getaran akibat mobilisasi alat berat, material, dan pekerja.	Sedang (*Moderate*)	Menyusun dan menerapkan Rencana Pengelolaan Kebisingan dan Getaran, beserta pembatasan jam operasional dan kegiatan mobilisasi, sebagai bagian dari langkah-langkah mitigasi yang diusulkan. Penyediaan dan pelaksanaan Mekanisme Penanganan Keluhan masyarakat terkait dampak kebisingan & getaran.
Limbat Padat/ Limbah Tidak Berbahaya (Non-B3)	**EIA08:** Limbat padat/limbah tidak berbahaya akibat pembukaan lahan dan vegetasi ketika konstruksi.	Dapat diabaikan (*Negligible*)	Rencana Pengelolaan Limbah termasuk komponen pengelolaan air limbah berdasarkan Ketentuan Perlindungan Lingkungan dan Sosial Proyek mencakup penyediaan Tempat Penampunagn Sementra (TPS) sesuai jenis limbah serta identifikasi pengangkut limbah pihak ketiga. Secara pararel, Rencana Pengelolaan Kontraktor dan Pemasok memastikan bahwa pemasok lokal berizin atas material sipil dan struktural mematuhi persyaratan regulasi pemerintah yang berlaku.
	EIA09: Limbah padat/limbah tidak berbahaya akibat aktivitas pekerja ketika konstruksi dan operasional.	Ringan (Minor)	Rencana Pengelolaan Limbah termasuk komponen pengelolaan air limbah berdasarkan Ketentuan Perlindungan Lingkungan dan Sosial Proyek mencakup penyediaan tempat sampah terpilah, identifikasi pihak ketiga pengangkut limbah, serta tangki septik dengan perawatan rutin.
Limbah Berbahaya (B3)	**EIA10:** Limbah berbahaya ketika konstruksi dan operasional.	Sedang (*Moderate*)	Pengelolaan limbah B3 sesuai PP No. 22 Tahun 2021. Rencana Pengelolaan Limbah termasuk komponen pengelolaan air limbah berdasarkan Ketentuan Perlindungan Lingkungan dan Sosial Proyek Selain itu, susun dan diimplementasikan Rencana Kesiapsiagaan dan Tanggap Darurat serta Rencana Pengelolaan Asbes ditambah dengan Penyediaan fasilitas penyimpanan sementara limbah B3 milik proyek (TPS B3) sesuai dengan peraturan pemerintah, serta koordinasi dengan lembaga pengelola limbah B3

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Reseptor	Dampak Potensial	Evaluasi Signifikansi Dampak	Usulan Mitigasi
			berizin, merupakan bagian integral dari langkah-langkah mitigasi yang diusulkan.
Lalu Lintas	**EIA11:** Dampak terhadap eksisting kondisi jalan lokal akibat bertambahnya volume lalu lintas dikarenakan oleh kegiatan mobilisasi dan keamanan jalan ketika fase konstruksi.	Sedang (*Moderate*)	ANDALALIN atau Rencana Pengelolaan Lalu Lintas merupakan bagian dari AMDAL dan disusun pada tahap perencanaan suatu proyek, termasuk persetujuan dari Kementerian Perhubungan yang berkoordinasi dengan Dinas Perhubungan Kabupaten Banyuwangi, dan masyarakat sekitar wilayah Proyek (penjadwalan dan mobilisasi). Menyusun dan melaksanakan Rencana Pengelolaan Lalu Lintas (RTL) sesuai dengan dokumen ANDALALIN berdasarkan Ketentuan Perlindungan Lingkungan dan Sosial Proyek, termasuk melaksanakan sesi orientasi rutin bagi pengemudi Proyek dan/atau EPC dengan fokus pada ANDALALIN, koordinasi pemangku kepentingan, penjadwalan pergerakan kendaraan, dan pengendalian volume kendaraan untuk meminimalkan emisi merupakan bagian dari langkah-langkah mitigasi yang diusulkan.
Emisi Gas Rumah Kaca	**EIA12:** Dampak terhadap emisi gas rumah kaca akibat pembakaran bahan bakar ketika mobilisasi peralatan, material, dan pekerja.	Dapat diabaikan (*Negligible*)	Meskipun dampak yang ditimbulkan tergolong dapat diabaikan, penerapan praktik terbaik tetap diharapkan dalam pelaksanaan proyek. Salah satu langkah yang perlu dilakukan adalah memastikan kendaraan dan alat berat menjalani servis rutin sesuai standar.
	EIA13: Dampak terhadap emisi gas rumah kaca akibat pembukaan lahan, pekerjaan sipil, dan pembangunan proyek komponen.	Dapat diabaikan (*Negligible*)	Mitigasi dengan praktik terbaik: perawatan kendaraan, pembatasan waktu *idle* kendaraan, serta revegetasi area terganggu.
	EIA14: Dampak positif terhadap pengurangan emisi gas rumah kaca akibat operasional PLTS.	Positif	Pembangkit Listrik Tenaga Surya (PLTS) dikenal sebagai sumber listrik terbarukan dan bersih. Tidak seperti pembangkit listrik konvensional yang membakar bahan bakar dan menghasilkan gas rumah kaca, PLTS tidak menghasilkan emisi, sehingga secara efektif menggantikan pembangkit listrik berbahan bakar.

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Reseptor	Dampak Potensial	Evaluasi Signifikansi Dampak	Usulan Mitigasi
Keanekaragaman Hayati Darat (*Terrestrial)*	**EIA15:** Hilangnya habitat keanekaragaman hayati darat (*terrestrial)* akibat konstruksi proyek.	Ringan (Minor)	Area yang diusulkan untuk pembukaan lahan modul surya fotovoltaik terdiri dari ladang tebu (habitat lahan pertanian), yang mendukung keanekaragaman hayati yang lebih rendah di antara burung, mamalia, dan serangga dibandingkan dengan habitat perkebunan campuran. Sebagai bagian dari langkah-langkah mitigasi, Induksi Lokasi Keanekaragaman Hayati akan dilakukan bersamaan dengan Induksi Lokasi K3L, dan peta tata letak lokasi akan disediakan dalam batas tapak proyek yang telah ditentukan.
	EIA16: Perubahan habitat keanekaragaman hayati darat (*terrestrial).*	Dapat diabaikan (*Negligible*)	Tidak diperlukan tindakan mitigasi khusus selama semua tindakan yang diusulkan untuk mengatasi hilangnya habitat dilaksanakan dengan benar.
	EIA17: Kematian fauna burung akibat tabrakan atau sengatan listrik.	Sedang (*Moderate*)	Rute dan koridor saluran transmisi harus tetap tidak berubah kecuali terdapat penilaian tambahan yang memastikan bahwa risiko tumbukan dan sengatan listrik terhadap burung masih dalam batas yang dapat diterima, dan setiap perubahan signifikan pada desain selama detailed engineering design (DED) harus disertai dengan pembaruan kajian oleh spesialis yang berkualifikasi. Jalur akhir, konfigurasi menara, serta susunan konduktor dan kawat harus ditinjau terhadap data survei untuk mengidentifikasi bentang dengan risiko tinggi—terutama di dekat titik pengamatan utama, vegetasi pohon dewasa, area pertanian, dan lokasi dengan aktivitas burung yang signifikan—dan pada area tersebut harus dipasang alat pengalih penerbangan burung (bird flight diverters) yang sesuai sebelum energisasi, terutama pada kawat tanah/OPGW sesuai praktik terbaik. Desain juga harus memastikan jarak aman bagi burung pada seluruh struktur, dengan langkah mitigasi seperti insulasi atau redesain diterapkan jika terdapat risiko sengatan listrik. Setelah energisasi, pemantauan mortalitas secara sistematis harus dilakukan setidaknya selama satu tahun dengan mempertimbangkan bias deteksi dan aktivitas musiman burung; apabila tingkat kematian melebihi ambang batas yang ditetapkan, langkah adaptif seperti penambahan diverter atau perpanjangan pemantauan harus dilakukan. Operasi rutin juga harus mencakup inspeksi terhadap aktivitas bersarang dan hinggap, khususnya oleh burung pemangsa, dengan tindakan pengelolaan yang diperlukan dilaksanakan oleh tenaga ahli yang berkualifikasi.

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Reseptor	Dampak Potensial	Evaluasi Signifikansi Dampak	Usulan Mitigasi
	EIA18: Berpindahnya keanekaragaman hayati akibat gangguan proyek.	Ringan (Minor)	Tidak diperlukan tindakan mitigasi khusus selama semua tindakan yang diusulkan untuk mengatasi hilangnya habitat dilaksanakan dengan benar.
	EIA19: Gangguan terhadap keanekaragaman hayati akibat pemasangan panel surya.	Sedang (*Moderate*)	Dengan melibatkan spesialis keanekaragaman hayati, Proyek akan melakukan inspeksi pra-pembukaan lahan bersama untuk memastikan bahwa lokasi Proyek tidak tumpang tindih dengan koridor satwa liar yang ada yang merupakan bagian dari wilayah jelajah spesies tersebut.
Keanekaragaman Hayati Perairan (*Aquatic)*	**EIA20:** Kerusakan habitat perairan.	Dapat diabaikan (*Negligible*)	Mengacu pada tindakan mitigasi erosi, sedimentasi dan penurunan kualitas air permukaan. Proyek menerapkan langkah-langkah pengendalian yang efektif untuk mencegah limpasan, menjaga kestabilan tanah, serta melindungi kualitas badan air di sekitar area kegiatan konstruksi.
Ecosystem services	**EIA21:** Berkurangnya penyediaan ekosistem yang vital.	Dapat diabaikan (*Negligible*)	Menetapkan program Pengembangan Masyarakat atau CSR yang berkoordinasi dengan pemerintah daerah terkait, PTPN XII dan para pemangku kepentingan untuk mendukung pembangunan ekonomi dan sosial setempat, beserta penerapan mekanisme pengaduan proyek, merupakan komponen utama dari langkah-langkah mitigasi yang diusulkan.
Sosial			
Masyarakat Terdampak Akibat Pengadaan Lahan	**SIA01:** Gangguan atau dampak terhadap sosial-ekonomi dan mata pencaharian masyarakat baik pemilik dan penggarap lahan.	Sedang (*Moderate*)	Melaksanakan studi pengadaan tanah dan pemukiman kembali untuk mendukung masyarakat terdampak, memantau hilangnya pekerjaan di area perkebunan tebu PTPN XII, membangun program Pengembangan Masyarakat atau CSR untuk pembangunan ekonomi dan sosial setempat, serta menerapkan mekanisme pengaduan yang mudah diakses dan efisien bagi masyarakat terdampak.
	SIA02: Gangguan atau dampak terhadap sosial ekonomi dan mata pencaharian peternak dan pemilik dari Omah Telu	Dapat diabaikan (*Negligible*)	Meskipun dampaknya dapat diabaikan, praktik terbaik diharapkan dapat diterapkan oleh Proyek, misalnya dengan melibatkan tokoh masyarakat, komunitas, pelaku usaha & petani/peternak untuk sosialisasi proyek, manfaat, area terbatas, serta memastikan mekanisme keluhan disosialisasikan, ditindaklanjuti, dan diselesaikan tepat waktu.

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Reseptor	Dampak Potensial	Evaluasi Signifikansi Dampak	Usulan Mitigasi
	Homestay disekitar perkebunan Wangkal.		
Ekonomi dan Mata Pencaharian	**SIA03:** Terbukanya peluang ketenagakerjaan dan bisnis lokal selama penyiapan lahan dan pekerjaan sipil.	Positif	Memprioritaskan masyarakat terdampak dan pekerja lokal untuk pekerjaan, membangun proses rekrutmen yang transparan dengan berkoordinasi bersama pemerintah daerah, memastikan upah sesuai dengan tingkat keterampilan dan peraturan ketenagakerjaan, serta menanamkan komitmen untuk mengoptimalkan lapangan kerja dan peluang bisnis lokal dalam kontrak dengan kontraktor dan subkontraktor EPC.
Ekonomi dan Ketenagakerjaan	**SIA04:** Terbukanya peluang ketenagakerjaan dan bisnis ketika fase persiapan lahan, proyek konstruksi, dan operasional.	Positif	Mengembangkan Rencana Manajemen Tenaga Kerja (LMP) sesuai Standar nasional dan AIIB ESF, mendukung bisnis lokal melalui pelatihan dan pengembangan kapasitas, memastikan kepatuhan terhadap undang-undang ketenagakerjaan dan standar Organisasi Perburuhan Internasional (ILO) untuk mencegah praktik yang tidak etis, dan membangun mekanisme pengaduan untuk masalah perekrutan.
	SIA04A: Risiko terkait rekrutmen dan keberadaan personil keamanan proyek selama fase konstruksi dan operasional proyek.	Sedang (*Moderate*)	Proyek ini akan melakukan penilaian risiko keamanan, menyediakan pelatihan dan kesadaran yang memadai terkait protokol keamanan, teknik de-eskalasi konflik, pelatihan tentang adat dan norma setempat, serta mengembangkan ERP (Rencana Tanggap Darurat) yang mencakup prosedur untuk insiden terkait keamanan.
Fasilitas Publik	**SIA05:** Gangguan atau dampak terhadap Jalan Umum Lokal, Fasilitas Komunitas, dan Fasilitas Publik akibat Aktivitas Konstruksi dan Operasi Proyek.	Sedang (*Moderate*)	Menetapkan Rencana Manajemen Lalu Lintas (RTM) untuk memastikan keselamatan, menunjuk Petugas Penghubung Masyarakat (PKM) untuk melibatkan pemangku kepentingan dan konsultasi lalu lintas, menjaga komunikasi dengan pemerintah daerah dan PTPN XII mengenai kemajuan proyek, dan menerapkan mekanisme pengaduan untuk menangani keluhan masyarakat.
Lanskap Alam dan Dampak Visual	**SIA06:** Dampak terhadap lanskap alam dan visual berkaitan	Ringan (Minor)	During construction, minimize site clearing, maintain vegetation, install fencing near settlements, and ensure timely waste and equipment removal.

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Reseptor	Dampak Potensial	Evaluasi Signifikansi Dampak	Usulan Mitigasi
	dengan proyek konstruksi dan operasional proyek.		
	Dalam fase operasional, proyek akan melibatkan asosiasi pariwisata dan pendidikan masyarakat setempat untuk menyoroti dampak visual sebagai potensi daya tarik edukasi.	Positif	Melibatkan asosiasi pariwisata, lembaga edukasi lokal, serta pemangku kepentingan daerah dalam mengemas keberadaan proyek sebagai sarana edukasi energi hijau dan potensi atraksi wisata.
Sosial-Budaya	**SIA07:** Dampak terhadap sosial budaya dan jalinan sosial masyarakat lokal akibat konstruksi dan operasional proyek.	Ringan (Minor)	Consulting local leaders on socio-cultural issues, coordinating with the Banyuwangi Manpower Office on local employment, ensuring cultural induction for workers, supporting local culture, providing a Stakeholder Engagement Plan, and ensuring a grievance mechanism to address socio-cultural concerns.
Cagar Budaya	**SIA08:** Gangguan atau dampak terhadap cagar budaya akibat konstruksi proyek.	Ringan (Minor)	Berkonsultasi dengan para pemimpin Dusun Wangkal untuk memastikan masalah lokasi pemakaman, berkoordinasi dengan para pemimpin desa untuk menghindari gangguan, dan memastikan adanya mekanisme pengaduan yang tersosialisasi dengan baik untuk masalah warisan budaya.
Kesehatan Masyarakat	**SIA09:** Dampak kesehatan masyarakat akibat debu dan kualitas udara dari aktivitas konstruksi, mobilitas material, dan persiapan lahan.	Sedang (*Moderate*)	Melakukan konsultasi dengan masyarakat tentang jadwal lalu lintas dan konstruksi, memantau data Infeksi Saluran Pernapasan Akut (ISPA), mempertimbangkan program CSR bantuan kesehatan, dan membangun mekanisme pengaduan untuk masalah debu dan polusi.
	SIA10: Dampak kesehatan akibat keberadaan tenaga kerja non lokal selama tahap konstruksi dan operasional proyek.	Sedang (*Moderate*)	Pemeriksaan kesehatan wajib bagi pekerja, pemantauan penyakit di masyarakat sekitar, pelatihan tentang isu-isu kesehatan, koordinasi dengan otoritas lokal terkait kejahatan dan kesehatan, serta mekanisme pengaduan untuk masalah terkait.

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Reseptor	Dampak Potensial	Evaluasi Signifikansi Dampak	Usulan Mitigasi
Keselamatan Masyarakat	**SIA11:** Dampak keselamatan masyarakat berkaitan dengan meningkatnya volume lalu lintas selama tahap konstruksi.	Sedang (*Moderate*)	Menginformasikan kepada masyarakat tentang jadwal konstruksi, menjadwalkan mobilisasi kendaraan berat di luar jam sibuk, memastikan keselamatan jalan dengan rambu-rambu dan petugas, menyediakan area parkir dan laydown, memastikan kepatuhan kendaraan, mengelola batas muatan dan kecepatan, memperbaiki jalan yang rusak, dan menawarkan mekanisme pengaduan untuk masalah transportasi.
Kesehatan dan Keselamatan Kerja	**SIA12:** Risiko dan dampak terhadap kesehatan dan keselamatan kerja selama fase konstruksi dan operasional proyek.	Sedang (*Moderate*)	Menyelaraskan standar pekerja dengan persyaratan K3 nasional, menyediakan pelatihan dan APD, menegakkan aturan K3 yang ketat dalam kontrak, menerapkan pendekatan tanpa toleransi terhadap ketidakpatuhan, dan menerapkan Mekanisme Pengaduan Pekerja yang rahasia dengan investigasi segera.
Hak Asasi Manusia (HAM)	**SIA13:** Risiko dan dampak terkait hak-hak tenaga kerja dan kondisi kerja selama proses rekrutmen, konstruksi, dan operasional proyek.	Sedang (*Moderate*)	Mengembangkan LMP untuk melindungi hak-hak pekerja, memastikan kepatuhan kontraktor, menangani masalah ketenagakerjaan dengan kontraktor, dan menerapkan mekanisme pengaduan pekerja selama rekrutmen.
	SIA14: Diskriminasi dan kekerasan berbasis gender selama fase konstruksi	Sedang (*Moderate*)	Mengembangkan Rencana Manajemen Tenaga Kerja untuk melindungi hak-hak pekerja, memastikan inklusi gender, menerapkan langkah-langkah untuk mengatasi kebijakan Kekerasan Berbasis Gender (KBG), menyediakan akomodasi yang aman, dan melibatkan kantor perempuan dalam mekanisme pengaduan dengan pelaporan dan dukungan personal.
Persepsi Masyarakat	**SIA15:** Perubahan persepsi masyarakat akibat aktivitas proyek pada fase pra-konstruksi, konstruksi, dan operasional.	Sedang (*Moderate*)	Mengungkapkan detail proyek kepada masyarakat terdampak, melibatkan para pemangku kepentingan, memastikan kompensasi lahan yang layak, menerapkan langkah-langkah keselamatan dan lingkungan, serta menyediakan mekanisme pengaduan yang tersosialisasi dengan baik.

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Mekanisme Penanganan Keluhan (Grievance Redress Mechanism) dan PPM AIIB

PT PLN Indonesia Power telah membentuk Mekanisme Penanganan Keluhan (Grievance Redress Mechanism/GRM) sebagai bagian dari Rencana Pelibatan Pemangku Kepentingan (Stakeholder Engagement Plan/SEP) untuk Proyek PLTS Ground-Mounted Banyuwangi. GRM ini menyediakan saluran yang mudah diakses, transparan, dan sesuai dengan konteks budaya bagi masyarakat terdampak proyek untuk menyampaikan keluhan atau kekhawatiran terkait kinerja lingkungan dan sosial proyek selama tahap pra-konstruksi, konstruksi, hingga operasional.

GRM dirancang untuk menerima, mencatat, menyelidiki, dan menyelesaikan keluhan secara tepat waktu serta tanpa biaya bagi pengadu. Proses GRM terdiri dari lima tahapan utama, yaitu: (i) penerimaan keluhan, (ii) pencatatan dan pendelegasian, (iii) pencarian fakta dan investigasi, (iv) penyelesaian dan banding, serta (v) umpan balik dan penutupan kasus. Seluruh keluhan akan dikelola melalui sistem pencatatan terpusat dan ditangani oleh Project SPC dan Kontraktor EPC dengan dukungan pemangku kepentingan terkait apabila diperlukan.

Untuk menjamin transparansi dan aksesibilitas, informasi mengenai prosedur pengajuan keluhan, jangka waktu respons, serta pihak yang bertanggung jawab akan disampaikan kepada masyarakat terdampak dalam bahasa dan format yang mudah dipahami.

Pada tahap pengembangan proyek saat ini, keluhan dapat disampaikan langsung kepada **PT PLN Indonesia Power** melalui kontak berikut:

- **Narahubung :** Amir Hakim
- **Telepon :** +62 812 1691 8158
- **Email :** amir.h@plnindonesiapower.co.id
- **Alamat :** Jl. Jenderal Gatot Subroto Kavling 18, Kuningan Timur Setiabudi, Jakarta Selatan 12950

Selain GRM di tingkat proyek, masyarakat terdampak juga dapat mengakses Project-Affected People's Mechanism (PPM) milik Asian Infrastructure Investment Bank (AIIB) apabila keluhan tidak dapat diselesaikan secara memuaskan melalui GRM proyek. PPM menyediakan mekanisme independen untuk meninjau pengaduan yang terkait dengan kepatuhan AIIB terhadap Kebijakan Lingkungan dan Sosialnya.

Secara keseluruhan, GRM Proyek dan PPM AIIB menyediakan kerangka kerja yang komprehensif untuk memastikan penanganan keluhan yang efektif, keterlibatan pemangku kepentingan yang bermakna, serta akuntabilitas sepanjang siklus hidup proyek.

Tanggung Jawab dalam Pelaksanaan Rencana Pengelolaan Lingkungan dan Sosial

Pihak-pihak utama yang terlibat dalam pelaksanaan Rencana Pengelolaan Lingkungan dan Sosial (ESMP) serta peran masing-masing dapat dijelaskan sebagai berikut:

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- PT PLN Indonesia Power (PT PLN IP) – bertanggung jawab penuh atas pelaksanaan dan pemantauan proyek secara keseluruhan, serta memastikan semua kewajiban lingkungan dalam ESMP dipatuhi.
- SPC (*Special Purpose Company*) – perusahaan khusus yang dibentuk untuk melaksanakan ESMP secara mandiri, memastikan proyek dijalankan sesuai prinsip keberlanjutan, sosial, dan mendapat dukungan dari masyarakat maupun pemangku kepentingan.
- Kontraktor EPC – wajib menyusun *Contractor ESMP (C-ESMP)*, serta mengelola aspek lingkungan dan sosial selama tahap konstruksi agar proyek tidak hanya berhasil secara teknis, tetapi juga berkelanjutan dan diterima masyarakat.
- Operator Proyek – bertanggung jawab penuh atas penerapan ESMP saat tahap operasi. Untuk proyek PLTS Banyuwangi, PT PLN Indonesia Power bekerja sama dengan GCL (GCL Intelligent Energy (Suzhou) Co., Ltd.) dan membentuk SPC yang akan mengelola konstruksi sekaligus operasional proyek.
- Kontraktor Operasional Lainnya – wajib mematuhi persyaratan ESMP yang telah ditetapkan oleh PT PLN Indonesia Power.

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1 Introduction

1.1 Project Background

In the current global climate situation, countries globally aim to limit temperature increase by 1.5°C from the pre-industrial level. In that regard, Indonesia is committed to a 29% reduction of its greenhouse gases (GHG) emission by 2030 with its own efforts or 41% with international support. To implement this commitment, Indonesia has issued law that sets a minimum 23% of renewable energy in energy mix by 2025 and 31% by 2050.

As of the first semester of 2023, the renewable energy generating capacity is 12.7 GW or 15% of the total generating capacity of 84.8 GW, with total installed solar power generation capacity reached 322.6 MW. This figure is still far from the government's target of 23% renewables of the total energy mix by 2025.

To accelerate the energy transition into renewable energy development, the Client has initiated the preparation of Green Energy (*Proyek Hijaunesia*) 2023 which will develop 7 GW of green energy spread across 108 locations throughout Indonesia. The Banyuwangi ground-mounted solar PV power plants are included within this green energy projects.

The Projects are expected to utilize the Solar Photovoltaic (PV) plant following the solar PV quota in National Electricity Supply Business Plan or *Rencana Usaha Penyediaan Tenaga Listrik* (RUPTL) 2021-2030 for this region. The planned capacity for Banyuwangi PV PP is 100MWac with target COD is 2024[2].

PT PLN Indonesia Power (The Client" or "PT PLN IP") has engaged PT AFRY Indonesia (the "Consultant" or "AFRY") to conduct an Environmental and Social Impact Assessment (ESIA) for a ground mounted Banyuwangi PV PP in East Java Provinces (the "Project"). AFRY proposed to conduct the assessment of the Project in two Phases i.e. Pre-ESIAs Phase (the "ESIA Scoping") and ESIAs Phase (the "ESIAs). This report presents the ESIA of Banyuwangi Solar PV PP.

PT PLN Indonesia Power is a significant player in Indonesia's energy sector, serving as a subsidiary of Indonesia's state-owned electricity company (Perusahaan Listrik Negara – PLN). The main business activity focuses on providing electricity through power generation and providing operation and maintenance services for power plants scattered throughout Indonesia.

The potential location for 131.2 MWp/100 MWac PV PP is part of the Wangkal Plantation, Kalipuro Regency, East Java Province owned by PT. PN XII with approximate land available for development of 156 hectares. The total area for PV and other facilities including Transmission Line on land area will cover approximately 166.7 ha.

This ESIA report covers all components of the ground-mounted PV Project, include the Project site, switchyard, substation, transmission line, and access road.

1.2 Scope and Content of the ESIA

An Indonesia regulatory environmental impact assessment referred as *Analisis Mengenai Dampak Lingkungan Hidup* (AMDAL) for the Ground-mounted PV activity is conducted by an AMDAL consultant within the same timeline with the ESIA. The AMDAL are a key requirement for acquiring an environmental approval and permitting for the Project.

[2] MEMR Regulation No.13, 2021

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No previous ESIA is available for the Banyuwangi Project. This ESIA report was prepared to meet the requirements of Government of Indonesia (GoI) laws and regulations, Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF) and Environmental and Social Standards (ESSs), as well as international best practice standards such as the Equator Principles, International Finance Corporation (IFC) Performance Standards (PS) and World Bank Group General EHS Guidelines.

The Banyuwangi Solar PV Ground Mounted Project is likely to trigger a resettlement (economic displacement) due to the Project land requirement through a land acquisition process. Based on scoping report, the acquisition of land mostly will be required for the purpose of the Transmission Line tower footing given the majority of land for this purpose has been identified as dryland agricultural and rice field, assuming they are own individually by the local community. Whilst the area land intended for the switchyard, landing point, include extension bay are under the Directorate General of Water Resources (Balai Wilayah Sungai/BBWS) land ownership. No indication of any physical structure in the intended land. There were no Indigenous Peoples identified within the project area.

Overall, the Banyuwangi Ground-Mounted PV Project is assessed to present a moderate level of combined environmental and social (E&S) risk and impact, consistent with a Category B classification under the AIIB ESF. Environmental impacts are expected to be site-specific, reversible, and manageable through standard mitigation measures. The project will involve involuntary resettlement affecting more than 200 affected persons (APs), primarily through economic displacement, which requires careful planning and implementation of appropriate mitigation measures. Involuntary resettlement and the number of affected people will be discussed in detail in corresponding management plan (LALRP). No Indigenous People are present in the project area, and related risks are negligible. Taken together, the identified impacts are considered largely localized and manageable with established safeguard instruments, supporting an overall risk profile aligned with Category B, provided that mitigation and management measures are effectively implemented.

Further requirements of the ESIA include conducting a gap analysis to determine the scope of additional environmental and social impact studies necessary to comply with Indonesian law and regulation as well as international standards. It also involves carrying out necessary baseline studies to understand the existing environmental and social conditions to support the impact assessment process and developing the ESIA to meet the requirements of lenders.

The objectives of the ESIA are:

- to identify, describe, and assess all potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence.
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management.

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In short, the main objective of this ESIA is to identify, evaluate key environmental and social risks and impacts, and then recommend mitigation measures where relevant to improve environmental and social performance of the Project Structure of the ESIA.

The ESIA report has been prepared and organized as follows:

1. Executive Summary
2. Section 1: Introduction
3. Section 2: Policy, Legal, and Administrative Framework
4. Section 3: Project Description
5. Section 4: Description of the Environment and Social Baseline
6. Section 5: Environmental and Social Impact Assessment Methodology
7. Section 6: Environmental and Social Impact Assessment
8. Section 7: Climate Change Risk Assessment
9. Section 8: Cumulative Impacts Assessment
10. Section 9: Environmental and Social Management Plan
11. Section 10: Reference
12. Section 11: Appendix

1.3 ESIA Assumptions and Limitations

In the preparation of ESIA and ESMP for the Banyuwangi Ground Mounted Solar PV Power Plant Project, the Consultant factoring the following of assumptions and limitations:

- The findings of the ESIA report reflects its sound assessments considering the timeframe, budget constraints, and the information accessible during its commission. This ESIA and Rapid CIA studies are based on the Project Description as per the Ground Mounted Solar PV Project Feasibility Study updated as per Mid of February 2024 and subsequent discussion with the PLN Indonesia Power and the Lender's Team. It is possible that in the future this might change as such future review (of ESIA and ESMP) is recommended to assess for any potential gaps in risk assessment and possible mitigation.
- Initially, the social impact assessment has been conducted without detailed information on the land acquisition process (and resettlement plans) given at the time of this impact assessment being prepared, the LARAP is still in the process of preparation under the responsibility of PT PLN Indonesia Power. Although in its finalization, the updated LALRP study is included in the assessment in this document.
- The social economic baseline studies were prepared using household surveys, in-depth interviews, and secondary data. This research also used secondary data from publicly available information at the time of writing or provided by **PT PLN Indonesia Power**. Certain limitations are inherent in the process of conducting a social baseline study for a solar PV project. One important limitation lies in the potential challenges of obtaining comprehensive and unbiased data, as social dynamics are complex and diverse. These studies may face challenges in capturing the full spectrum of community perspectives and needs, especially if certain demographic groups or marginalized voices are underrepresented. Apart from that,

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the scope of this activity is limited to the area of impact at each site, focusing only on villages predicted to be affected by the Solar PV Project.

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2 Policy, Legal and Administrative Framework

This section sets out the regulatory framework for the Project's ESIA processes. AFRY reviewed applicable Indonesian environmental and social legal requirements, as well as international standards and Good International Industry Practice (GIIP).

2.1 National Legislation

The Government of Indonesia (GoI) issues numerous national legislations as well as regional level such as East Java Provinces, Banyuwangi Regency to ensure that all major development activities can be managed sustainably with regards to environmental protection and conservation, as well as with appropriate social, economic, and cultural considerations.

2.1.1 Environmental Impact Assessment Process

The Indonesian regulatory environmental impact assessment (EIA) or AMDAL is a statutory process required under Omnibus Law No. 11 of 2020 regarding job creation, which states in article 1 that any business and/or activity shall have an environmental approval as part of the issuance of business license. It is further elaborated in the Government Regulation (GR) No. 22 of 2021 on implementation of environmental protection and management, which states in Article 3 that an environmental approval shall be obtained through the preparation of AMDAL or environmental management and monitoring efforts or *Upaya Pengelolaan Lingkungan Hidup dan Upaya Pemantauan Lingkungan Hidup* (UKL-UPL).

AMDAL is initiated through project screening in order to determine the required EIA document for the proposed project as regulated in the Ministry of Environment and Forestry Regulation No. 4 of 2021 on types of business and/or activity that are required to prepare an AMDAL, UKL-UPL, or capability statement for environmental management and monitoring or *Surat Pernyataan Kesanggupan Pengelolaan dan Pemantauan Lingkungan Hidup* (SPPL). Referring to this regulation, the Banyuwangi ground-mounted solar PV Project with capacity 100MW each location within a category that requires an AMDAL. The process of those environmental impact assessment studies for the Project are prepared by the AMDAL consultant.

Based on Government Regulation No. 5 of 2021 regarding the Implementation of risk-Based business licensing in Appendix I of the Energy and Mineral Resources Sector for business plans and/or activities with KBLI No. 35101 on electric power generation, the assessment will fall under the Ministry of Environment and Forestry.

2.1.2 Environmental and Social Laws and Regulations

In addition to the national regulatory EIA, there are a number of Indonesia laws and regulation on environmental and social aspects that are applicable for the Project as presented in **Appendix A.**

2.2 International Requirement

2.2.1 Asian Infrastructure Investment Bank (AIIB)

The Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF) (2024) describes Environmental and Social Policy (ESP) encompasses Environmental and Social Standards (ESSs) and Environmental and Social Exclusion List (ESEL) to ensure its projects align with sustainable development principles and adhere

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to environmental and social safeguards. These frameworks guide project planning, implementation, and monitoring to mitigate environmental impacts and promote positive social outcomes.

Environmental and Social Standards (ESSs), which set out more detailed mandatory environmental and social requirements to be implemented. These standards cover the following:

- ESS 1: Environmental and Social Assessment and Management

The standard requires the implementation of environmental and social assessment and management through studies to the potential risk and impacts of the project.

- ESS 2: Land Acquisition and Involuntary Resettlement

ESS2 addresses impacts of Project-related land acquisition, including restrictions on land use and access to assets and natural resources, which may cause physical displacement (relocation, loss of land or shelter), and/or economic displacement (loss of land or assets, or restrictions on land use, assets and natural resources leading to loss of income sources or other means of livelihood).

- ESS 3: Indigenous Peoples

ESS 3 requires the design and implementation Projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, economies and cultural heritage.

2.2.2 Equator Principles 4 (EP4)

The Equator Principles are guidelines for financial institutions on managing environmental and social risk in project financing. EP require projects located in Non-Designated Countries, such as Indonesia, to evaluate compliance with applicable IFC Performance Standards on Environmental and Social Sustainability and the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).

The latest update of the Principles, EP4, was released on 18 November 2019. The principles apply to new project financing globally where the total project capital cost exceeds US$10m, and to project finance advisory activities. New projects signed on or after 1 October 2020 are required to implement EP4, which introduces new and strengthen existing Principles in the area of human rights and climate change, as well as enhanced efforts around biodiversity and ecosystem management. The ten requirements of the Equator Principle Financial Institutions (EPFIs) are as follows:

- Principle 1: Review and Categorization. There are three categories including A, B, and C with potentially significant, potentially limited, and minimal or no adverse environmental and social risks and/or impacts, respectively.
- Principle 2: Environmental and Social Assessment. Assessment process to evaluate environmental and social risks and the magnitude of impacts associated with the proposed project, ensuring it meets the satisfaction of the Equator Principle Financial Institution (EPFI);
- Principle 3: Applicable Environmental and Social Standards. To evaluate the project's adherence to the applicable environmental and social laws, regulations, and permits in the host country and compliance with the IFC PS on Environmental and Social Sustainability and the World Bank EHS Guidelines, whichever is more stringent.
- Principle 4: Environmental and Social Management System and Equator Principles

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Action Plan. Based on the evaluation in the ESIA, the Project to develop and/or maintain an Environmental and Social Management Plan to address issues raised in ESIA. For Category A and B, the Project to develop the Environmental and Social Management System;

- Principle 5: Stakeholder Engagement. This showcases the practice of effective Stakeholder Engagement. This engagement should be continuous, conducted in a structured manner, and tailored to the cultural context, involving affected communities, workers, and, where applicable, other stakeholders.
- Principle 6: Grievance Mechanism. For Category A and B, the Project as part of ESMS to develop effective grievance mechanism which are used by the affected communities and workers as appropriate.
- Principle 7: Independent Review. An independent environmental and social consultant will be nominated to conduct an evaluation of the assessment process, which includes the Environmental and Social Management Plans (ESMPs), the Environmental and Social Management System (ESMS), and the documentation of the Stakeholder Engagement process related to the Project.
- Principle 8: Covenants. Where a client is not in compliance with its environmental and social covenants, the EPFI will work with the client on remedial actions to bring the Project back into compliance. If the client fails to re-establish compliance within an agreed grace period, the EPFI reserves the right to exercise remedies, including calling an event of default, as considered appropriate.
- Principle 9: Independent Monitoring and Reporting. The principle requires independent monitoring and reporting for all Category A and, as appropriate, Category B Projects in order to assess Project compliance with the Equator Principles after Financial Close and over the life of the loan; and
- Principle 10: Reporting and Transparency. The principle requires all Category A and, as appropriate, Category B Projects to publicly report a summary of their ESHIA, annual GHG emission levels, and non-sensitive Project-specific biodiversity data with the Global Biodiversity Information Facility.

2.2.3 International Finance Corporation (IFC) Performance Standards

The IFC Environmental and Social Performance Standards define the Project's responsibilities for managing the environmental and social risk. There are 8 performance standards that will be referred for the Project:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts to highlight the significance of effectively overseeing environmental and social performance across the entire lifespan of a project;
- Performance Standard 2: Labour and Working Conditions to acknowledge the need of balancing economic growth by job creation and income generation while safeguarding the labour rights;
- Performance Standard 3: Resource Efficiency and Pollution Prevention to acknowledge the increase industrial operation and urban development often lead to elevated pollution on air, water, and pose potential threats to both local and global level;
- Performance Standard 4: Community Health, Safety and Security to acknowledge that project activities pose risks to community. Furthermore, communities who already affected by the consequences of climate change may observe a

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magnification and/or exacerbation of those effects as a result of project-related activities;

- Performance Standard 5: Land Acquisition and Involuntary Resettlement to specify that involuntary resettlement encompasses not only physical displacement, such as physical displacement or housing loss but also economic displacement, which involves the loss of assets or access to assets, leading to a loss of income sources and livelihoods;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of living Natural Resources to acknowledge that safeguarding and preserving biodiversity constitutes a fundamental aspect of sustainable development;
- Performance Standard 7: Indigenous Peoples to acknowledge that Indigenous Peoples (IP), as social communities with identities distinct from the dominant groups, frequently find themselves among the most marginalized and vulnerable sectors of the population; and
- Performance Standard 8: Cultural Heritage to acknowledge the significance of cultural heritage for both present and forthcoming generations. This performance standard is geared towards guaranteeing that clients take measures to safeguard cultural heritage throughout the course of their project endeavours.

In addition to those performance standards above, the Project will also refer to Utility Scale Solar Photovoltaic Power Plants: A Project Developer Guide (2015). In addition, for workers' accommodation, the Project will refer to European Bank for Reconstruction and Development (EBRD)'s workers' accommodation: processes and standards[3].

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

AIIB refers to a set of Environmental, Health and Safety (EHS) guidelines from the World Bank group, which are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP), when it comes to pollution prevention and control technologies and practices. Therefore, the Projects will also consist with the standards, however when this differs with national regulations, the Project will achieve whichever is more stringent.

The following World Bank Group General EHS Guidelines are applicable for the Projects:

- General EHS Guidelines, covering:
  - Environmental (ambient air quality, energy conservation, wastewater and ambient water quality, water conservation, hazardous material management, waste management, noise and contaminated land);
  - Occupational health and safety (general facility design and operation, communication and training, physical hazards, chemical hazards, personal protective equipment (PPE) and monitoring);
  - Community health and safety (water quality and availability, structural safety of project infrastructure, traffic safety, disease prevention and emergency preparedness and response); and
  - Construction and decommissioning (environment, occupational health and safety and community health and safety).

[3] https://www.ebrd.com/downloads/about/sustainability/Workers_accomodation.pdf accessed on 17 October 2023.

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- Sector-Specific EHS Guidelines for Electric Power Transmission and Distribution: These guidelines are also applicable as the Project includes a transmission line component. They provide additional standards, and mitigation measures relevant to electric power transmission activities, including live routing, electromagnetic field (EMF) management, bird and wildlife interactions, and occupational and public safety considerations.

Since there are no specific solar industry sector guidelines, the Projects will apply the General EHS Guidelines as above.

2.2.5 International Human Rights Framework

The International Human Rights Framework comprises norms and principles crafted to protect, respect, and fulfil human rights globally. Anchored in pivotal documents such as the Universal Declaration of Human Rights, the International Covenant on Economic, Social, and Cultural Rights, and the International Covenant on Civil and Political Rights, this framework establishes a legal and ethical basis for safeguarding individuals' fundamental rights. It aims to foster an environment that upholds human dignity, combats discrimination, and ensures access to fundamental freedoms for all. With the participation of diverse nations on the international stage, this framework signifies a global dedication to establishing a just and inclusive world free from human rights violations. Adhering to and implementing this framework forms the foundation for cultivating an international society prioritizing fundamental rights and universal justice.

UN Guiding Principles (UNGPs) on Business and Human Rights

The UN Guiding Principles on Business and Human Rights (UNGPs)[4] is a set of guidelines for States and companies to prevent, address, and remedy human rights abuses committed in business operations. The guidelines were proposed by the UN Special Representative on Business and Human Rights, John Rugie, and supported by the UN Human Rights Council in June 2011. It consists of three pillars: Protect (state duty to protect human rights), Respect (the corporate responsibility to protect human rights), and Remedy (access to remedy for victims of business-related abuses) as well as 31 principles implementing these pillars.[5]

Indonesia is one of the countries fully committed to strengthening the Implementation of UNGPs.[6] The UNGPs require states to encourage and, where appropriate, require business enterprises to communicate how they address their human rights impacts. Therefore, as a business enterprise, **PT Indonesian Power** should respect and fulfil all provisions contained in the UNGPs by, among other means, conducting Human Rights Potential Risk.

International Labour Organization (ILO) Conventions

Indonesia has ratified various core International Labour Organization (ILO) conventions that recognize and protect the rights of workers, including: (see **Table 2-1** below).

[4] UNGPs are the global standard for understanding the responsibility of business enterprises to respect human rights and are the foundation for Total's human rights commitments as set out in the Total Human Rights Guide, https://www.ohchr.org/sites/ default/files/documents/publications/guidingprinciplesbusinesshr_en.pdf
[5] Business & Human Rights Resource Centre, https://www.business-humanrights.org/en/big-issues/un-guiding-principles-on-business-human-rights/
[6] Public Relations of Directorate General of Human Rights, Government of Indonesia Committed to Strengthening the Implementation of the United Nations Guiding Principles on Business and Human Rights (UNGPs), https://ham.go.id/2021/06/01/pemerintah-indonesia-berkomitmen-untuk-perkuat-implementasi-united-nations-guiding-principles-on-business-and-human-rights-ungps/

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Table 2-1 *ILO Convention Ratified by Government of Indonesia*

Convention	Title
ILO Convention No. 29	Forced Labour.
ILO Convention No. 100	Equal Remuneration for Men and Women Workers for Work of Equal Value
ILO Convention No. 105	Abolition of Forced Labour.
ILO Convention No. 111	Discrimination in Respect of Employment and Occupation.
ILO Convention No. 138	Minimum Age for Admission to Employment
ILO Convention No. 182	Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour.

A government ratification of International Labour Organization (ILO) conventions is crucial in committing to global labour standards. This ratification reflects the willingness of the government to acknowledge, respect, and protect workers' rights by international norms. In the context of labour, the ILO has issued various conventions covering diverse aspects, such as freedom of association, the elimination of forced labour, and the right to work in humane conditions. By ratifying these conventions, a country signals its readiness to participate in efforts to create a fair, safe, and human-rights-respecting work environment. Moreover, ratification can be a foundation for the government to develop national regulations aligned with international standards, improving working conditions and enhancing worker protection.

2.3 Corporate (PT PLN Indonesia Power) Requirements and Guidelines

The commitment of environmental management of the Client is regulated in Director's Decree No. 41.K/010/IP/2012 on Occupational Safety, Health and Environmental Policy. At the international level, the Client implements Environmental Management System and Occupational Health and Safety Management Systems that refers to ISO 14001:2015 and ISO 45001:2018 respectively, which are integrated into the Integrated Management System (IMS).

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3 Project Description

3.1 Project Alternative

3.1.1 No Project Alternative

The objective of 'no project alternative' is to understand the consequences if the Project is not to proceed. In this scenario, the potential positive and negative impacts of the proposed activities would not occur.

The benefits 'no project alternative' are to avoid potential adverse environmental and social impacts arising from construction and operation activities of the Project. This includes avoiding impacts such as changes in land use, generation of dust, noise and vibration, disturbance on surface water quality, erosion, sedimentation, generation of waste, traffic and disturbance of biodiversity. In addition, disruption on social aspects such as health and safety impact to community, unplanned events, loss of land and livelihood would be prevented.

Meanwhile, the disadvantages of 'no project alternative' will have consequences as follow:

- Potential positive benefits on socio-economic from the Project such as employment opportunity for local community, increased access to electricity, local economic benefits would not realize.
- It may result in the need to establish alternative plants using other energy and fuel sources e.g., gas-fired, or coal-fired Thus, it will delay Indonesia from achieving 23% of renewable energy mix by 2025 and prevent its commitment of 29% reduction of its GHG emission by 2030.

3.1.2 Site Specific Selected

The Banyuwangi PV site is already designated in the Decree of Energy and Mineral Resources Ministry No. 188.K/HK.02/MEM.L/2021 regarding Business Plan for Providing Electricity (*Rencana Usaha Penyediaan Tenaga Listrik* = RUPTL) for 2021-2030. Nonetheless, the site study evaluates the proposed location concerning the general suitability for on-site solar energy generation with respect to the impacts of the solar farm on the physical plant, daily operations, and the surrounding community. Additionally, it aims to identify the optimal site based on various factors, including climate (solar radiation received at the location, average temperature, humidity), environmental conditions (land accessibility, land use), geography (land slope, elevation, plot areas, land orientation), and proximity (distance from residential areas, distance to main roads, distance to the river, distance to water reservoir and wetlands, distance to substation). The objective of the site selection process is to conduct a multi-criteria evaluation to identify areas that are highly suitable for solar farms, maximizing annual electricity production while minimizing potential investment costs.

Moreover, the Banyuwangi PV site also took into account the space utilization principles as the basis of ground-mounted PV design, as follows:

- Spatial planning suitability;
- Avoiding the protected rice field as much as possible;
- Avoiding forest area;
- Type of land use to avoid impact on land acquisition and resettlement;
- Land slide index;

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- Flash flood hazard index; and
- Earthquake hazard index.

3.1.3 Technology Alternative

3.1.3.1 Solar PV Module

Solar PV module consists of cells that are connected electrically and encased with protective material to protect the cells from the environment. The cell itself can be manufactured majority from crystalline silicon (C-Si). Two types of solar PV modules had been considered for the Project, mono-crystalline and poly-crystalline types. The comparison of the two modules is presented in **Table 3-1**. As a result, mono-crystalline is selected for the Project.

Table 3-1 *Comparison of solar PV modules*

Characteristic	Mono-crystalline	Poly-crystalline
Configuration	One pure silicon crystal (high purity rating)	Many silicon fragments melt together
Colour	Blue-hued PV cells	Blue-hued PV cells
Lifespan	25-40 years (longer due to the stable and inert properties of the silicon)	20-35 years
Efficiency	15% to 22% at a higher price due to more complex manufacturing process	13% to 17% thus inexpensive due to simpler manufacturing process
Typical temperature coefficient	-0.3% to -0.5%/°C **better** performance in higher temperatures than polycrystalline	-0.3% to -1.0%/°C **less** performance in higher temperatures compared to monocrystalline
Area	Require less space (high ratio of capacity per area)	Require more space to produce the same level of power
Highest capacity	700 Wp	330 Wp
Overall remarks	Selected, due to its higher efficiency, longer lifespan and require less space.	Not selected.

Source: Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025

3.1.3.2 Inverter

Two types of inverters are broadly considered for Solar PV projects, namely string, and central inverters. The comparison of the two types of inverters is presented in **Table 3-2**. As a result, string inverter is selected for the Project.

Table 3-2 *Comparison of inverters*

Parameter	Central Inverter	String Inverter
Quantitative		
Inverter Number	25 @ 2 MWac	250 @ 0.2 MWac
Installation Costs (Labour)	1825 hours @ 20$/hours $36,500	1937.5 hours @ 20$/hours $38,750
CAPEX	13.1 $cent/W	15 $cent/W

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Parameter	Central Inverter	String Inverter
	$6,550,000	$7,500,000
OPEX	Central Inverter OPEX would have between 2.6 – 3.7 $cent/W lower than string over the system lifetime.	
Qualitative		
Access road and heavy equipment necessary for installation of Central Inverter	Heavy equipment will be able to reach the site, however the site might not be suitable for Central Inverter installation and maintenance due to undulated terrain in some location.	
Availability of skilled service technicians	Each site is approx. 2 hours flight away from Jakarta. A skilled technician should be readily available within 24-48 hours after notified.	
Terrain condition	Irregular and hilly in some location	
Shading condition	Non-uniform shading possibility is rather high	
Overall remarks	Not selected	Selected, due to the site condition.

Source: Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025

3.1.3.3 Mounting Structure

The mounting structure are categorized into fixed-tilt and tracking systems, described as follows:

1. Fixed-tilt

The PV module brackets are installed at a fixed tilt angle, which is a well-established and widely adopted support structure for large-scale PV power stations due to its cost-effectiveness. The amount of solar irradiation received by the PV module surface varies with the tilt angle. Therefore, to optimize energy output, the tilt angle should correspond to the angle that maximizes annual global solar irradiation on an inclined plane which is typically close to the latitude of the project site.

2. Tracking System

The tracking PV module support consists of two types: i) single-axis tracking support, and ii) double-axis tracking support as described in the **Table 3-3** below.

Table 3-3 *Types of the mounting structure*

Type	Description
Single-axis tracking support	The single-axis tracking supports (i.e., horizontal single-axis tracking system and inclined single-axis tracking, mostly in N-S axis) can follow up the solar trace at a constant tilt angle from the east to the west. In practise, horizontal single N-S axis tracking system is commonly used.
Double-axis tracking support	The double-axis tracking support (i.e., full tracking), can change its azimuth angle and tilt angle based on the seasonal position change of the solar trace. For automatic tracking support, its inclined plane can maximally receive global solar irradiation to increase its energy output.

Source: Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025

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The following factors should be considered when implementing a tracking system:

- The automatic tracking support is complex with relatively high requirements for both electro-mechanical control and mechanical transmission components which leads to relatively high initial cost and maintenance costs.
- The occupied area of the support equipment for the tracking system and installation space is larger than that of fixed-tilt support, but the land area available on-site is limited.
- The automatic tracking support will consume some electric energy. The benefits generated from additional solar irradiation obtained by installing tracking support may not be able to offset the comprehensive cost of installing the tracking support.
- For a Solar PV project located in a country such as Indonesia, which is located near the equator, having automatic tracking support may not have an added benefit to the overall energy production as the sun's path does not change significantly throughout the year and the installed PV modules are directly overhead facing the sun almost at all time.
- Backtracking system is highly recommended to avoid near shading between tracking tables during early morning/late evening.

Considering the mounting structure mechanism, the space occupied by support equipment, and backtracking system requirements, fixed-tilt steel supports are recommended for the PV arrays in the Banyuwangi Project as it is a well-established and widely adopted solution for large-scale PV power stations due to its simplicity and cost-effectiveness.

3.2 Project Location and Site Setting

3.2.1 Project Location

The Banyuwangi ground-mounted solar PV power plants are planned to be added to Java Region electricity network. The total targeted capacity of the Project is 100 MWac following the solar PV quota in National Electricity Supply Business Plan or *Rencana Usaha Penyediaan Tenaga Listrik* (RUPTL) 2021-2030 for East Java Province.

The preliminary design for the ground-mounted solar PV power plant with mono-facial PV module technology follows a typical design of a string consisting of 28 modules connected in series. Then the 14 strings are connected in parallel to a 200 kWac string inverter. Types of electricity generation using solar energy are solar thermal and solar PV. Solar thermal power generation utilizes heat radiation from the sun whereas photovoltaic power generation utilizes photons in the sunlight to ionize semiconductor material creating a flow of direct electrical current. The Banyuwangi ground-mounted solar PV power plants are expected to increase renewable energy penetration in the East Java sub-system.

Table 3-4 *General information of the Project sites*

Location & Plant area	Administrative Location	Coordinate	Nearest Substation
Banyuwangi (155.39 Ha)	Kalipuro, Banyuwangi Regency	209377.049 – 210794.450 Easting; 9096673.286 –	Banyuwangi SS (4.3 km)

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Location & Plant area	Administrative Location	Coordinate	Nearest Substation
		9098345.046 Northing	

Source: LARAP, 2025

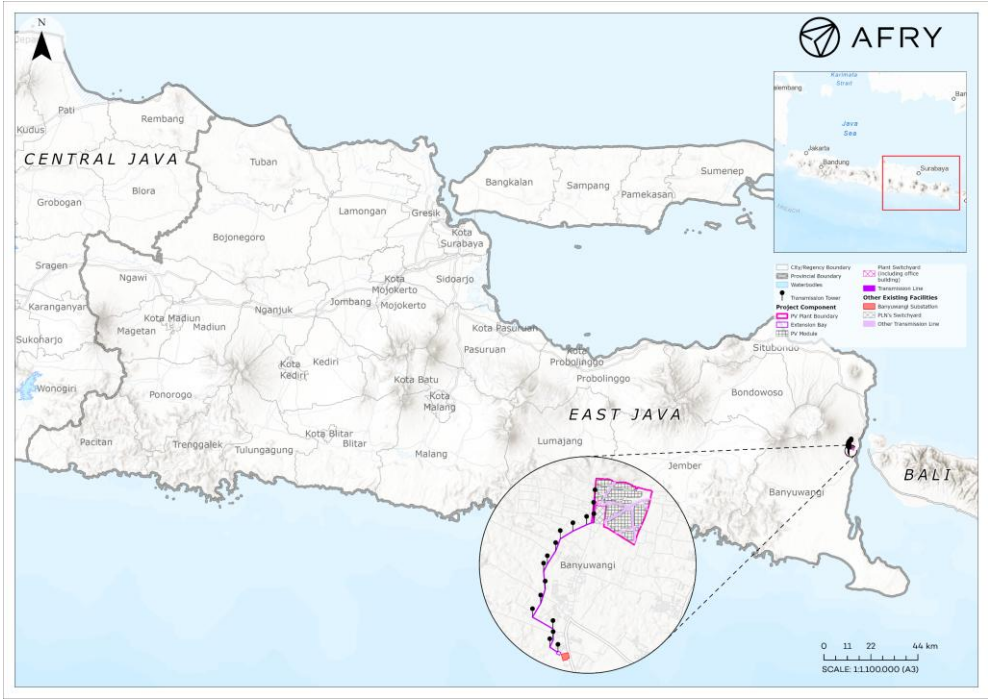


Figure 3-1 *Location ground-mounted Solar PV Plant at East Java Province*

The potential location for 131.2 MWp / 100 MWac PV PP is part of the Wangkal Plantation, Kalipuro Subdistrict, Banyuwangi Regency, East Java Province with approximate land need for the development of 155.39 Ha. The total area for PV and other facilities including Transmission Line on land area will cover approximately 164.78 ha. The location of Wangkal Plantation can be access through national road (Raya Banyuwangi – Situbondo Road) and local road (Argopuro Road, Raden Wijaya Road and Joyoboyo Road) from Banyuwangi City.

General overview of the Project is described at **Table 3-5** and **Figure 3-2**.

Table 3-5 *Project components by administrative location*

Project Sites	Project Component	Administrative Location
Ground-mounted solar PV PP Banyuwangi	Ground-mounted solar module and Switchyard	• Kalipuro Subdistrict: - Kalipuro Village
	Transmission line	• Kalipuro Subdistrict: - Kelir Village - Kalipuro Village • Giri Subdistrict: - Giri Village
	Extension Bay	• Giri Subdistrict: - Giri Village

Source: FS and Preliminary ESIA scoping site visit, July 2023

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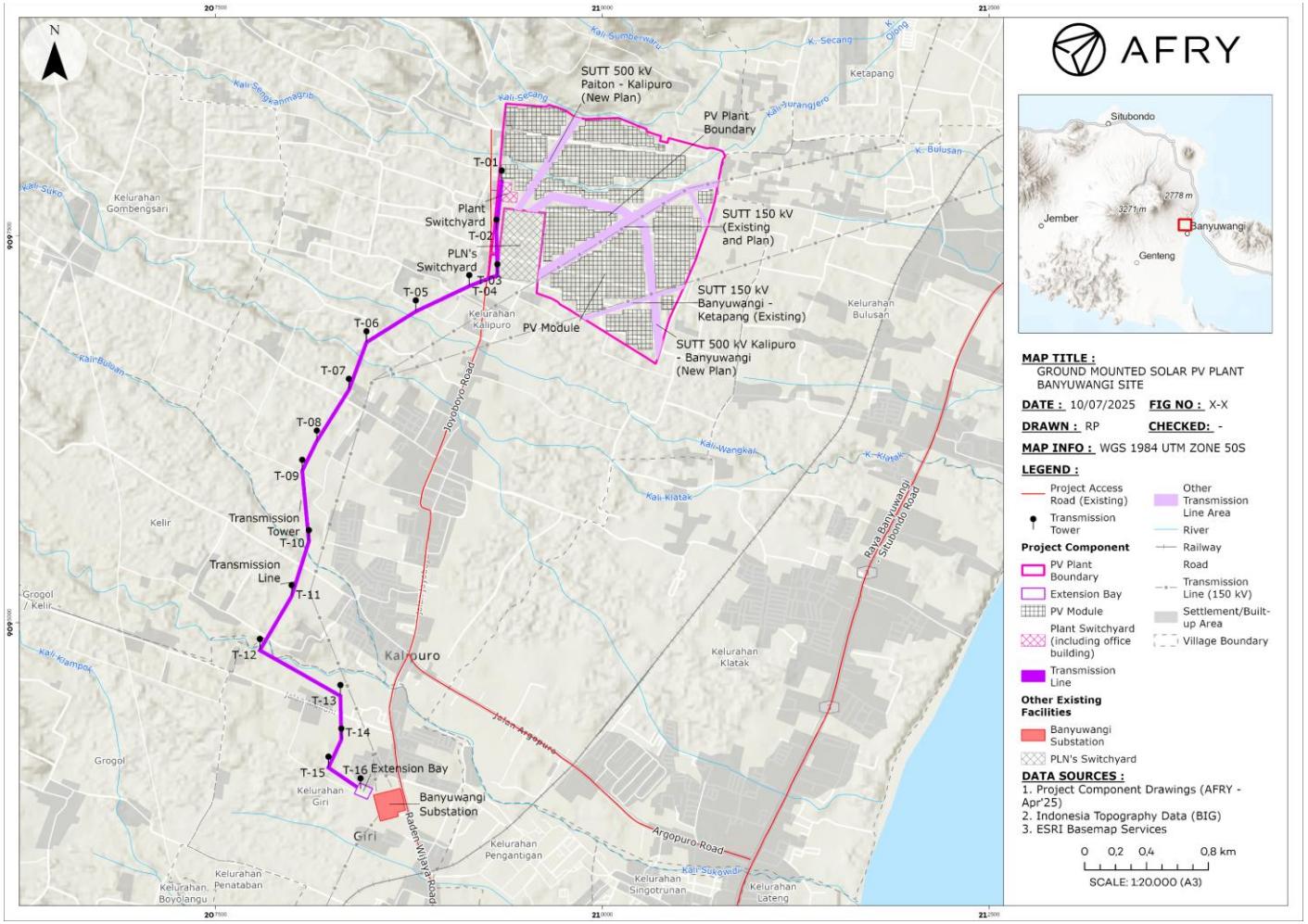


Figure 3-2 *Location of ground-mounted solar PV power plant Banyuwangi*

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3.2.2 Project Layout

The breakdown area for Banyuwangi Solar PV Power Plant as shown on **Table 3-6**.

Table 3-6 *Land Area Breakdown for Banyuwangi PV*

No	Project Component	Total Area (Ha)
1	Ground-mounted PV (Boundary), Switchyard, PV Modul, Transmission line RoW 1,2 partially RoW 3, Transmission Tower 1-3)	155.39
2	Gantry	0.06
3	Extension Bay	0.54
4	RoW Transmission Line	8.24
5	Transmission Tower 4-16	0.55
Total		**164.78**

Source: LARAP document (2025)

The preliminary layout of each PV plant based on the land available in each area. It should be noted that this layout is preliminary and shall be refined during the conceptual design phase to reflect the designed site configuration and topography. Connection to Banyuwangi Substation will be via a 150kV overhead TL. The preliminary Banyuwangi PV layout as shown on ***Figure 3-3*** *and general plant layout and its facilities as shown on Source: Source: Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025*

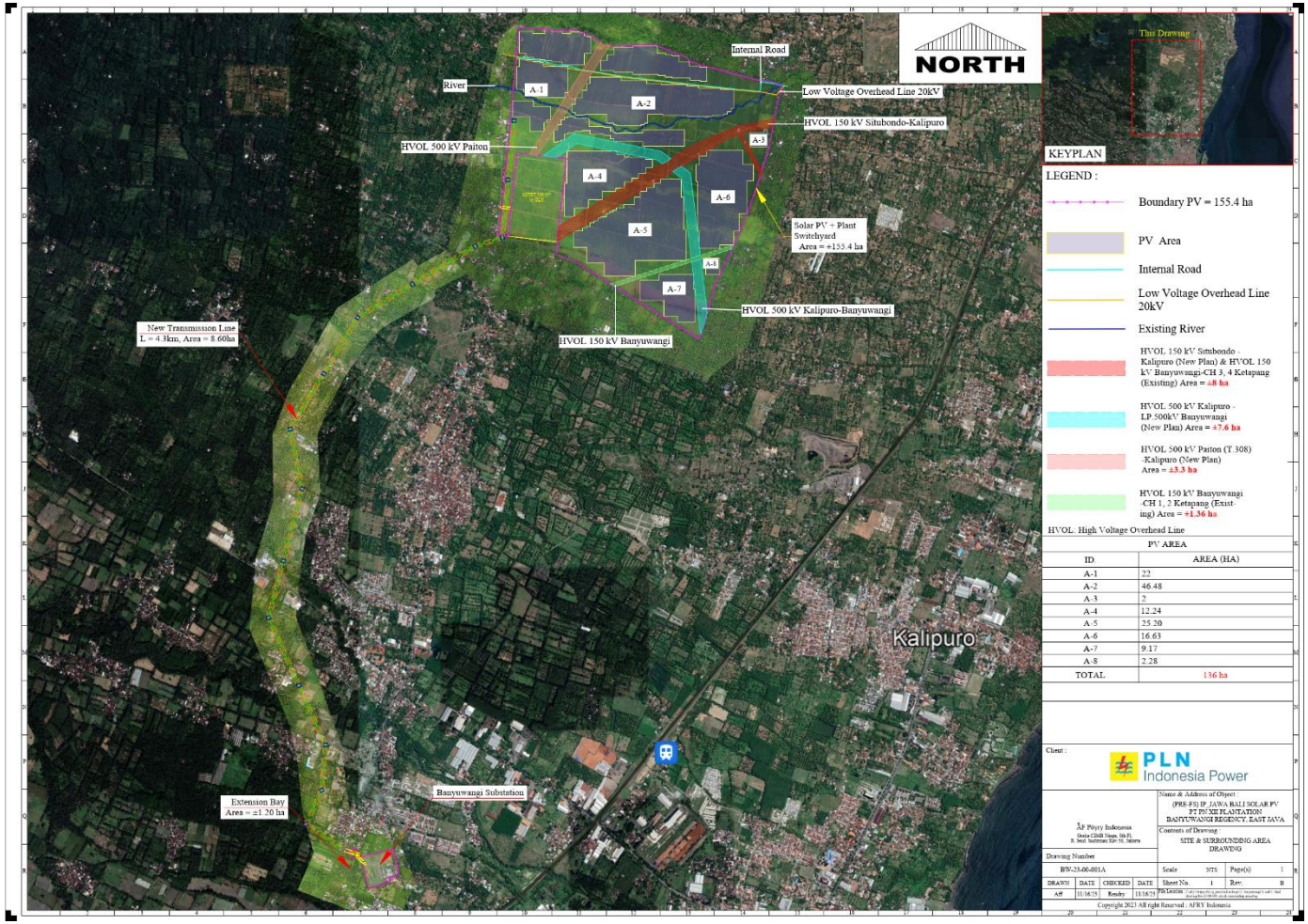
Figure 3-4.



Figure 3-3 *Banyuwangi PV Preliminary Plant Layout*

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Source: Source: Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025
Figure 3-4 *General plant layout and its facilities for Banyuwangi PV*

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3.2.3 Plant Capacity

In feasibility study, 10° tilt and inter-row spacing of 1.5 m (distance between each table) is selected for the energy yield analysis, to ease the mass module installation, provide maintenance access and mitigate mutual shading between the tables. 25 sets of string inverter will be installed in the middle of each 6.3MV Block, next to MV transformer to minimize the AC cabling losses.

Based on the technical feasibility study, the Technical Consultant suggested 2 DC/AC for Banyuwangi PV considering the land availability. **Table 3-7** below show the summary of Banyuwangi PV Project's configuration.

Table 3-7 *Preliminary PV Plant Configuration of Banyuwangi PV*

Site Configuration	DC/AC	
	1.1	1.27
Site Coordinates	8.155285 °S, 114.368427 °E	
Site Altitude	113 MASL	
DC Nominal Capacity (kWp)	110,000	127,400
AC Nominal Capacity (kWac)	100,000	
No. of Modules	169,232	196,000
No. of Inverters	500	
Total Module Area (m^2)	525,694	608,845
Module Orientation	Potrait	
PV module	Trina Solar 650 Wp TSM-650DE21 (Mono-facial)*	
Inverter (string type)	Huawei Sun2000-215KTL-H3*	
Array tilt angle	10°	
Azimuth	0° (North)	
No. of modules per string	28	
Total no. of Strings per Inverter	14	
Total no. of Strings of PV Plant	6044	7000

*Notes: *) The PV module and inverter type options are indicative at this stage; the final selection will be determined based on the bidding results*
Source: Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025

3.3 Project Components

The main components of the solar PV Project are:

- Solar PV modules – key component which converts sunlight into electrical energy using semi-conductor material;

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- Inverters – component which converts direct current (DC) electricity generated by solar panels to alternation current (AC) electricity;
- Mounting structure – it is a racking system that support and secures solar panels in place, the main functions are for support and stability; optimal angle and orientation; protection and ventilation;
- Electrical substation – facility that transforms, controls and distributes electrical power at different voltage levels, ensuring the safe and efficient delivery of electricity;
- Transmission line – a network or cable or wires to efficiently transport electricity from power plant to substation and distribution networks;
- Internal access roads; and
- Other project infrastructure – this includes workers accommodation, waste facilities etc.

*The typical Solar PV Power Plant component is presented in **Figure 3-5**. Banyuwangi site layouts is depicted in Source: Source: Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025*

Figure 3-4.

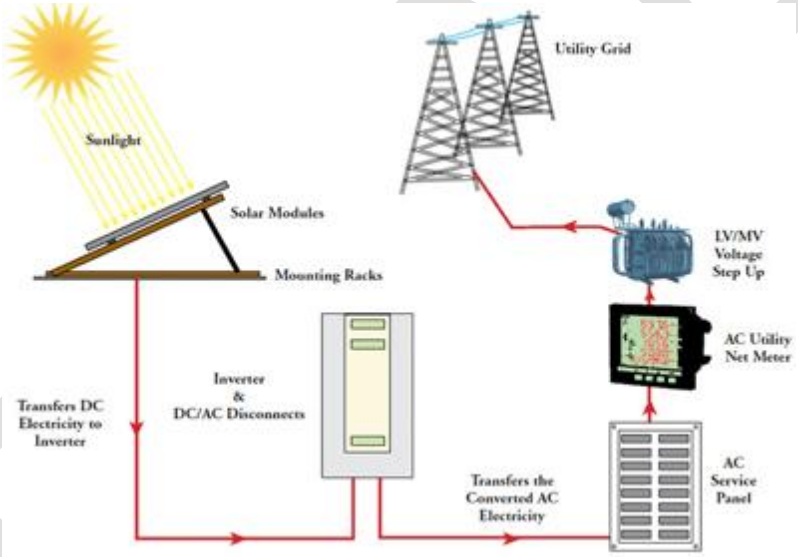


***Figure 3-5** Typical Conventional Solar PV Power Plant Component*[7]

3.3.1 Solar PV Module

Solar PV module consists of cells that are connected electrically and encased with protective material to protect the cells from the environment. The cell itself can be manufactured from various materials; however, crystalline silicon (c-Si) currently takes up the majority as the material from which PV cells are manufactured. Therefore, it is used commercially on large scale. C-Si PV panels can be categorized into two types as described in the **Figure 3-6**.

[7] Solar Satellite: A Green Energy Infrastructure for Power Challenged Environments, a Case for Solar Cell I-V Behaviour

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(Source: https://ases.org/monocrystalline-vs-polycrystalline-solar-panels/ accessed 9 August 2023)

Figure 3-6 Monocrystalline solar cell and polycrystalline solar cell

According to Feasibility Study Report for 200 MWac Java Land Based Solar PV Power Plants, 2023, the Client will use mono-crystalline panels since it is more efficient, more durable, and more applied by large commercial PV Plants nowadays compared with poly-crystalline panels. On top of that, the price of mono-crystalline panels drops significantly, therefore it becomes more competitive with poly-crystalline panels. The main specification of the PV module for the Projects is presented in **Table 3-8**.

Table 3-8 *Main specifications of PV modules*

Specifications	Mono-facial TSM-DE21
Type	Mono-crystalline
Rated capacity P_{mpp}	650.00 Wp
Number of photovoltaic cells	132 [6x22]
Dimension	2384×1303×35 mm
Weight	33.6 kg
Front cover	3.2 mm, high transmission, AR coated heat strengthened glass
Frame	35 mm, anodized aluminium alloy
Junction box ingress protection (IP)	IP 68
Output cable	Photovoltaic Technology Cable 4.0mm^2, length can be customized
Guaranteed performance	• Minimum 98% of the labelled power output after the first year • Minimum 84.8% of the labelled power output at the end of 25 years

Source: Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025

3.3.2 String Inverter

The inverter converts the direct current (DC) power produced by the solar modules into alternate current (AC) power before being transferred to the power grid. Despite central inverter would have been cheaper to install (approximately 2$cent/W cheaper in CAPEX and approximately over 2-4$cent/W cheaper in OPEX) compared to string inverted, the string inverter is selected to be utilized by the Projects. Several considerations as follow:

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- The access road within the project site might not be suitable for central inverter installation and maintenance due to undulated terrain in some locations.
- Skilled technician can reach each site within approximately 2 hours flight from Jakarta. Therefore, only available at site by 24-48 hours after being notified.
- Terrain condition which is irregular and hilly in some areas.
- Non-uniform shading possibility is rather high.



Source: (AFRY, 2023)

Figure 3-7 *String Inverters*

The main technical parameters of the inverter are shown in **Table 3-9**.

Table 3-9 *Main specifications of string inverter*

Specification	Value
Input (DC)	
Max. Input Voltage	1,500 V
Max. Current per MPPT	30 A
Max. Short Circuit Current per MPPT	50 A
Start Voltage	550 V
MPPT Operating Voltage Range	500 V ~ 1,500 V
Nominal Input Voltage	1,080 V
Number of Inputs	18
Number of MPP Trackers	9
Output (AC)	
Nominal AC Active Power	200,000 W
Max. AC Apparent Power	215,000 VA
Max. AC Active Power (cosφ=1)	215,000 W
Nominal Output Voltage	800 V, 3W + PE
Rated AC Grid Frequency	50 Hz / 60 Hz
Nominal Output Current	144.4 A
Max. Output Current	155.2 A
Adjustable Power Factor Range	0.8 LG ... 0.8 LD
Max. Total Harmonic Distortion	< 1%
Operating temperature range	-25°C ~ 60°C (-13°F ~ 140°F)
Relative humidity	0 - 100%
Ingress Protection Rating	IP66
DC Connector	Staubli MC4 EVO2
AC Connector	Waterproof Connector + OT/DT Terminal

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Source: Inverter Datasheet in Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025

3.3.3 Mounting Structure and Foundation

The type of support foundation of PV modules is still under consideration. It will depend on various factors (e.g., soil geography, topography, climate conditions, and natural disaster of each site) including durability, capital cost, and maintenance cost. The common types of foundations are presented in **Table 3-10**.

Table 3-10 *Types of foundation*

Type	Description
Helical steel pile foundation	The helical steel pile foundation features rapid construction speed which is suitable for no large-scale site levelling terrain and small environmental disruption.
Grouting pile foundation	The grouting pile foundation is suitable for clayey soil, silty soil, various rocks, gravelly soil, expansive soil, and hard clay or compacted sandy soil serving as bearing stratum.
Mini precast pile foundation	The mini precast pile foundation is suitable for slightly dense sandy soil.
Independent foundation	The independent foundation features fair construction speed, fair wind resistance, and a relatively large environmental impact.
Strip foundation	The strip foundation features good integrity, strong wind resistance, slow construction speed, severe environmental disruption, and large consumption of engineering material.

Source: Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025

For mounting structure, after considering type of mounting structures between fixed-tilted or tracking system, fixed tilted is opted due to the Project location condition for Banyuwangi site. The supports made of steel for the PV array for each project, see **Figure 3-8**.



Figure 3-8 *Fixed-tilted angle*

The installation angle of PV modules is taken as 7° and the azimuth field orientation is facing north (0°). According to the design, 4x14 cell modules are installed on each PV cell module support. The design of the mounting structure shall have a main and

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secondary beam supported by two stand columns in the front and back as well as inclined support to support PV modules.

3.3.4 Medium Voltage (MV) and High Voltage (HV) Transformer

Power transformer raises the voltage from the inverter AC output to achieve a higher efficiency transmission in the power lines of the photovoltaic plant.

Based on the general design, the MV transformer will be stepping up the inverter power output from 800 V to 20 kV level and connecting to MV switchgear. Then the outgoing feeder MV switchgear will go to the HV transformer to step 20 kV up to 150 kV. Finally, the power is transmitted to the existing authority substation.

Apart from the IEC standard, the transformer will be designed according to SPLN and in compliance with European Ecodesign regulation Number 548/2014 set by the European Commission. Furthermore, for the design of dry-type power transformers, IEC 60076-11:2004 will be applied.

3.3.5 Low Voltage (LV), MV and HV Cable

Considering the long distance from Project substation to existing authority substation, then the selection of HV overhead line (OHL) will be more optimal compared to underground cable (UGC).

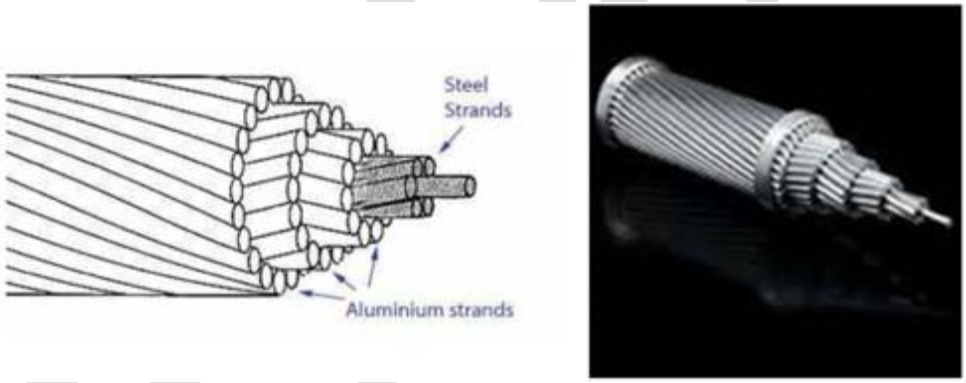


Figure 3-9 *Cross-Sectional View of Typical ACSR OHL Conductor*

3.3.6 Internal Access Road

The site area is located relatively close to the collector road. The access road to the site is in good transportation condition, allowing equipment to be directly transported to the site through local road. The design of the on-site roads (internal roads) will include both permanent and temporary roads, with a minimum of lifespan of 25 years. For construction and equipment transportation during construction, flat trucks/ three axles trailer (7A) or AASHTO HS20 Standard vehicles will be used. During operation, the onsite roads will be designed following the guidelines of "*Manual Desain Perkerasan Jalan No.02/M/BM/2017*."

The main access road will have a 6-meter width subgrade, with a 5-meter width pavement. The pavement structure will include a 4 cm thick "Laston" AC-WC (Asphaltic concrete Wearing Course), a 30 cm thick cement stabilized limestone base course, and a 20 cm graded crush limestone sub-base. An earthen drainage ditch will be constructed

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along one or both sides of the road. The horizontal curve design and minimum turning radius will meet the transportation requirements for box-type transformers, with a minimum turning radius of 8 meters at this stage. The bearing capacity of road pavement will not be less than 15 tons, with a compaction rate of 95%.

3.3.7 MV Switchgear

The medium voltage (MV) switchgear, control gear, and fuse gear shall be located indoors, in metal-clad sheet steel cubicles with front access doors and be manufactured and tested in accordance with relevant International Standards. The indicative MV switchgear is shown in **Figure 3-10**.



Figure 3-10 *Indicative implementation of MV switchgear*

3.3.8 Electrical 150 kV TL

Banyuwangi PV power plant will be connected to the existing grid via Banyuwangi 150 kV Substation by OHL with approximately length of 4.3 km. The aerial view of existing Banyuwangi Substation as shown on **Figure 3-11**. In general, the physical construction of a 150 kV TL consists of tower, the conductive wire (phase wire), earth wire and insulator.

For Banyuwangi TL, 150kV lattice towers for the circuits will be used. The distance between the ground and the lowest conductor on a standard tower is 19 m – which is used as the standard tower height (+0) for the Banyuwangi TL. Minimum horizontal clearance for TL tower for 150kV is approximately 10 m, meanwhile vertical clearance depends on type of structure as shown in **Table 3-11**. There will be 16 towers and the routes of respective sites are presented in **Figure 3-2**.

The basic tower types for 150 kV transmission line as provided in SPLN T5.004.2010 are as follows:

- Tower type Aa (Angle 0^o – 5^o) - Suspension tower
- Tower type Bb (Angle 0^o – 10^o) - Tension tower
- Tower type Cc (Angle 10^o – 30^o) - Tension tower with jumper

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- Tower type Dd (Angle 30° – 60°) - Tension tower with jumper
- Tower type Ee (Angle 60° – 90°) - Tension tower with jumper
- Tower type Ddr (Angle 0° – 60°) - Tension tower with jumper

The project will use a 150 kV Lattice Type Tower, which has 3 horizontal arms stacked vertically to accommodate 2 electric circuits (double circuits) which located in the left and right position in the tower. Each circuit consists of 3 conductors, and we refer to the conductors as phases (Phase R, Phase S, Phase T). The height from the ground to the lowest cross arm shall be 22 meters. The typical design of the pylon to be used in the projects as shown on **Figure 3-12**.

The foundation of Banyuwangi TL Towers will use foundation type Class 5 with the allowable bearing capacity of equal to or 0.50 kg/cm² up to 0.70 kg/cm², angle of frustum 0°, the weight of soil of about 1950 kg/m³ (wet) for pressure, and 950kg/m³ for uplift. This choice is influenced by the proximity of some towers to the water body, where we anticipate high rain intensity.

The tower schedule which contained data such as the location of towers including weight of span for each tower is provided in **Table 3-12**.



Figure 3-11 *Aerial view of existing Banyuwangi Substation*

Table 3-11 *Minimum Vertical Clearance 150 kV Transmission Line with Nearby Objects*

No.	Object	150 kV (m)
1.	Open surface [a)]	8.5
2.0	Distinctive objects	
2.1	Buildings, bridges [b)]	5.0
2.2	Trees, forests, plantations [b)]	5.0
2.3	Road/motorways/railways [a)]	9.0
2.4	Public spaces [a)]	13.5
2.5	LV, MV, HV OHL [b)]	4.0
2.6	Telecommunication lines, antenna, cable cars, the highest point of a ship during high tide in a water traffic space [b)]	4.0
Note: [a)] Minimum vertical clearance is measured from the conductor to the ground or road or railway surface. [b)] Minimum vertical clearance is measured from the conductor to the highest/closest point underneath it		

Source: MEMR Regulation No. 13 of 2021

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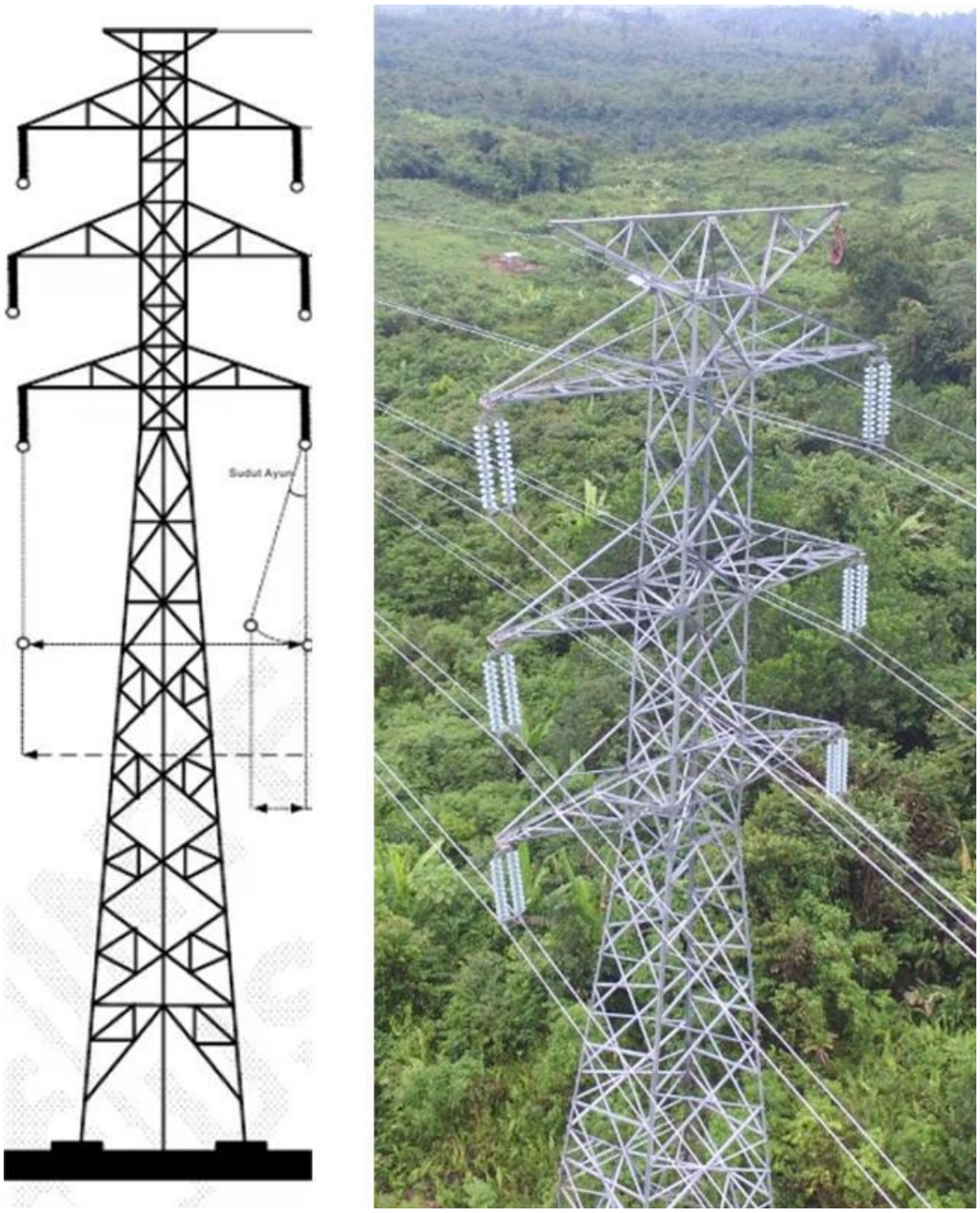


Figure 3-12 *The typical design of the pylon to be used in the project*

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Table 3-12 *Detail of tower schedule of Banyuwangi PV Transmission Line*

No	Tower Name	Tower Type	Crossarm Elev (m)	Span Cumulative Distance (m)	Span Sagging (m)	Span Actual (m)	Span Weight (WT) (m)	Span Wind (WN) (m)	Span Ratio (Tan Θ) (WT/WN)	Span Conductor Length (m)	*Elevation (Primary Data) (m)	Elevation (Secondary Data) (m)
1	Banyuwangi Solar PV											
2	T01	Ddr+0	179.237	319.932	8.447	319.932	166.598	159.966	1.041	320.416	155.97	157.24
3	T02	Aa+0	177.973	607.388	6.818	287.456	303.001	303.694	0.998	287.807	155.97	155.97
4	T03	Ee+0	176.955	802.563	3.144	195.175	194.269	241.316	0.805	195.285	156.74	154.96
5	T04	Aa+3	181.735	1184.684	12.055	382.121	329.526	288.648	1.142	382.946	156.74	156.74
6	T05	Aa+3	181.787	1560.923	11.700	376.239	322.289	379.180	0.850	377.026	156.79	156.79
7	T06	Cc+0	194.591				408.611	351.829	1.161		172.59	172.59

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No	Tower Name	Tower Type	Crossarm Elev (m)	Span Cumulative Distance (m)	Span Sagging (m)	Span Actual (m)	Span Weight (WT) (m)	Span Wind (WN) (m)	Span Ratio (Tan Θ) (WT/WN)	Span Conductor Length (m)	*Elevation (Primary Data) (m)	Elevation (Secondary Data) (m)
				1888.342	8.847	327.419				327.938		
8	T07	Bb+6	194.657				345.753	360.351	0.959		173.16	166.66
				2281.625	12.771	393.284				394.183		
9	T08	Bb+3	198.156				408.516	372.091	1.098		173.16	173.16
				2632.524	10.165	350.899				351.538		
10	T09	Cc+3	193.664				388.538	333.043	1.167		154.21	168.66
				2947.711	8.215	315.187				315.650		
11	T10	Cc+3	179.209				281.187	343.834	0.818		154.21	154.21
				3320.192	11.454	372.481				373.245		
12	T11	Dd+9	176.028				516.104	420.385	1.228		123.32	145.03
				3788.482	18.195	468.290				469.808		
13	T12	Aa+0	145.325				279.812	359.125	0.779		118.75	123.32
				4038.442	5.156	249.961				250.192		

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No	Tower Name	Tower Type	Crossarm Elev	Span							*Elevation (Primary Data)	Elevation (Secondary Data)
				Cumulative Distance	Sagging	Actual	Weight (WT)	Wind (WN)	Ratio (Tan Θ)	Conductor Length		
			(m)	(m)	(m)	(m)	(m)	(m)	(WT/WN)	(m)	(m)	(m)
14	T13	Cc+0	140.747				266.330	265.512	1.003		113.46	118.75
				4319.507	6.520	281.064				281.392		
15	T14	Cc+0	135.462				212.723	240.570	0.884		113.46	113.46
				4519.583	3.302	200.076				200.195		
16	T15	Ee+0	135.020				352.951	252.209	1.399		113.02	113.02
				4823.925	7.673	304.343				304.759		
17	T16	Ddr+0	116.081				120.119	200.070	0.600		100.95	100.08
				4919.723	0.761	95.797				95.810		
18	Gantry Banyuwangi	0	122.947								100.95	100.95

Source: Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants PLTS Banyuwangi, 2025

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3.4 Land Status – Land Agreement

Banyuwangi Solar PV Power Plant is located in Kalipuro Sub-district, Banyuwangi Regency, East Java Province. According to spatial planning of Banyuwangi Regency or *Peraturan Daerah* (PERDA) Number 8 of 2012, the Banyuwangi Solar PV Power Plant, switchyard site, and transmission line route area are within plantation area (*perkebunan*) and partially transmission line route located within irrigated agriculture (*pertanian beririgasi*). The spatial planning also mentions that Banyuwangi Regency is designed for development of renewable energy which includes solar power plant specifically Kalipuro Sub-district and Wongsorejo Sub-district. It is reflected on the space utilization conformity approval (*Persetujuan Kesesuaian Kegiatan Pemanfaatan Ruang* – PKKPR) which has been issued by Indonesia Government on 24th January, 2023[8].

Based on Ministry of Agrarian Affairs and Spatial Planning/Head of the National Land Agency No. 1589/SK-HK.02.01/XII/2021 on protected rice fields[9] in regencies/cities in several provinces including East Java Province, Banyuwangi Solar PV plant including switchyard and transmission line routes are located outside the protected rice field (**Figure 3-14**).

While according to forest classification, the locations the Banyuwangi Solar PV Power Plant including its components and the transmission line route are located within non forest areas also known as an area for other land uses (*area penggunaan lain* – APL) see **Figure 3-15**.

In terms of land ownership, the location for the Banyuwangi Solar PV Power Plant, switchyard area and some transmission line towers/route are part of the Wangkal Plantation, Kalipuro Sub-district, Banyuwangi Regency, East Java Province owned by PT Perkebunan Nusantara XII (PTPN XII) which commodity is sugarcane. A memorandum of understanding (MoU) has been established between the Client and PTPN XII to utilize the land which will then followed by cooperation mechanism. Meanwhile, in addition to the Wangkal Plantation, towers and transmission lines also pass through land owned by community. Each Transmission Tower occupies an area of approximately 20 x 20 meters (with a total of 16 tower locations, 3 of which will be located within the Wangkal Plantation and have been acquired together with the Wangkal Plantation area). Thus, the total number of towers to be built is 13, all of which are located on private land owned by the local community members. Based on the LARAP document, these 13 transmission towers will require a total of 0.67 hectares of land from 14 landowners. Most of the affected landowners hold formal land certificates, while a smaller number possess other forms of documentation such as Letter C or Tax Due Notification Letter (SPPT), as further detailed in the Banyuwangi LALRP document. The transmission line towers will not be constructed on existing roads. While most of the tower sites fall outside of RoW corridors, two land parcels overlap with the designated RoW for the transmission line, and appropriate land acquisition arrangements will be made accordingly through engagement with the affected landowners.

[8] Approval for the conformity of space utilization for business activities No. 25012310413510086. Issued by Minister of Agrarian Affairs and Spatial Planning/Head National Land Agency Minister of Investment/Head of Investment Coordinating Board on 24th January, 2023.

[9] The purpose of the establishment of the regulation is to control the conversion of rice fields into other functions such as housing, shops, offices, and other investment functions.

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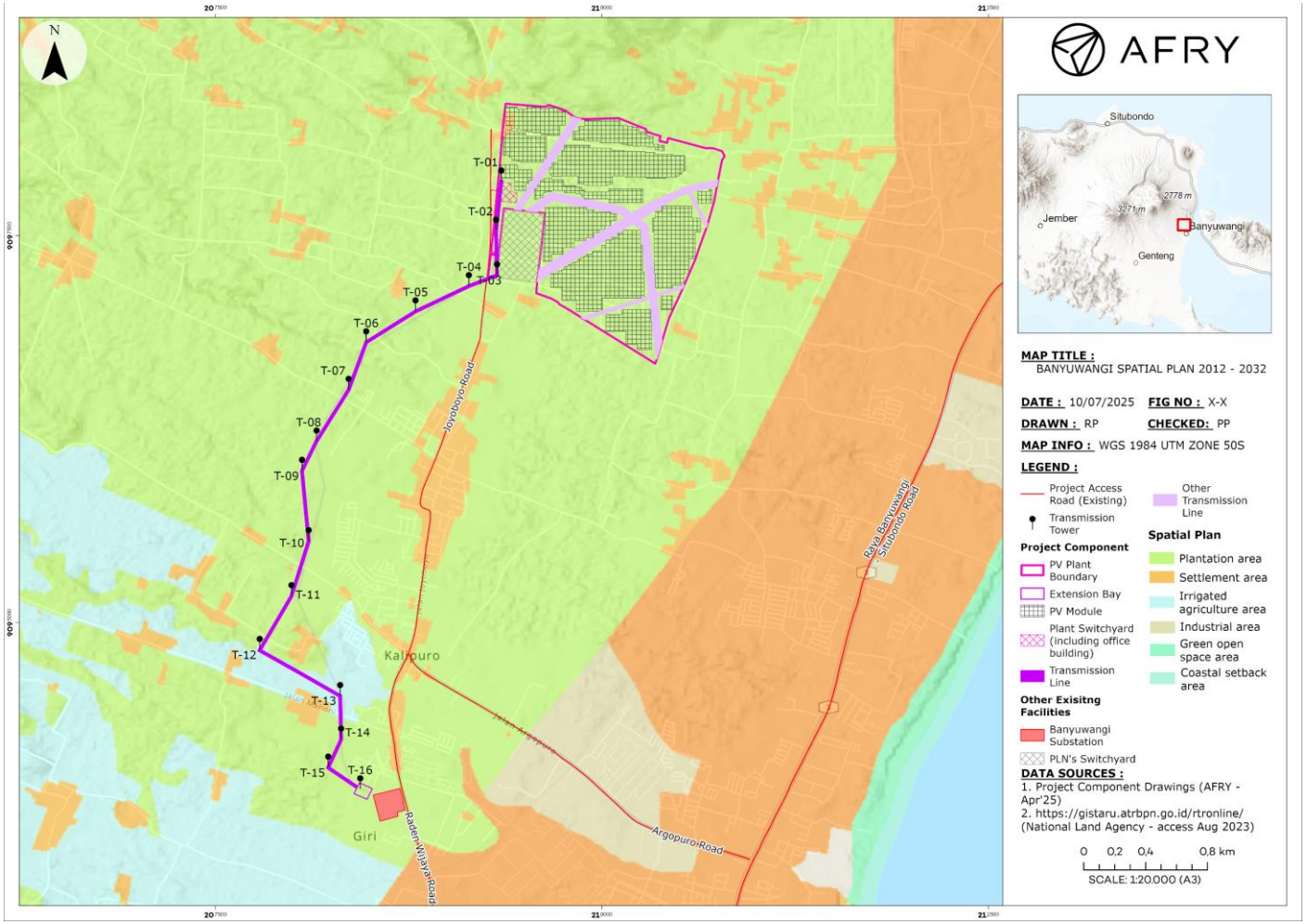


Figure 3-13 *Spatial planning of Banyuwangi Solar PV Power Plant*

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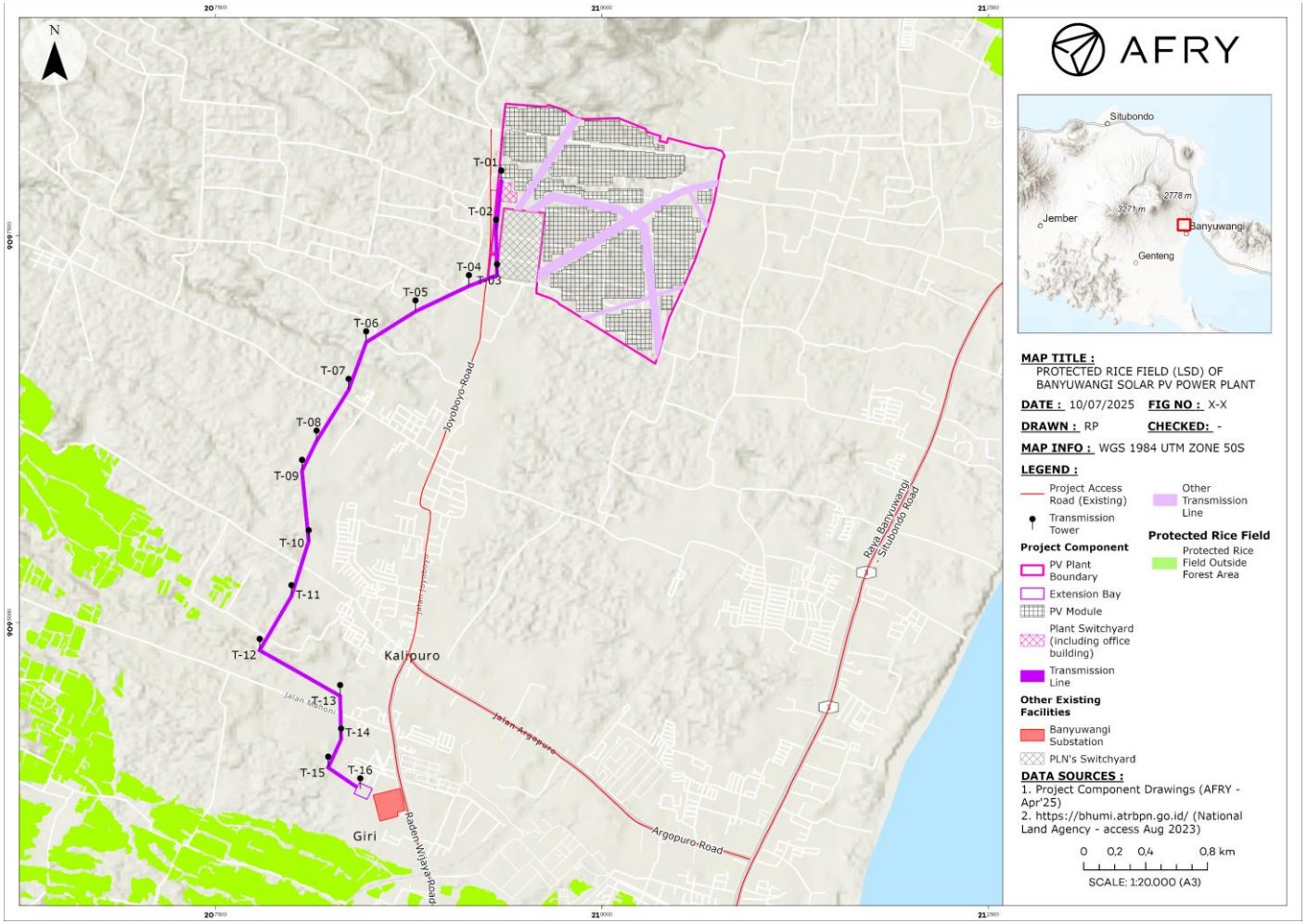


Figure 3-14 *Protected Rice Field (LSD) area near Banyuwangi Solar PV Power Plant*

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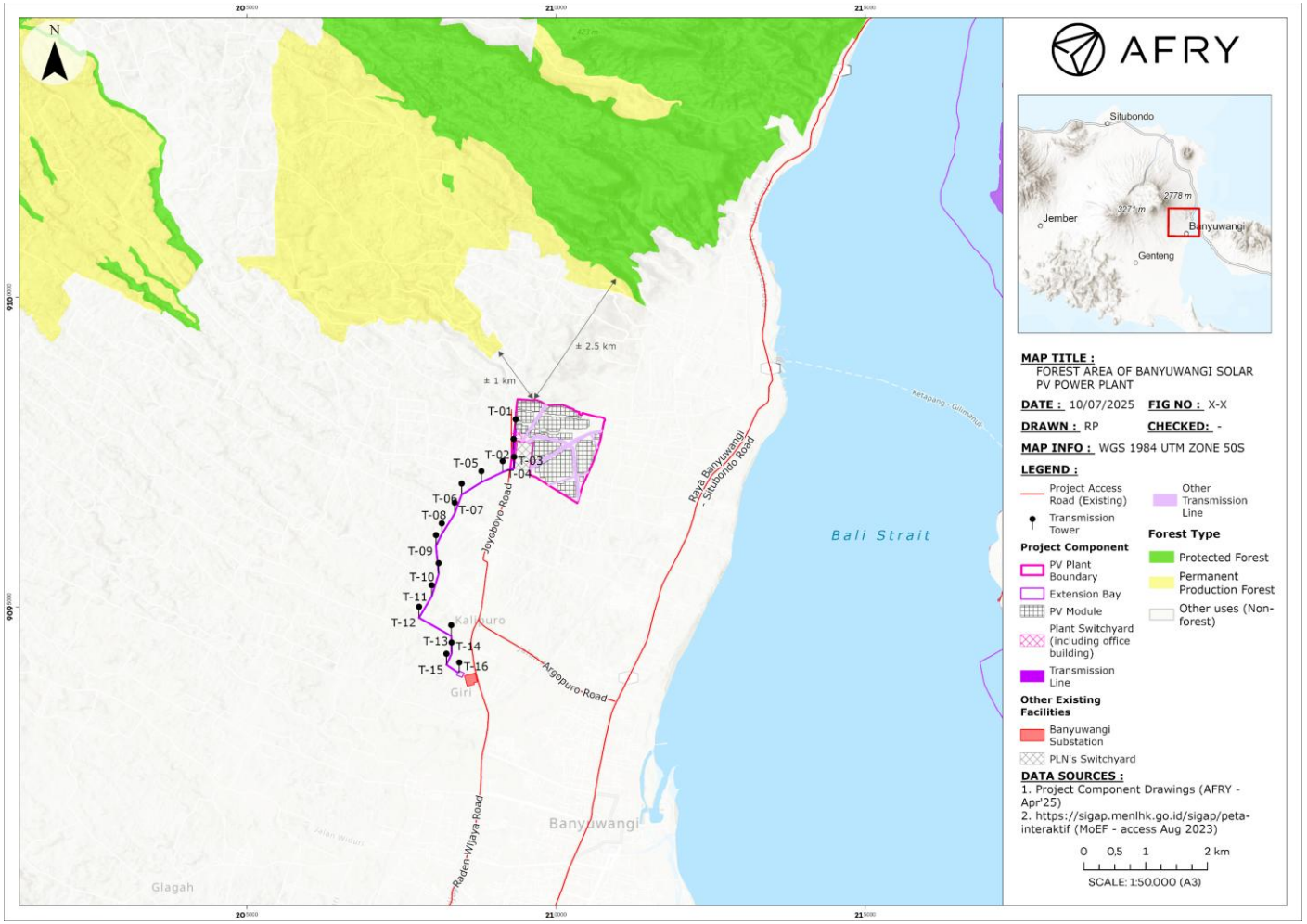


Figure 3-15 *Forest area of Banyuwangi Solar PV Power Plant*

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3.5 Project Schedule

The key milestones in this Project are shown in **Table 3-13**.

Table 3-13 *Key Milestones for Ground Mounted PV Power Plant Projects*

Milestone	Timeline
Feasibility Study	2023 – 2024
AMDAL/ESIA and Permitting	2023 – 2025
Partner Selection and EPC Tender	2023 – 2024
PPA Signing	T0
EPC Contract Signing	T0 + 0.5 Month
Financial Close	T0 + 2 Months = T1
Commercial Operation Date (COD)	T1 +T2 Months

Source: Updated Feasibility Study Report for 100 MWac Java Land Based Solar PV Power Plants, PLTS Banyuwangi, 2025

3.6 Project Phase

The project will involve pre-construction, construction, operation, and post operation phases. Based on FS document, pre-construction phase will take about 10 (ten) months and construction phase from NTP to COD of the plant is estimated to be 12 (twelve) months. The operation phase is approximately 25 years according to the design lifetime of the PV module, and Project Purchase Agreement (PPA) term.

3.6.1 Pre-Construction

3.6.1.1 Land Acquisition

A memorandum of understanding (MoU) has been established between PT PLN Indonesia Power and PTPN XII to utilize the land which is currently sugarcane plantation. The Transmission Network, including Transmission Towers and Right of Way (RoW), stretches side by side with agricultural land occupied by residents. Each Transmission Tower occupies an area of approximately 20 x 20 meters (with a total of 16 tower locations, 3 of which will be located within the Wangkal Plantation and have been acquired together with the Wangkal Plantation area. Thus, the total number of towers to be built is 13 towers because its status is private land owned by the individual community, while the RoW stretches 20 meters wide and 5.01 km long. Based on field data, there are 24 landowners in the transmission Right of Way. The landowners will receive compensation for the impact, but no land purchase will be made.

3.6.2 Construction

Construction activities of the Banyuwangi ground-mounted Solar PV Power Plant will comprise:

- Land preparation and civil work;
- Workforce mobilization and accommodation;
- Equipment and material mobilization;
- Waste handling and disposal;
- Mechanical and electrical works (PV power plant installation); and
- Construction of TLs;

Detail of each activity will be discussed in the sub-sections below.

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3.6.2.1 Land Preparation and Civil Work

Topographically, Banyuwangi site is located on a relatively flat area (slope less than 5%). Therefore, earthworks activities at Banyuwangi site will be relatively straightforward. This is also because the proposed Banyuwangi site is currently sugarcane plantation. In general, the land preparation and civil work for both sites will include, land clearing, grubbing, topsoil removal, minimum cut/fill work.

Demolition works are also anticipated for both sites to construct the project as the site contains several non-permanent facilities such as parking area, composting facility, canteen, and a small mosque. Any structures located within the designated areas for the Solar PV system and supporting facilities will need to be removed, including asbestos -containing materials found in the roofing components of the existing Wungkal Afdelling Office and employee's housing.

Site levelling will only be conducted for the buildings, warehouse, switchyard area, electrical cluster and its access road, assembly yard of PV modules and area of temporary construction facilities. Other area will only be subjected to slight trimming other than large-scale site levelling. The earth excavation works mainly include surface clearing, site levelling, on-site road excavation, transformer foundation, collector line/ cable trenches, on-site drainage ditch.

Most of civil and structural material, such as ready mix, batching plant, crushed stone /quarry, will be available from permitted local suppliers in the nearest city or approximately within one hour of land transportation to the Project area.

The batching plant company is required to obtain an Industrial Business Permit (IBP), locally known as *Izin Usaha Industri* (IUI), in accordance with Government Regulation (GR) No. 14/2021, which serves as one of the implementing regulations of Law No. 11 of 2021 on Job Creation (the "Omnibus Law"). This regulation amends Government Regulation No. 22 of 2020 concerning the Implementing Regulation of Law No. 2 of 2017 on Construction Services ("GR 22/2020"). The project proponent will ensure that the materials used are sourced from licensed suppliers that comply with Indonesian environmental management laws and regulations.

3.6.2.2 Workforce Recruitment

The peak estimation of construction worker requirement for Banyuwangi PV Project is approximately 431 workers. It is divided for project management, engineering department, procurement, QA/QC, general, finance and construction team. It is expected that 80% of construction workers or about 341 people are from locals with the required specification. The project schedule is aimed for 12 months of construction, however the breakdown for workers distribution is estimated for 9 months construction period as shown on **Table 3-14**.

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Table 3-14 *Workers Estimation for Banyuwangi PV Construction*

No	Section	Worker																	
		1st Month		2nd Month		3rd Month		4th Month		5th Month		6th Month		7th Month		8th Month		9th Month	
		Expert	Local	Expert	Local	Expert	Local	Expert	Local	Expert	Local	Expert	Local	Expert	Local	Expert	Local	Expert	Local
1	Project Management	6	-	6	-	6	-	6	-	6	-	6	-	6	-	6	-	6	-
2	Engineering Department	7	-	7	-	7	-	7	-	7	-	7	-	7	-	7	-	7	-
3	Procurement Department	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-
4	Construction Department	7	1	7	1	7	3	7	3	7	3	7	3	7	3	7	2	7	1
5	QA/QC Department	-	1	-	1	-	2	-	2	-	2	-	2	-	2	-	1	-	1
6	General Department																		
	General Manager	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-
	Doc Control Engineer	1	-	1	-	1	2	1	2	1	2	1	2	1	2	1	2	1	1
	Security Officer	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
	Security Personnel	-	5	-	10	-	15	-	15	-	15	-	15	-	15	-	15	-	5
	Translator	-	1	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	1
	Driver	-	1	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
	Cook	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1
	House Keeper & Commis	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3
7	Finance Department	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	Commercial Department	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-
9	Construction Team																		
	Civil Workers	2	-	20	-	30	-	30	-	30	-	30	-	30	-	5	-	2	-
	Installer	3	-	5	-	20	-	20	-	20	-	20	-	20	-	15	-	5	-
	Machine Operator	2	-	4	-	4	-	4	-	4	-	4	-	4	-	2	-	2	-
	Local Workers	-	45	-	164	-	280	-	288	-	288	-	288	-	288	-	152	-	33
10	Testing & Commissioning																		
	General Workers	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	20	-	20
	Commissioning Workers	-	-	-	-	-	-	-	-	-	-	-	-	8	-	12	-	12	-
	TOTAL	35	60	57	187	82	313	82	321	82	321	82	321	90	341	62	203	49	70
		95		244		395		403		403		403		431		265		119	

Sources: EPC_CEEC Bidder Doc, 2024

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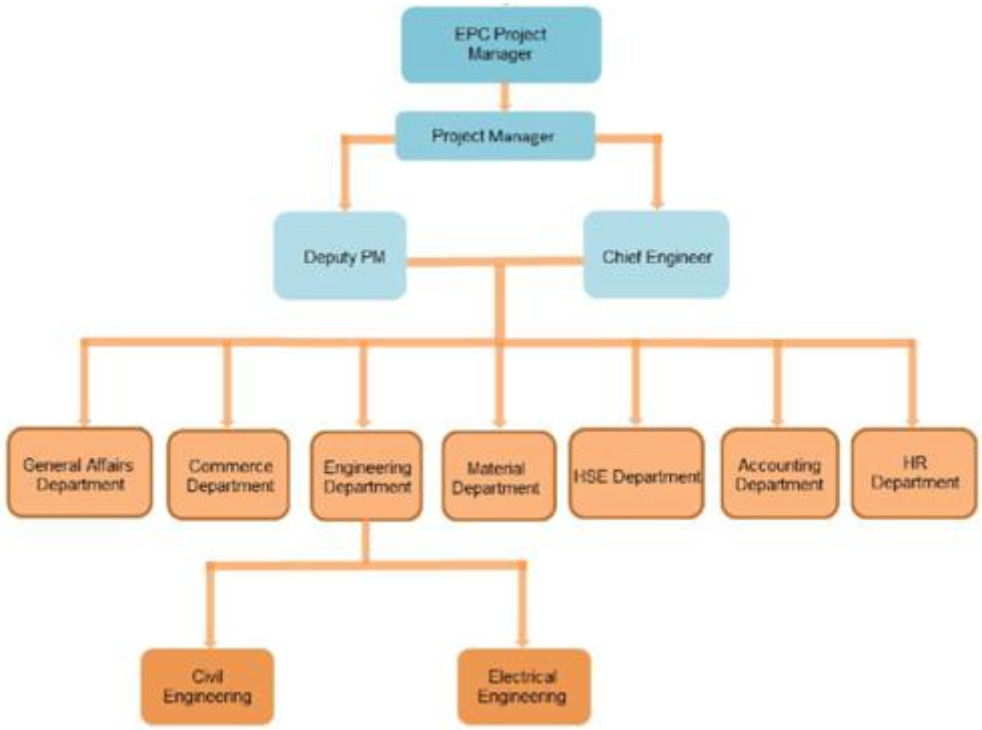


Figure 3-16 *EPC Construction Structure Organization Chart*

3.6.2.3 Equipment and Material Mobilization

Juanda International Airport in Sidoarjo is the main international airport in East Java located in the outskirt of Surabaya, the capital city of East Java. Multiple daily flights from Jakarta are available as well as connection to Singapore, Kuala Lumpur, and Hong Kong. The Banyuwangi site can be accessed from this airport. There is also an airport in Banyuwangi with connection to Surabaya and Jakarta that can be utilized for the Banyuwangi Project, otherwise the Banyuwangi Project could also utilize the Tanjung Perak seaport.

The main seaport would be Tanjung Perak Seaport in Surabaya with a secondary seaport also available in Banyuwangi (Banyuwangi seaport). Banyuwangi seaport will be the primary option for main equipment unloading of Banyuwangi Project, otherwise the Banyuwangi Project could also utilize the Tanjung Perak seaport. The construction machinery configuration as shown on **Table 3-15**.

Access road to the Banyuwangi site will be used for equipment and material mobilization during construction. The road network proposed with National Road (Class of Road III). The design of on-site roads shall include both permanent and temporary roads. The roads shall be designed for the life of minimum 25 years.

The Banyuwangi Solar Panel PV PP site can be accessed from the nearest city via a two lane 3-meter-wide asphalt road. This road is mainly used by the public and trucks rarely pass this route. Access along the perimeter of the site and within the site itself are via a 3-meterwide local road made of soil. This access road is wavy and might turn into muddy during rainy season. This road is mainly used by the plantation worker to mobilize crops and for their daily commuting.

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Table 3-15 *Construction Machinery Configuration*

No	Description	Model & Specification	Unit	Qty
1	Crawler crane	250t	set	1
2	Truck crane	25t	set	4
3	Flat carrier	30t	set	1
4	Drilling machine	-	set	6
5	Excavator	-	set	6
6	Dump truck	10t	set	6
7	Internal combustion water pump	Gasoline type	set	6
8	Tamping machine	-	set	4
9	Road roller	-	set	2
10	Agitator	-	set	6
11	Diesel generator	Portable	set	10
12	Vibrator	-	set	10
13	Jack drill	Internal combustion and portable type	set	6
14	Multimeter	S2	piece	15
15	Weigh brigde	500kg	set	6
16	Steel tape	50m	piece	10
17	Torque wrench	-	piece	30
18	Hydraulic clamp	-	pair	10
19	Electric total station	±2"	set	3
20	Electric theodolite	±2"	set	6
21	Water level	-	set	6
22	Laser plumb instrument	1/200000	set	3
23	Interphone	-	pair	6
24	Reinforcing steel cutter	GQ40-F	set	2
25	Steel bar bender	GJ7-40	set	2
26	Table saw for perecise woodworking	MJ6128/450	set	1
27	Woodworking planner	MB504B	set	2
28	Circular saw	MJ104A	set	2
29	Electric welder	BX3500-2	set	5
30	Electrical test equipment	-	set	1

Sources: EPC_GCL Bidder Doc, 2024

3.6.2.4 Construction & Operation of Basecamp

There will be temporary site installation area for worker include staff containers, offices, canteen, accommodation, and small mosque. Workers, who will move from elsewhere to work in the power plant, will be provided by accommodation. Meanwhile, warehouse and dormitory building are provided as function for storing and living facility, with two stories frame structure building and have a floor space about 360 m^2.

The construction of work barracks is carried out by the construction contractor, under the supervision of the company's technical manager (Project proponent). The work barracks to be made are 15 m x 10 m or 150 m^2 in size, divided into 12 rooms, measuring 3 m x 3 m, or 1 barrack unit containing 12 rooms with 2 workers/room. Accommodation will be constructed at site for construction workers. The Project is committed to aligning worker accommodation with the European Bank for Reconstruction and Development (EBRD) and IFC Guidance Note on worker's

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accommodation: processes and standards. Since the workers will be recruited gradually, thus it the Project will construct 5 units with each unit can accommodate 24 workers.

- Bathrooms and toilets will be provided at each accommodation camp as well as septic tanks.
- A canteen will be provided at each camp.
- Temporary waste storage will also be constructed to accommodate domestic waste from accommodation camp activities.

Water source will come from groundwater which will be stored at the storage tanks. The Project will secure the groundwater extraction permit prior to commencement of construction phase.

3.6.2.5 Construction of Solar PV and Supporting Facilities

The PV module placed on a stand or support at an angle certain. Then install the pole at the desired height customized. The poles are made of galvanized iron to protect against rust. The dimensions of the PV Module to be installed are 2,384 long mm x 1,303 mm wide, and 35 mm thick, total 210,000 units, the number of inverters is 500 units, and transformers is 200 unit. Infrastructure such as cabling, and conduits will be established within the PV site to connect the individual modules to the convertor box and central inverter. Connecting conduits will be established below ground, with small trenches dug to install the equipment.

The design of on-site roads (internal road) will include both permanent and temporary roads, with a minimum of lifespan of 25 years. The main access road will have a 6-meter wide subgrade, with a 5-meter wide pavement. The pavement structure will include a 4 cm thick "Laston" AC-WC (Asphaltic concrete Wearing Course), a 30 cm thick cement stabilized limestone base course, and a 20 cm graded crush limestone sub-base. An earthen drainage ditch will be constructed along one or both sides of the road.

3.6.2.6 Construction of TL

The construction of overhead transmission line will be undertaken by special skilled workers. The work includes preparing construction corridor, laying the foundations for towers, assembling the towers on the ground, erecting string of conductors, testing and commissioning the line.

No workers will be sourced from outside the country. If local workers are unavailable, sourcing will occur first at the provincial level and then at the national level. In addition, worker accommodation will be provided. The transmission line construction is regulated by the Ministry of Energy and Mineral Resource (MEMR) Regulation Number 13 of 2021 as described on chapter 3.3.8 which stipulates: 1) minimum horizontal clearance; 2) vertical safety clearance; 3) tower height; and 4) tower span design.

3.6.3 Operation

3.6.3.1 Solar PV Operation and Maintenance

<u>Operational Workforce</u>

The operational phase of Ground-mounted PV Plant Project will require approximately local 54 workers with the appropriate qualification. It includes Plant Supervisor, HSE &

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Admin, Operator & Technician, Helper and security personnel. Workers Estimation for Banyuwangi Ground Mounted PV Operation as shown on table below.

Table 3-16 *Workers Estimation for Banyuwangi Ground Mounted PV Operation*

No.	Staff Position	Total
1	Plant Supervisor	1
2	HSE & Admin	3
3	Operator & Technician	16
4	Helper (e.g., cleaning, janitor)	6
5	Security	28
Total		54

Source: Feasibility Study Report of 200 MWac Java Ground Mounted Solar PV, 2023

Operation and maintenance

Solar PV PP activities during operation phase will include:

- Regular monitoring of the solar plant operation including maintenance of the electrical systems;
- Regular cleaning of PV modules from dust; and
- Internal road repair when required;

One of the critical maintenance activities for solar PV plants is the cleaning of PV modules. With regular cleaning, the soiling loss caused by the dirt can be reduced, and hence the plant generation output can be optimized. To determine the cleaning frequency, the FS document recommends that:

- For Dry Season: At least One Visual check and one cleaning cycle every three months;
- For Rainy Season: At least One Visual Check every three months and decide to clean as required.

Based on the designed solar PV plant layout, it is assumed that 2 litre of water is required to clean one module. For example, for 1.27 DC/AC, the number of modules is 196,000 pieces, thus 392,000 litre of water is required. Assumed that cleaning will be done once every three months, water required is calculated as 1,568,000 litre per year.

In addition, water with high mineral content of total hardness greater than 200 ppm should be avoided. It is recommended that the total hardness shall be less than 75 ppm. Cleaning modules is recommended during early mornings (before 6 am) and evening (after 6 pm) to avoid big temperature difference between the water and the panels.

There will be amount of wastewater process to be produced and water used for PV module cleaning is generally demineralized, so it does not indicate any harm after cleaning the panel surface. A waste management plan will be implemented on the Project site to comply with the Indonesian solid and hazardous waste storage and disposal regulations, see further in Section 3.9.

3.6.3.2 Operation of Transmission Line

Maintenance for transmission lines basically to keep insulator clean, checking the conductor damage and maintaining the structural integrity of the towers. Maintenance is also related to the preservation of the protection zone of the overhead transmission line: cutting trees, lopping branches, refreshing earth fillings near the towers.

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With regard to the Banyuwangi substation, the maintenance comprises of regular inspections and control measurements of equipment parameters.

3.6.4 Post Operation/Decommissioning

The decommissioning process is essentially the reverse of the construction process, i.e., dismantling and disposing of equipment and materials and will be carried out in line with the state-of-the-art of the time after 25 years of operation. Recyclable materials will be sold as scrap.

Hazardous waste will be disposed in accordance with Indonesia's hazardous waste guidelines, while general waste will be transported to the local final disposal by the approved third party. Furthermore, a decommissioning plan will be developed prior to the decommissioning phase. The project components will be continuously maintained throughout the lifetime of the Project.

Regarding the termination of employment, the workers will be sought to be transferred to other parts of PT PLN Indonesia Power, in accordance with company policy.

3.7 Water Resources

Based on information from the communities, water supply in the area is mainly provided by the *Perusahaan Daerah Air Minum* (PDAM), the regional state-owned company for clean water services. Communities of the Kalipuro Village use PDAM Banyuwangi for their daily use, and it is expected that during construction, water is also supplied by PDAM. Installation of groundwater well is possible but only if it is required. The project planned to install two units of water storage tanks with volume of 2.5 m^3 each. The EPC contractor shall also be able to purchase water from local suppliers via water truck that can be used during the construction if required. During construction, clean water will be mainly used for domestic activities of workers (toilets/bathrooms and canteens) at the basecamp and water used for construction works.

During operation, water will be mainly used for maintenance activities (cleaning of solar PVs) and daily activities of employees (toilets, canteens, and garden watering). Cleaning solar PV arrays typically require significant amounts of water, which has been detailed in Section 3.6.3.1. Water will be sourced from PDAM and planned to be stored in a 20m^3 water storage tank. Rainwater retention ponds could be integrated into the design to constitute water reserves for cleaning. Alternatively, a groundwater source (deep well) could be possible in this area, however a productive aquifer has to be indicated based on the hydrogeology map or groundwater exploration. If a groundwater well is required, it is planned to be treated using active carbon filtration prior to use.

Table 3-17 below shows the estimate volume of water consumption during construction, operation and post operation activities.

Table 3-17 *The water needs for construction, operation, and post operation activities.*

No	Component and Activity	Worker	Area (ha)	Estimate Schedule (Day)	Daily Water Need (litre)	Water Need	
						Litre/day	m^3/day
1	**CONSTRUCTION**						
	Non-local Worker	90	-	1	60	5,400	5.40
	Local worker*	341	-	1	30	10,230	10.23

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No	Component and Activity	Worker	Area (ha)	Estimate Schedule (Day)	Daily Water Need (litre)	Water Need	
						Litre/day	m³/day
	Ground-mounted PV (Boundary), Switchyard, PV Module, Transmission Line RoW (RoW 1, 2 partially RoW 3) and Transmission Tower (1-3)	-	155.39	110	30	423,790.91	423.79
	Gantry	-	0.06	20	30	900	0.90
	Extension Bay	-	0.54	20	30	8,100	8.10
	RoW Transmission Line	-	8.24	60	30	41,200	41,20
	Transmission Tower	-	0.55		30	2,750	2.75
2	**OPERATION**						
	Basecamp Worker	-	-	-	-	-	-
	Local worker	54	-	1	30	1,620	1.62
	Panel Cleaning					4,603	4.60
		Total water needs					498.59

Note: AFRY, 2023; EPC-CEEC Bidder 2004

Source:

Panduan Sistem Bangunan Tinggi (Juwana, 2005)
Water for Contruction per m^2 (30 litre) or per ha (30,000 Litre)
60 litre/day based on Ministry of Public Work No 14 of 2010 about Minimum Standard Area Of General Works And Space Arrangement (The Minister of Public Work and Housing Republic of Indonesia, 2010).
**) half day for daily water needs*

3.8 Energy Supply

During construction phase, electricity will be mainly required for construction works and the operations of basecamp, which will be sourced from the *Perusahaan Listrik Negara* (PLN) Java-Bali Grid, the regional state-owned company for power services, with capacity of 200 kVA. Two units of gensets will be installed as back up with capacity of 250 kVA and 150 kVA each.

Similar to construction phase, electricity for operational phase will be supplied by PLN and two genset units for backup. The operational duration of the genset units is expected to be short as the power outage in the area rarely occurred.

3.9 Waste Management

Domestic and Hazardous Waste

During construction phase, the site will build three separate temporary waste storages as follow:

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- Domestic waste temporary storage will collect waste mainly from workers and accommodation camp activities. It will have two separate blocks to sort the waste based on category, organic and inorganic waste. Each block will be covered with a roof to avoid rainwater. The company approved third party waste collector will be engaged to transport the waste disposal facilities;
- Construction waste temporary storage will collect construction waste (i.e., wood, metal scraps, wire scraps etc.). It will have two separate blocks (20 m^2) to sort the waste based on category, organic and inorganic wastes. Each block will be covered with a roof to avoid rainwater. The storage will be covered with a roof but without walls. Third party waste collectors will then be permitted to take the waste, and the Soil disposal area will be provided when necessary, due to the area is relatively flat. The soil will be reused as the foundation for all manner of groundwork; and
- Hazardous waste temporary storage will collect waste such as used battery, used oil, used rags, broken lamps etc. emergency equipment and protective personal equipment will be provided at the temporary storage. Licensed third party hazardous waste transporter or processor will be engaged to transport or process the waste to the final disposal/processor.

An indicative volume of solid domestic waste generation during construction calculated based on SNI 19-3964-1994 regarding Measuring Samples Method for Generation and Composition of Urban Waste, is presented in **Table 3-18** below.

Table 3-18 *The indicative amount of daily domestic waste at construction phase*

Component and Activity	Worker	Estimate Schedule (Day)	Solidwaste (Domestic) Litre/day	Solidwaste	
				Litre/day	m^3/day
CONSTRUCTION					
Non-local Worker	90	1	2.5	225	0.23
Local worker	341	0.5	2.5	426	0.43
TOTAL					0.65

Source: AFRY, 2024 (SNI 19-3964-1994 about Measuring Samples Method for Generation and Composition of Urban Waste (Indonesia National Standards, 1994)*)*

It is expected that the above waste storage facilities will be also used during the operational phase. Wastes generated during operational phase will consist of:

- Domestic wastes will be mainly generated from the power plant and office activities categorized as organic (food waste, leaf waste, etc.) and inorganic waste cardboard, plastic wastes, etc.) Domestic waste during operational phase is expected to be minimum as number of workers will be small. Domestic waste will be collected periodically by the company approved third party waste collector to the local final disposal area.
- Hazardous waste will be typically generated from power plant maintenance activities such as used oil, broken solar modules, contaminated containers, oily rags, broken lamps, electronic components (e-waste), etc., and office activities such as used batteries, printer cartridges, broken office lamp waste, etc. Hazardous waste will be collected periodically by a licensed third-party hazardous waste transporter or processor.
- Regarding broken solar module in operation phase, the Project will establish agreement with the solar module supplier, to be able to return the broken modules to be then treated accordingly. It will be handled as electronic waste by the Project,

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a special warehouse to keep these broken modules will be built. The special warehouse will be located within the project area; no additional land is required.

An indicative volume of solid domestic waste generation during operations is presented in **Table 3-19** below.

Table 3-19 *The indicative amount of daily domestic waste at operation phase*

Componen and Activity	Worker	Estimate Schedule (Day)	Solidwaste (Domestic) Litre/day	Solidwaste	
				Litre/day	m³/day
OPERATION					
Local Worker	54	0.5	2.5	67.5	0.07
TOTAL					0.07

Source: AFRY, 2024 (SNI 19-3964-1994 about Measuring Samples Method for Generation and Composition of Urban Waste)

During the decommissioning phase, most of the solid material (e.g., concrete and brick walls, steel, glass mirrors, electrical cables, pipes, pumps) can be recycled and/or sold as scrap or used for other purposes such as road construction. The used PV panels could be collected and recycled as a raw material to produce new components for other PV modules, or if not recycled, these components need to be processed by an authorized facility since they contain hazardous material (e.g., heavy metals). A waste management system will be implemented on the Project site to comply with the Indonesian solid and hazardous waste storage and disposal regulations.

At Banyuwangi regency, there are 19 locations of temporary domestic waste disposal facilities or *Tempat Pembuangan Sementara* (TPS) with total volume of waste managed is 16,117.01 ton/year in 2023 and 2 locations of final domestic waste disposal landfill or *Tempat Pembuangan Akhir* (TPA) of Gintangan and Karangbendo landfills with total volume of waste managed is 47,804.05 ton/year (National Waste Management Information System, 2023).

The closest temporary waste disposal facilities to the project are TPS Penganjuran (capacity of 7,683.25 ton/year) and TPS Tembokrejo (capacity of 1,696.16 ton/year), which would be able to receive domestic wastes from the project.

3.10 Wastewater

During the construction phase, septic tanks will be installed to process domestic wastewater from accommodation camp (toilets). It is expected that the water discharged to the environment will be in accordance with applicable regulations and requirements. While for wastewater from canteen, a grease trap will be installed before entering the settling ponds. It will then be treated through the Sewage Treatment Plant (STP) and subsequently discharged to the environment in accordance with applicable standards.

Based on SNI 03-2399-2002 regarding Procedures for Planning Public Toilet Facility, estimation number of toilets needed during construction phase is shown in **Table 3-20** below.

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Table 3-20 *The estimated amount of toilet for the worker during construction*

Component	Amount of Worker	Toilet Room		
		Shower	Wash	Toilet
Non-local Worker	90	2	4	4
Local Worker	341	8	11	12

Source: AFRY, 2024 (SNI 03-2399-2002 about Procedures for Planning General Toilet Facility (Indonesia National Standards, 2002)*)*

Septic tanks will be constructed to treat domestic wastewater from the accommodation camp and office. A total of nine (9) septic tanks will be installed with the volume of 19.4 m^3 each to accommodate 431 workers as required by SNI 2398:2017 regarding Procedures for Planning Septic Tanks with advanced treatment (infiltration wells, infiltration fields, up flow filters, sanitation ponds) (Indonesia National Standards, 2017).

Wastewater from the project (canteen, grey water, etc.) will be channelled into a a settling pond that is equipped with grease trap prior to release into the environment. The settling pond is planned to have a dimension of 4 m x 4 m x 2 m, which would be able to receive 95.35 m^3/day of wastewater during construction. **Table 3-21** below shows the estimate amount of wastewater generated daily during the construction phase.

Table 3-21 *The amount of wastewater at the construction phase.*

Component and Activity	Area (ha)	Estimate Schedule (Day)	Daily Water Need (litre)	Water Need		Waste-water Produce
				Litre/day	m³/day	m³/day
Ground-mounted PV (Boundary), Switchyard, PV Module, Transmission Line RoW (RoW 1, 2 partially RoW 3) and Transmission Tower (1-3)	155.39	110	30	423,790.91	423.79	84.76
Gantry	0.06	20	30	900	0.90	0.18
Extension Bay	0.54	20	30	8,100	8.10	1.62
RoW Transmission Line	8.24	60	30	41,200	41,20	8.24
Transmission Tower			30	2,750	2.75	0.55
TOTAL						95.35

Source: (AFRY, 2023)

Wastewater collected from the drainage and settling pond will be directed to a Sewage Treatment Plant (STP) for treatment prior to discharge into the environment. Regular cleaning and collection of grease and oil from the grease trap will be carried out, and the waste will be managed as hazardous waste in accordance with applicable regulations. During the construction phase, wastewater will first be collected in a 32 m³ settling pond and subsequently treated in an on-site Sewage Treatment Plant (STP) with a planned capacity of 6 m³. The wastewater retention time in the STP is estimated to be 0.4 days, or around 9.6 hours before being discharged into the environment in compliance with applicable standards.

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The STP use Blower Based Aeration system (Equalisation Chamber and Aerobic Chamber). The flowmeters will be installed at both the inlet and outlet points of the STP to measure the volume of wastewater entering and exiting the system. Wastewater that has been treated at the STP will be discharged only after meeting the quality standards stipulated in the MoEF No. P.68/MenLHK/Setjen/2016 concerning Domestic Wastewater Quality Standards and WBG EHS Guidelines for Treated Sanitary Sewage Discharges. Treated domestic wastewater will be used for watering plants/garden Treated domestic wastewater will be used for watering plants/garden.

During operation phase, water will be mainly used for solar PV module cleaning activities, which has been explained in section 3.6.3.1. No wastewater treatment is expected from cleaning activities as there will be no chemicals added during the cleaning. Water for cleaning will be treated by active carbon filtration if required. Other water use during operations phase would be for workers' domestic activities (toilets, office, and canteen), where usage amount would be insignificant due to the limited number of workers. Based on wastewater produce during operation phase, the wastewater retention time in the STP is estimated to be 29.23 days before being discharged into the environment. The treated domestic wastewater will be reused for watering for watering plants and garden areas in accordance with good environmental practice and applicable standards.

Table 3-22 below shows the estimate amount of domestic wastewater generated during operational phase.

Table 3-22 *Amount of domestic wastewater generated during operational phase*

Componen and Activity	Worker	Estimate Schedule (Day)	Daily Water Need (Litre/Person/ Day)	Water Need	Waste Produce	
				Litre/day	m³/day	m³/day
Operation						
Local worker	54	1	30	1,620	1.62	1.30

Source: (AFRY, 2023)

3.11 Unplanned Events

The nature of solar power plant operations is typically not considered as a high-risk operation. However unplanned events still need to be anticipated and managed to ensure that workers and assets are protected. In order to manage risks associated to any unplanned events, Emergency Response Plan (ERP) will be developed as part of overall environmental and social management system/plan. The unplanned events that will be covered within ERP are as follow but not limited to:

- Oil spills or chemical spills;
- Natural disaster such as flooding and earthquakes;
- Weather events such as lightning strikes;
- Fire due to electrical failure during the operation.
- The collapse or structure failure of transmission line.

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4 Description of The Environmental and Social Baseline

4.1 Environmental Baseline Data

4.1.1 Overview

This section presents collated environmental baseline information to describe the features of environmental settings within and surrounding Ground Mounted PV Project area. The presented materials were gathered from (1) previous studies by PT PLN Indonesia Power, (2) available relevant documents from targeted institutions, and (3) environmental sampling and survey conducted in December 2023 - January 2024.

The environmental baseline samplings and surveys were conducted to collect primary data of ambient air quality, noise, vibration, surface water quality, traffic, and biodiversity. The environmental baseline samplings and surveys were conducted from 3rd-15th December 2023 (1st baseline survey) during the dry season and additional biodiversity survey in 19th-21st March 2025 (2nd baseline survey). Primary data collection activity was performed as planned and described in the Pre-ESIA Report.

Environmental data collection is based on limited one season sampling with assumption that such conditions are uniform, temporary impact and not variable over time. The other complementary various data were compiled from baseline data on the Amdal (ANDAL document), and additional biodiversity baseline was carried out as well. The Amdal consists of three main documents: the Terms of Reference (KA), the Environmental Impact Analysis (ANDAL), and the Environmental Management and Monitoring Plan (RKL-RPL).

River water sampling was adjusted due to field condition (accessibility). River water sampling of SW03 was grab recorded on downstream of project site. SW01 and SW03 of river water sampling observed dry located in upstream area and project site. Determination of river water sampling was not based on water depth, but rather on representativeness of the downstream water quality conditions.

Groundwater sampling location of GW01 was selected considering field accessibility and is situated adjacent project site. Groundwater sampling was obtained from a tap connected to a groundwater well, which is enclosed in a concrete structure.

Terrestrial biodiversity survey is limited to the selected area relevant to the proposed project site. The survey was conducted using a common method known for biodiversity surveys with some adjustments due to time constraint. The survey results do not present the species diversity of all terrestrial biodiversity in the study area but is considered sufficient to provide an overview of ecosystem conditions and the presence of flora and fauna in general and to verify the presence of certain flora and fauna based on previous studies.

Traffic counting was conducted at 2 (two) sampling location at the existing road that expected will be use as project access road during mobilisation of equipment and material phase. The traffic survey was conducted to obtain baseline information of traffic conditions which represents during weekend and weekday on potential peak time of traffic flow. The other complementary various data were compiled from traffic counting as stated on the Traffic Technical Approval (if available). The sensitive receptors (e.g.,

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public health facilities, school, worship places, etc) was identified for road safety assessment.

Summary of secondary and primary data collection activities is presented in **Table 4-1**, while more detailed primary data collection results are provided in **subchapter 4.1.2–4.1.14**. The location of baseline sampling is presented in **Figure 4-1** and **Table 4-2**. In addition, baseline data was also collected from existing secondary sources.

Table 4-1 *Summary of Secondary and Primary Data Collection Activity*

Environmental Component	Methodology
Climate	Climate data refers to data reported in the Banyuwangi Regency Statistics Berau Statistics. Presented climate data in this report include rainfall and rainy days, temperature, and relative humidity. Meteorological parameters including wind speed, wind direction, air pressure, air temperature and relative humidity will also be monitored.
Ambient Air Quality	1-hour and 24-hour samplings were conducted at three (3) location points. Incorporating the parameters specified such as SO_2, NO_2, TSP, PM_{10}, and $PM_{2.5}$. Location for sampling was determined with reference to SNI No.19-7119.6-2005 Section 6 for Determining Ambient Air Quality Sampling Location and the results were compared against standard of Indonesian Government Regulation No. 22 of 2021, Appendix VII.
Noise	24-hour and 48-hour samplings were conducted at three (3) location points which were selected by considering sensitive receptors. The noise measurement refers to WBG EHS guidelines and Indonesia's Minister of Environment Decree No. 48/1996 on Standard of Noise Level.
Vibration	Sampling was conducted at three (3) location points where noise measurement was conducted. The vibration measurement was carried out with reference to Indonesia's Minister of Environment Decree No. 49/1996 on Standard of Vibration Level.
Surface water quality	One surface water sample and one groundwater sample were collected and analysed for selected parameters. Surface water quality analysis results were compared against water bodies quality standard of Indonesian Government Regulation No. 22 of 2021, Appendix VI for River Quality Standard and the Ministry of Health Regulation No. 2 of 2023 about Environmental Health (Water Hygiene and Sanitation) for Groundwater Quality Standard.
Aquatic Biodiversity	Primary survey include plankton, benthic macroinvertebrates, nekton, periphyton, macrophytes and river habitat condition. The total number of sampling points is one (1) represents existing land cover conditions.
Terrestrial Biodiversity	Primary survey includes flora and vegetation type, birds, mammals, reptiles, and amphibians. The total number of sampling points is four (4) represents existing land cover conditions.
Ecosystem Services	Primary data collection for provisioning and regulating services follow the methodology and sampling locations determined for biodiversity. Stakeholder interviews and household surveys conducted as part of the socio-economic

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Environmental Component	Methodology
	study include questions to determine the benefits derived by the local community from the natural ecosystems
Landscape and Visual	The ZTV (Zone of Theoretical Visibility) and human eye-level viewpoints photograph from visual receptors towards highly visible project features and additional tourist at tourism area were acquired to assess potentially affected landscape character areas.
Traffic and Road Safety	The traffic counting and road condition observation was conducted at two (2) sampling points during weekday and weekend condition. The road safety observation was conducted by identified potential receptor and secondary data information on traffic incident along the proposed mobilisation project route.

Collected samples, specifically of ambient air quality, noise, vibration, surface water quality, groundwater and spring water quality, erosion and sedimentation, and aquatic biodiversity, were analysed in laboratory and the results are presented in this section.

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Table 4-2 *Environmental Baseline Sampling Coordinates and Locations*

No	Sampling	Sampling ID	Coordinates (UTM 49S)	Location	Sampling Point Consideration
1	Air Quality	UA01	208607, 9094721	Antongan, Kalipuro	Residential area
2		UA02	209115, 9096599	Wr Kopat, Kalipuro	Residential area
3		UA03	210732, 9098147	Lkr Kampung Baru, Bulusan	Residential area adjacent project site
4	Noise	NS01	208607, 9094721	Antongan, Kalipuro	Residential area
5		NS02	209115, 9096599	Wr Kopat, Kalipuro	Residential area
6		NS03	210732, 9098147	Lkr Kampung Baru, Bulusan	Residential area adjacent project site
7	Vibration	VB01	208607, 9094721	Antongan, Kalipuro	Residential area
8		VB02	209115, 9096599	Wr Kopat, Kalipuro	Residential area
9		VB03	210732, 9098147	Lkr Kampung Baru, Bulusan	Residential area and adjacent project site
10	Surface water	SW01	209280, 9098026	Upstream River (dry)	Upstream
11		SW02	210796, 9098038	Downstream River -Project Area (dry)	Downstream
12		SW03*	211939, 9099133	Downstream River (INKA)	Downstream
12	Groundwater	GW01	210705, 9098185	At Islamic Boarding School (Fathul Ulum)	Adjacent the project site
13	Terrestrial biodiversity	TB 01	210170, 9098756	North of the proposed project footprint	Represents the area north of the project site, at the intersection of the Sumberwaras and Sumberwaru Rivers
14		TB 02	210019, 9097565	Within the proposed project footprint	Project site area
15		TB 03	207932, 9096174	Overlapping with proposed OHTL corridor	A representative area of the surroundings along the transmission line corridor,

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No	Sampling	Sampling ID	Coordinates (UTM 49S)	Location	Sampling Point Consideration
					specifically located between towers T-08 and T-09
16		TB 04	208401, 9093859	Overlapping with proposed OHTL corridor	This area represents the surrounding of the Banyuwangi Station
17	Aquatic biodiversity	FBA*	212120, 9099083	Located to the Northeast and outside the project site	Downstream, from the confluence of Sumberwaras and Sumberwaru Rivers
18	Landscape & visual	LV01	209313, 9097666	Settlement area at Kalipuro Village	Visual perspective from the nearest settlement (West Side) toward the proposed PV module area
19		LV02	210779, 9097782	Settlement area at Kalipuro Villlage	Visual perspective from the nearest settlement (East Side) toward the proposed PV module area
20		LV03	208269, 9096480	Local road (Samarinda Road at Kalipuro Village)	Visual perspective from road user toward the transmission line
21	Traffic	TR1	208747, 9094795	Junction of Argopuro Road, Raden Wijaya Road, and Joyoboyo Road	Junction of existing local roads that will be used as project access during mobilisation of equipment and material activities
22		TR2	210979, 9093464	Junction of Argopuro Road and Sitobondo – Banyuwangi Road	Junction of existing national and local road that will be used as project access during mobilisation of equipment and material activities

Source: AFRY Baseline Survey (December 2023 – January 2024)

**) Adjustment in sampling point location considering field conditions.*

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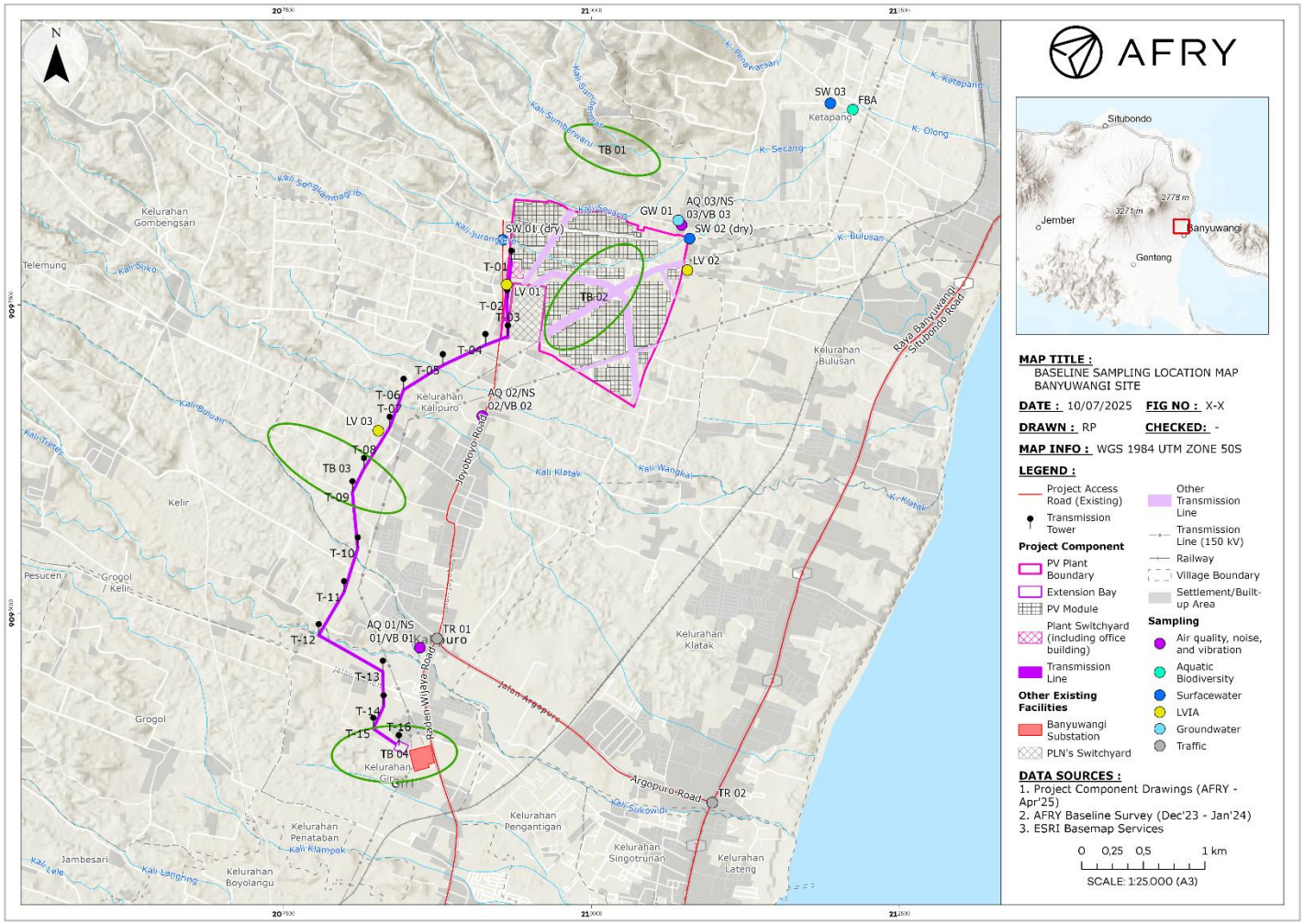


Figure 4-1 *The location of baseline sampling for Banyuwangi Ground-Moounted Solar PV Power Plant project*

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4.1.2 Climate and Meteorology

The baseline data for this section are obtained from the Central Bureau of Statistics/*Badan Pusat Statistik* (BPS) of Banyuwangi Regency. The main climatic conditions of the project site are gathered from the latest available publication by BPS.

The climate data for rainfall, rain days, temperature and humidity for the last 10 years from 2013-2022 (Source: BPS of Banyuwangi Regency period 2014-2023) are presented in **subsection 4.1.2.1– 4.1.2.3** below.

4.1.2.1 Rainfall and Rainy days

The rainfall data obtained from this station include monthly rainfall data from 2013-2022 (10-years). The highest monthly rainfall occurred in January 2013 (527.5 mm) and lowest in July and October 2019 (0 mm). According to Köppen-Geiger climate classification, the climate around Banyuwangi Ground-mounted PV area could be classified as a type Af (tropical rainforest climate) as the rainfall in the driest month reached ≥ 60 mm/month.

The average monthly rainy days year 2013-2022 at Banyuwangi area reached 13-14 days/month. The highest rain days during the period of 2013-2022 was 26 days, which occurred in 2017 (January and December), 2019 (January) and 2021 (February), while the lowest rain days was 0 days, which occurred in 2019 (July and October). **Table 4-3** and **Table 4-4** show rainfall and rain day data from 2013-2022.

Table 4-3 *Monthly Rainfall Year 2013-2022 at Banyuwangi Regency*

Month	Rainfall (mm)									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Jan	**527.5**	216.6	150.1	116.1	244	474.3	236.4	136.3	252.1	335.2
Feb	100.2	227.3	202.7	238.5	224.8	276	81.9	257	408.8	82.3
Mar	193.1	28.3	225.9	66.9	121.1	161.9	210.8	217.1	210	279.6
Apr	228.8	127	84.3	48.7	83.7	28.9	239.5	40.7	207.1	72.9
May	97.3	19.4	87.1	100	150.9	5.9	26.1	232.4	58.2	40.8
Jun	122.8	16.9	58.8	172.7	173.2	33.1	15.5	77.9	248.6	148.8
Jul	156	136.1	NA*	81.9	118.4	68.5	**0**	81.7	62.4	15.7
Aug	37.3	24.3	14.9	145.1	48.2	69.4	6.8	48	65.2	40.9
Sep	6.9	NA*	0.8	22.8	9.3	9	29.7	93.9	154	63
Oct	0.8	36.5	NA*	76.7	113.2	0.7	**0**	242	99	293.3
Nov	237.6	91.5	NA*	121.7	192.5	239.2	2.8	28.6	180.3	324.9
Dec	160.3	172.8	148.2	255.7	276.6	97.6	11.8	148.9	270.9	144.2

Source: (BPS Banyuwangi Regency, 2023)
**) NA: Not Available*

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Table 4-4 Monthly Rainy Days Year 2013-2022 at Banyuwangi Area

Month	Rain Days (Day)									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Jan	25	21	20	12	26	23	26	17	25	21
Feb	14	21	17	23	10	19	17	22	26	16
Mar	19	12	19	9	15	13	20	17	19	16
Apr	16	16	13	8	16	8	20	14	16	14
May	16	10	11	14	12	5	14	17	8	10
Jun	18	9	7	12	13	11	4	14	13	12
Jul	19	12	3	12	16	7	**0**	10	7	7
Aug	8	7	11	15	8	18	3	16	16	9
Sep	4	1	2	7	7	3	4	12	14	9
Oct	4	3	2	15	13	5	**0**	19	9	20
Nov	21	9	2	17	19	14	3	11	12	16
Dec	21	21	19	22	26	17	9	23	19	16

Source: (BPS Banyuwangi Regency, 2023)

4.1.2.2 Temperature

The average temperature at Banyuwangi area is between 24.8-29.6°C with the lowest temperature for the past 10 years occurred in October 2014 (18.2°C) while the highest temperature occurred in August 2021 (41.4°C).

Table 4-5 Monthly Average Temperature Year 2013-2022 at Banyuwangi Area

Month	Temperature (°C)									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Jan	26.7	27.4	27.6	28.7	27.4	27.6	28.0	28.5	27.2	26.8
Feb	27.7	27.0	27.6	27.4	28.1	27.6	28.4	28.0	26.7	27.3
Mar	27.4	28.0	27.5	28.0	28.0	28.5	27.9	28.2	27.3	27.4
Apr	**24.8**	28.0	27.4	29.0	28.6	29.5	28.6	28.7	27.9	27.9
May	27.5	28.5	27.2	28.8	28.2	28.1	28.1	28.0	27.8	28.1
Jun	27.0	27.4	26.5	28.2	26.9	27.0	26.5	27.0	27.0	27.2
Jul	26.1	26.2	25.6	27.5	26.1	26.2	25.7	26.3	26.3	26.2
Aug	26.0	26.3	25.6	27.2	26.1	25.7	25.8	26.3	26.6	26.4
Sep	26.3	26.2	26.3	28.5	27.1	27.1	26.2	27.0	26.8	26.7
Oct	28.2	27.8	27.6	29.0	28.3	28.8	27.7	27.2	27.5	26.4
Nov	27.4	28.2	29.6	29.1	27.9	29.2	28.7	28.2	27.3	26.9
Dec	27.2	27.9	28.7	27.9	27.7	29.2	**29.6**	27.2	28.0	27.4

Source: (BPS Banyuwangi Regency, 2023)

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Table 4-6 Monthly Maximum Temperature Year 2013-2022 at Banyuwangi Area

Month	Temperature (°C)									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Jan	31.7	34.0	34.8	35.2	32.6	31.4	34.8	34.9	33.3	34.0
Feb	32.3	32.8	34.0	33.5	33.0	31.7	34.6	34.2	32.2	33.9
Mar	32.0	33.4	33.6	34.4	33.6	32.2	34.8	33.9	33.0	33.1
Apr	31.7	33.4	33.4	34.0	33.8	34.0	32.7	34.0	32.4	33.0
May	31.5	33.0	32.0	33.8	32.5	29.6	32.7	33.4	32.5	33.0
Jun	30.3	32.5	31.0	34.2	31.2	30.4	32.3	32.2	32.0	33.3
Jul	29.6	31.6	31.0	32.2	31.0	30.6	30.4	30.0	31.2	31.9
Aug	29.4	31.0	30.4	32.2	32.0	30.6	30.7	32.2	**41.4**	31.2
Sep	30.1	31.4	31.6	33.8	32.0	32.7	30.8	32.4	31.4	31.0
Oct	32.5	33.8	33.4	34.0	32.8	32.2	31.7	32.0	32.4	32.4
Nov	31.9	34.6	34.6	34.6	33.8	32.8	33.2	33.2	32.7	32.4
Dec	31.7	34.2	34.4	34.0	33.2	32.8	34.7	33.7	34.2	32.8

Source: (BPS Banyuwangi Regency, 2023)

Table 4-7 Monthly Minimum Temperature Year 2013-2022 at Banyuwangi Area

Month	Temperature (°C)									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Jan	24.1	23.5	22.7	24.0	23.2	24.1	23.4	23.2	23.6	22.3
Feb	24.7	22.2	22.8	23.8	23.0	23.9	21.3	23.2	23.0	21.2
Mar	24.3	22.6	22.4	24.4	23.2	24.1	22.6	23.0	23.0	22.0
Apr	24.8	22.0	21.0	24.4	22.5	23.2	23.6	24.0	23.0	21.4
May	24.7	23.0	21.4	23.8	23.4	26.0	23.2	23.8	22.8	23.7
Jun	24.4	22.8	19.6	23.4	22.9	24.1	21.0	21.4	22.5	22.0
Jul	24.6	20.8	19.2	21.0	22.8	20.8	20.8	21.2	20.0	21.6
Aug	23.3	20.6	20.5	21.0	21.8	21.0	21.5	22.2	22.4	21.2
Sep	23.6	20.2	21.2	23.0	19.2	21.7	21.4	22.0	22.2	22.0
Oct	24.7	**18.2**	22.6	23.8	22.5	24.6	24.2	22.3	20.6	21.6
Nov	24.6	23.4	23.8	24.0	21.0	25.1	25.1	23.2	22.7	22.6
Dec	24.4	23.0	23.2	23.0	21.4	23.6	25.6	22.8	23.0	23.0

Source: (BPS Banyuwangi Regency, 2023)

4.1.2.3 Relative Humidity

The relative humidity data referred to the Banyuwangi Regency data from 2013-2022 with average relative humidity in the range of 69.0% - 88.0%, which indicates that the humidity within the Banyuwangi PV Project area is fairly high throughout the year.

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Table 4-8 Monthly Average Relative Humidity Year 2013-2022 at Banyuwangi Area

Month	Average Relative Humidity (%)									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Jan	86.0	80.0	87.0	76.0	81.0	83.0	80.0	74.0	82.0	80.9
Feb	81.0	82.0	**88.0**	84.0	76.0	79.0	76.0	80.0	85.0	79.4
Mar	82.0	76.0	80.0	76.0	77.0	73.0	79.0	79.0	81.0	81.7
Apr	83.0	78.0	83.0	76.0	75.0	71.0	78.0	77.0	76.0	76.9
May	84.0	72.0	79.0	78.0	77.0	85.0	77.0	81.0	79.0	79.1
Jun	86.0	75.0	81.0	76.0	83.0	78.0	78.0	80.0	80.0	79.5
Jul	82.0	80.0	80.0	78.0	82.0	76.0	78.0	79.0	77.0	79.8
Aug	78.0	78.0	80.0	76.0	80.0	78.0	76.0	80.0	80.0	77.8
Sep	77.0	75.0	78.0	74.0	79.0	72.0	77.0	78.00	79.0	79.3
Oct	75.0	73.0	77.0	73.0	78.0	**69.0**	72.0	81.0	77.0	84.1
Nov	82.0	73.0	72.0	80.0	80.0	74.0	72.0	77.0	81.0	83.2
Dec	83.0	79.0	77.0	79.0	81.0	74.0	71.0	81.0	78.0	78.5

Source: (BPS Banyuwangi Regency, 2023)

4.1.3 Topography

The topography survey has been conducted covering a total of 164.78 ha area of the Banyuwangi Solar PV project, including the ground-mounted Solar PV (boundary), switchyard, PV modul, Transmission Line RoW 1,2 partially RoW 3 and Transmission Tower 1-3. The project area also covered Gantry (0.06), the Extension Bay Area (0.54 ha), and RoW Transmission line (8.24 ha), while Transmission Line Tower (0.55 ha). The project site is connected to Banyuwangi Substation via 16 transmission line towers, spanning Kelir, Kalipuro and Giri Villages.

The ground-mounted solar PV and switchyard are located within a sugarcane plantation (Wangkal Kaliselogiri) owned by PT PN XII. The planned switchyard area is located at the highest elevation, from West to East across an elevation range of 145 to 150 m. Site levelling will only be carried out for the building area, storage yard for PV modules and supports, and the area designated for temporary construction facilities.

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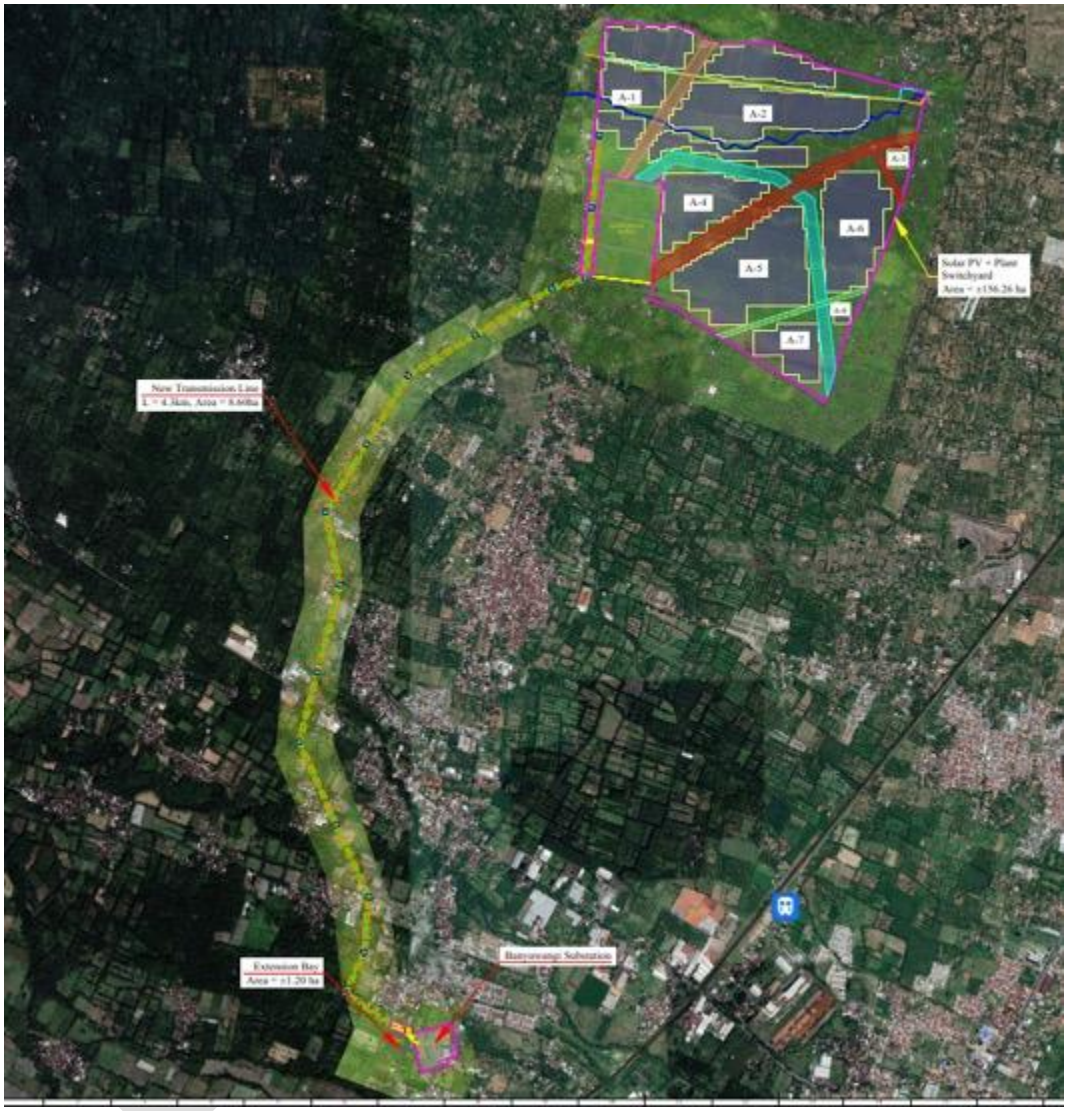


Figure 4-2 *Topography survey area Banyuwangi Grounmounted Solar PV*

4.1.4 Geology and Soil

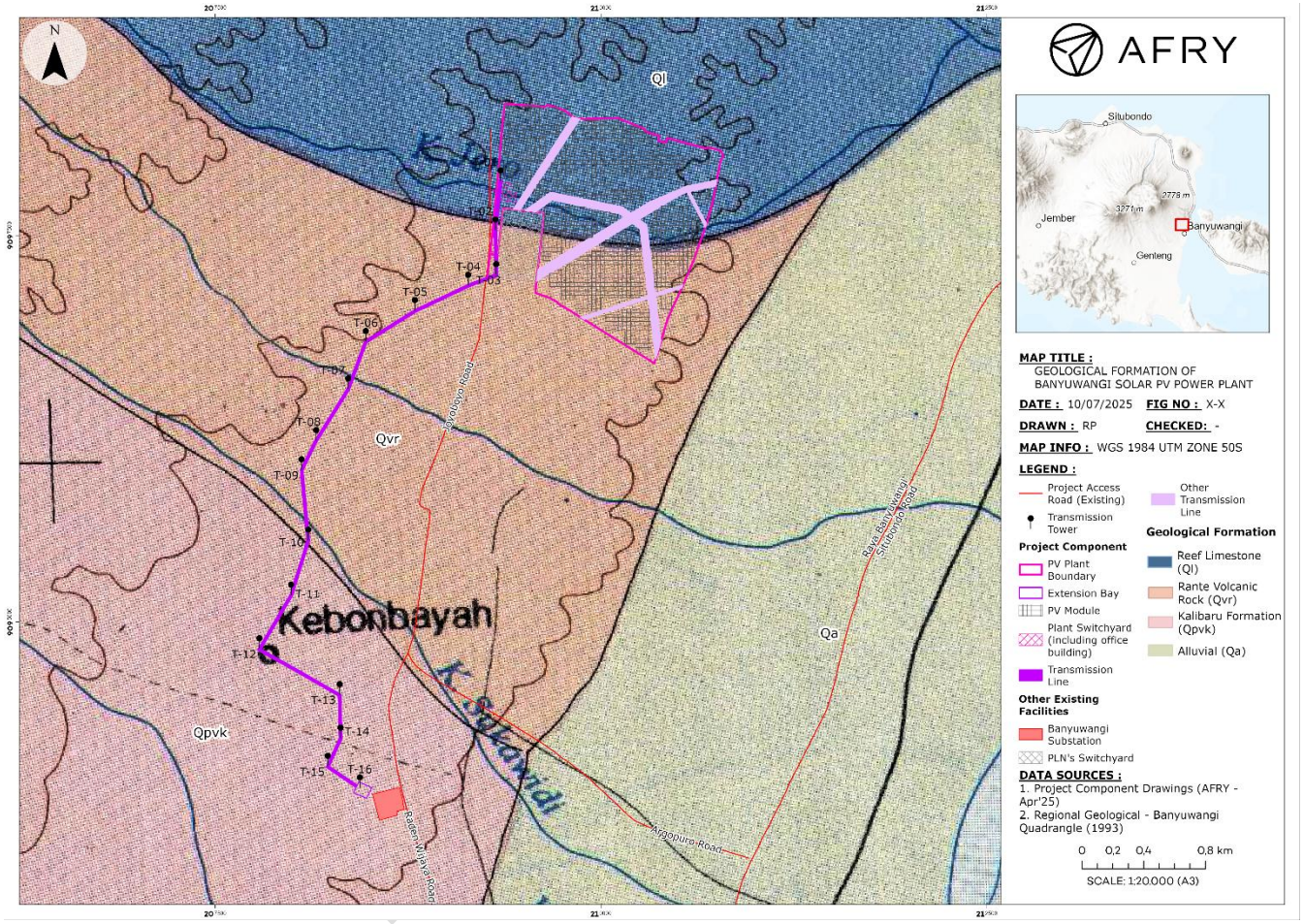
Information for the geological condition of Banyuwangi PV site location is inferred from the Geological Map of the Banyuwangi Quadrangle (Sidarto, T. Suwarti and D. Sudana, 1993) by Indonesia Geological Research and Development Centre.

The Banyuwangi project site is located at the Coralline Limestone Formation (Ql) and Merapi Volcanic Rock Formation (Qv(m)), which belongs to volcanic rocks group during the Holocene timescale. The Coralline Limestone Formation consists of intercalations of conglomerate and tuff. In some places, it presents as a rising coral colony. Meanwhile, the Merapi Volcanic Formation consists of volcanic breccia, agglomerate, lava, tuff, lapilli and boulder. This formation composed of andesite-basalt with feldspar, pyroxene, hornblende, quarts and volcanic glasss.

The geology map for Banyuwangi project site is shown in **Figure 4-3** below.

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Source: (Sidarto, 1993)

***Figure 4-3** Geological Maps of Banyuwangi Quadrangle*

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Subsoil stratigraphy of the Banyuwangi site is dominated with sandy silt, coarse sand, sandstone/boulder, silty sand and granite. The surface layer is dominated by sandy silt and topsoil medium stiff with low plasticity.

A soil investigation has been conducted by having four boreholes with results showed two soil layers for BH-2 and BH-04, where top layer is soft layer of SILT from 0.0-2.0 m and the bottom layer is a very strong layer of BOULDER > 2.0 m. The other boreholes, BH-05 and BH-06 showed that the top layer is medium stiff to very stiff layer of Clayey SILT from 0.0-6.50 m, while the next layer is dense to very dense layer of SANDSTONE/Coarse SAND stated at > 6.50m.

The surface layer is dominated by gravelly or sandy clay. The following table shows the soil classification.

Table 4-9 *Soil Classification*

No	Point ID	Max Depth (m)	Easting (X)	Northing (Y)	GWL Average (m)	Site Class
1	BH-02	20.00	209416.814	9098088.079	6.540	SC
2	BH-04	10.00	210012.882	9097591.886	5.680	SC
3	BH-05	15.00	209416.814	9098088.079	8.020	SD
4	BH-06	15.00	210652.088	9098016.016	7.180	SC

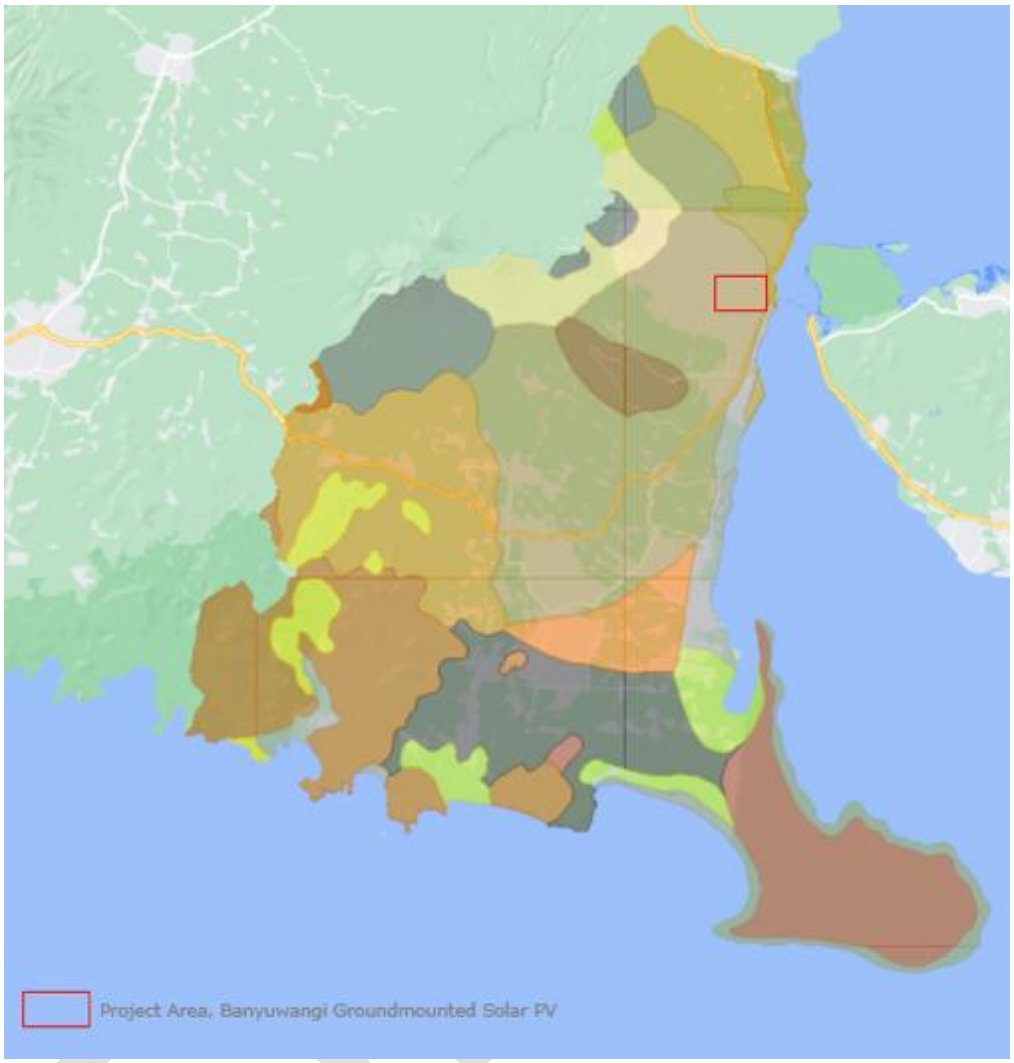
Note:

Soil Classification According to SNI 1726-2019 about Procedures for Earthquake Resilience Planning for Building and Non-Building Structures.:

1. SD (Medium Soil)	2. SC (Hard Rock Soil and Soft Rock)
-Shear Wave Velocity Vs (m/s): 175-530	-Shear Wave Velocity Vs (m/s): 350-750
-SPT Value N:15-50	-SPT Value N:>50
Undrained Shear Strength Su (kPa): 50-100	Undrained Shear Strength Su (kPa): >100

The settlement may not be an issue if shallow foundation is applied since after the top layer is Coarse SAND/BOULDER layer. The erosion will not be an issue, and no indication of erosion is apparent at the project site.

Based on the general description of Banyuwangi Regency, the soil classification within the project area is the association of brown Latosols and grey Legosols. It has erodibility of 0.186 (Puslitbang Pengairan Bogor, 1985), and showed the sensitivity of the soil to erosion is low at the project site.



Source: (Geographic Information System (GIS) of Banyuwangi Regency, 2024)

Figure 4-4 *Soil Type of Banyuwangi Regency*

4.1.5 Land Cover and Land Use

During the site survey, it was observed that the project area is used as sugar cane plantation managed and owned by PTPN XII with a total area of 24 ha, where sugar cane plants were present and ready for harvesting in certain sections (**Figure 4-5**). It was also observed that within the 24 ha area, other wood-producing plants, including beechwood (*Gmelina arborea*), silk tree (*Albizia falcataria*), chinaberry tree (*Melia azedarach*), and mahogany (*Swietenia mahagoni*) were also planted in certain areas where sugar cane is not suitable to grow (**Figure 4-6**).



Figure 4-5 *Sugar cane plantation*



Figure 4-6 *Silk tree at the plantation*

Regarding the planned transmission line route, it is set to traverse mixed areas of dryland agriculture, community residences, and paddy fields. The mixed dryland agriculture area is typically intercropping wood trees with other plants, such as teak trees, and other edible fruit plants, such as banana, coconut, *melinjo*, coffee plants, mango, and durian (**Figure 4-7**).



Figure 4-7 *Dryland agriculture and community houses along the proposed transmission line*

4.1.6 Hydrology

An intermittent creek or river exist within the project area, which is water-filled only during the rainy season. During the baseline survey, the creek/river was in dry condition where shrubs were observed covering the riverbanks (**Figure 4-8**).



Figure 4-8 *Dry condition at Intermittent River (Creek) at Project area*

Based on the Public Work Agency of Water Resources of East Java Province, Banyuwangi Regency is part of the River Area (*Wilayah Sungai*) of Baru – Bajulmati, which stretched along 3,695 km^2 (Public Work Agency of Water Resources of East Java Province, 2022) and the project area lies within the Banyuwangi groundwater basin with total area of 1737 km^2 (The Minister of Energy and Mineral Resources Republic of Indonesia, 2017).

There is a total of 60 sub-watersheds within the Banyuwangi Regency, where five (5) sub-watersheds are located within the project area. The Paleran is the main sub-watershed in the project area. Sub-watersheds within the project area are detailed in **Table 4-10** below:

Table 4-10 *The sub watershed located adjacent at project area*

No	Sub watershed	Area (km^2)
1	Paleran	17.84
2	Butusan	5.23
3	Klatak	40.13
4	Sukowidi	38.04
5	Banyuwangi	46.69

Source: *https://sih3.dpuair.jatimprov.go.id/main/spatial* (Information System on Hydrology, Hydrometeorology, and Hydrogeology Management at East Java Province, 2022)

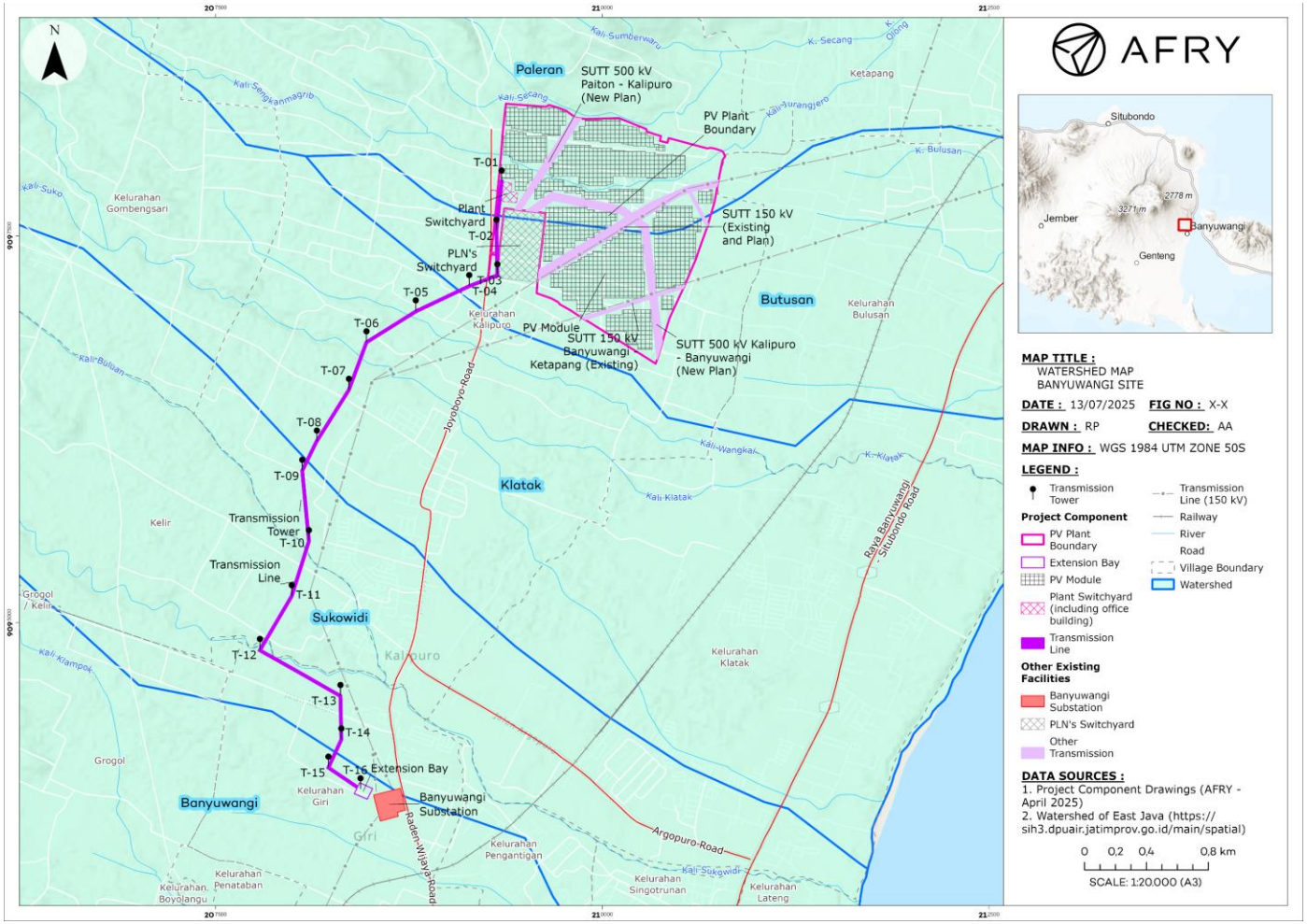


Figure 4-9 *Watershed within Project Area*

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Groundwater and Spring

In Banyuwangi Regency, clean water is mainly supplied by the state-owned water supplier company (locally known as *Perusahaan Daerah Air Minum* or PDAM Banyuwangi). In 2022, PDAM Banyuwangi has distributed water to 77,500 Customers with total volume of 15,592,176 m^3 (Source: The Central Bureau of Statistics of Banyuwangi Regency, 2023). PDAM Banyuwangi extracted water from ten spring water sources and twelve groundwater wells, with total of ± 469 litre/second water extracted (The State-Owned Water Supplier Company of Banyuwangi (PDAM), 2024).

Table below showed details of spring sources at Banyuwangi Regency that are utilized by PDAM Banyuwangi.

Table 4-11 *Details of spring sources at Banyuwangi Regency*

No	Water resouces	Amount of Source	Extraction Water Discharge	
			Minimum (Litre/Detik)	Maximum (Litre/second)
1	Spring Gedor I	115	85	73
2	Spring Gedor II	80	60	29
3	Spring Gedor III	60	20	15
4	Spring Rembesan	30	30	15
5	Spring Pawon/Gadog	60	40	20
6	Spring Seliwung	110	30	25
7	Spring Awal	60	50	21
8	Sumur Penataban	20	20	15
9	Sumur Banjarsari	10	10	6
10	Sumur Sobo/Kantor	20	20	15
11	Sumur Gajah Mada	20	20	15
12	Sumur Kalirejo	10	10	10
13	Spring Lungun	150	50	50
14	Sumur Bor Kedungrejo	20	20	20
15	Sumur Bor Kedungrejo	10	10	10
16	Spring Umbulsari	240	60	60
17	Spring Watu Gedeg	60	20	20
18	Sumur Bor Alasrejo	10	10	10
19	Sumur Bor Sumberanyar	15	15	15
20	Sumur Bor Alasbuluh	10	10	10
21	Sumur Bor Sumber Luhur	2.5	2.5	2.5
22	Sumur Bor Sumber Luhur	12.5	12.5	12.5
Total		**1,125**	**605**	**469**

Source: (The State-Owned Water Supplier Company of Banyuwangi (PDAM), 2024).

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4.1.7 Surface Water Quality

Physical, chemical, and biological characteristics of Paleran river (creek) water samples were assessed based on the Government Regulation (GR) No.22 of 2021, Appendix VI that provides the quality standards for river water.

The river within the project area is an intermittent river, which is water-filled only during rainy season. During the baseline survey, the planned sampling locations (SW01 and SW02) were found dry, and samples were not able to be taken. Therefore, samples were taken at approximately 1.6 km downstream from the project site (same river channel with SW01 and SW02) where water was found, and sample can be collected (named SW03). PT INKA, a train workshop/manufacturing facility is located approximately 700 m northeast from the project site and water sample at SW03 is taken approximately 300 m (downstream) from PT INKA facility.

The Appendix VI of GR Number 22 of 2021 provides four classification of water quality based on the utilization of water. The Paleran River is known used for fishing activity and irrigation. The overflow from the river is channelled into the INKA reservoir River which is also used for irrigation. Therefore, the water quality of Paleran River shall refer to Class II water quality standards. River water quality is not defined by the IFC EHS General Guideline, therefore the baseline quality only referred to the Indonesian quality standards.

Table 4-12 below show results of the surface water (river) analysis from SW03. The river water quality baseline data above showed compliance with the national standards for all parameters. Since samples cannot be taken from SW01 and SW02 due to dry condition, the results are identified in the table as NA.

Table 4-12 Surface Water Quality on Paleran River (Primary Data)

Parameter	Unit	Standard [a] (Class II)	SW01	SW02	SW03
Temperature	°C	Dev.3	NA	NA	27.4
Total Suspended Solids (TSS)	mg/L	50	NA	NA	4
Color	Pt-Co	50	NA	NA	0.02
pH	-	6-9	NA	NA	7.90
Dissolved Oxygen (DO)	mg/L	4	NA	NA	18.6
Total Nitrogen	mg/L	15	NA	NA	2.88
Total Phosphates as P	mg/L	0.2	NA	NA	<0.01
Hydrogen Sulphide (H_2S)	mg/L	0.002	NA	NA	<0.002
Arsenic (As)	mg/L	0.05	NA	NA	<0.001
Cadmium (Cd)	mg/L	0.01	NA	NA	<0.0001
Mercury (Hg)	mg/L	0.002	NA	NA	<0.0004
Lead (Pb)	mg/L	0.03	NA	NA	<0.001
Total Detergent	mg/L	0.2	NA	NA	<0.16
Transparency	m	-	NA	NA	0.60
Chlorophyll-a	mg/m^3	-	NA	NA	2.45

Source: Primary Data, December 2023
Notes:
[a]Government Regulation 22/2021 Appendix VI for river water quality standard,
SW01: Upstream River *SW03: Downstream River*

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SW02: Project Area *NA: Not Available (Dry During Baseline Survey)*

A secondary data of the AMDAL (Regulatory Environmental Impact Assessment) baseline results has been reviewed. The surface water sampling was reported taken in the period of 6th to 20th October 2023. Samplings were conducted at two locations at the upstream of Paleran River-outside project area (AP-1) and downstream of Paleran River-outside project area (AP-2) of the project area by an accredited laboratory using the methodology as per the Indonesian Regulation. Summary of the surface water analysis results taken from the AMDAL are provided in **Table 4-13** and **Table 4-14**

Table 4-13 *Surface Water Quality Sampling Location Based on AMDAL Secondary Data*

Location Code	Sampling Date	Location	Coordinate (UTM)
AP-1	6-20th October 2023	Upstream of Paleran River (outside project area)	209531, 9098417
AP-2	6-20th October 2023	Downstream of Paleran River (outside project area)	210761, 9098565

Table 4-14 *Surface Water Quality Result Based on AMDAL Secondary Data*

Parameter	Unit	Standard [(a)] Class II	Upstream of project area (AP-1)	Downtream of project area (AP-2)
Temperature	°C	Dev.3	29.0	29.5
Total Dissolved Solids (TDS)	mg/L	1000	140.5	136.9
Total Suspended Solids (TSS)	mg/L	50	<4.88	<4.88
Color	Pt-Co	50	6.51	<1
pH	-	6-9	7.8	7.5
BOD, 5 days 20°C	mg/L	3	**4**	**7**
COD by $K_2Cr_20_7$	mg/L	25	<8.91	14.35
Dissolved Oxygen (DO)	mg/L	4	4.09	4.15
Sulphate (SO_4)	mg/L	300	<0.967	<0.967
Chlorida (Cl)	mg/L	300	7.99	8.49
Nitrate (NO_3-N)	mg/L	10	1.56	<0.913
Nitrite (NO_2-N)	mg/L	0.06	<0.01	<0.01
Ammoniac (NH_3-N)	mg/L	0.2	<0.080	<0.080
Total Nitrogen	mg/L	15	<0.5	<0.5
Total Phosphates as P	mg/L	0.2	**0.36**	**0.36**
Flouride (F)	mg/L	1.5	<0.10	<0.10
Hydrogen Sulphide (H_2S)	mg/L	0.002	<0.001	<0.001
Cyanide (CN)	mg/L	0.02	<0.010	<0.010
Chlorine (CL_2)	mg/L	0.03	0.110	0.190
Barium (Ba)	mg/L	-	0.024	0.024
Dissolved Boron (B)	mg/L	1.0	<0.030	<0.030
Mercury (Hg)	mg/L	0.002	<0.00064	<0.00064

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Parameter	Unit	Standard [(a)] Class II	Upstream of project area (AP-1)	Downtream of project area (AP-2)
Arsenic (As)	mg/L	0.05	<0.010	<0.010
Selenium (Se)	mg/L	0.05	<0.009	<0.009
Iron (Fe)	mg/L	-	0.226	0.174
Cadmium (Cd)	mg/L	0.01	<0.008	<0.008
Cobalt (Co)	mg/L	0.2	<0.014	<0.014
Manganese (Mn)	mg/L	-	0.033	0.024
Nickel (Ni)	mg/L	0.05	<0.008	<0.008
Zinc (Zn)	mg/L	0.05	0.016	0.016
Copper (Cu)	mg/L	0.02	<0.007	<0.007
Lead (Pb)	mg/L	0.03	<0.014	<0.014
Chrome Hexavalent (Cr^{6+})	mg/L	0.05	<0.038	<0.038
Oil and Grease	mg/L	1	<1	<1
Total Detergent	mg/L	0.2	<0.10	<0.10
Phenol	mg/L	0.005	<0.10	<0.10
Coliform	mg/L	5000	0	17

Source: Secondary data, AMDAL Baseline October 2023, Surveyor Indonesia

Notes:

[(b)] *GR No.22 of 2021 Appendix VI for river quality standard, Class I* (Government Regulation of Republic of Indonesia, 2021)

Class II: Water utilized for recreational/tourism, fisheries (fish cultivation), irrigation and/or other utilization that requires similar quality standards.

The AMDAL surface water quality baseline data above showed compliance with the national standards for all applicable parameters from regulation limit, except for BOD and Total Phosphate at AP-1 and AP-2, which exceeds the standards. Copies of the surface water quality analysis report from the laboratory are provided in **Appendix D**.

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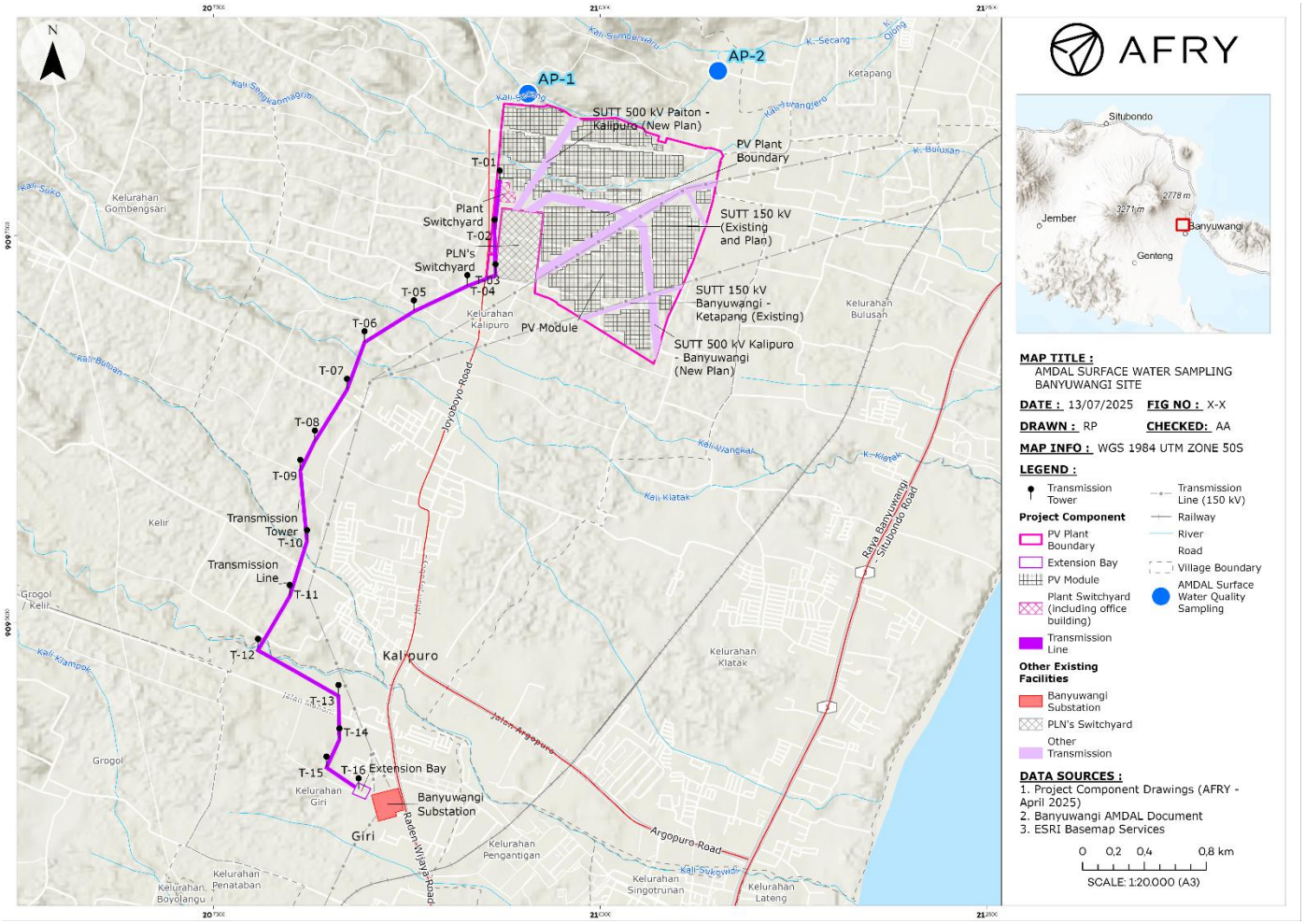


Figure 4-10 *AMDAL Surface Water Quality Sampling Location*

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Usage of Groundwater

The nature of Solar PV operations is unlikely to have impacts to groundwater. Water for daily use by the community is supplied from the municipal water supply of Banyuwangi Regency or locally called PDAM Banyuwangi. Most of the community do not install groundwater well due to high cost for installation. Adjacent to project area, a groundwater well installation was identified, which belongs to a boarding school (*Fathul Ulum*) with estimate depth of 100 m. A sample of the groundwater (GW01) is taken from the groundwater well owned by the boarding school as an additional information to the environmental condition in the area. Water quality analysis referred to the quality standards set up in the Minister of Health Regulation No. 2 of 2023 on Regulation No. 66 of 2014 regarding Environmental Health (Water Hygiene and Sanitation Parameters).

Table 4-15 *Groundwater Quality at adjacent Banyuwangi Project Area*

Parameter	Unit	Standard[(a)]	GW01
Physical			
Temperature	°C	Air temp. 3°C	28.6
Color	TCU	10	0.01
Turbidity	NTU	<3	0.01
TDS	mg/L	<300	172
Odor	-	No Odor	No Odor
Chemical			
pH	-	6.5-8.5	8.10
Iron, Fe	mg/L	0.2	<0.060
Mangan, Mn	mg/L	0.1	0.022
Nitrate, NO_3N^-	mg/L	20	1.68
Nitrite, NO_2N^-	mg/L	3	<0.001
Chromium Hexavalent, CR^{6+}	mg/L	0.01	<0.006
Microbiology			
Total Coliform	CFU/100mL	0	**25**
E. Coli	CFU/100mL	0	0

Source: Primary Data, January 2024
Notes:
[(a)] *The Minister of Health No. 2 of 2023 on Implementing Regulations of Government Regulation No. 66 of 2014 concerning Environmental Health (Table 3 Water Hygiene and Sanitation Parameters)* (The Minister of Health of Republic Indonesia, 2023)

The groundwater water quality analysis results data above showed compliance with the national standards except for total coliform, which exceeds the regulation threshold for clean water. This is likely due to the operational of the boarding school itself, particularly from its septic tanks. The boarding school use the groundwater for daily activities such toilets/bathrooms and gardening. It was reported that the school provides bottled water for drinking.

The groundwater quality analysis report from the laboratory is provided in **Appendix D**.

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4.1.8 Ambient Air Quality

The baseline data collection of ambient air quality was conducted from 27th to 29th December 2023 at three (3) different locations around the proposed project site with details as shown in **Table 4-16.** All sampling locations were taken in settlement areas.

Table 4-16 *Ambient Air Quality Sampling Location Based on Baseline Survey*

Location Code	Sampling Date	Location	Coordinate (UTM)
UA01	29th December 2023	Antongan, Kalipuro	208607, 9094721
UA02	27th December 2023	Wr Kopat, Kalipuro	209115, 9096599
UA03	28th December 2023	Lkr Kampung Baru, Bulusan	210732, 9098147

The weather conditions at all sampling locations during the sampling period were mainly clear/sunny, with occasional evening rainfall, particularly in Banyuwangi District, which is adjacent to Kalipuro District. No significant sources of emissions were found around the sites. However, typical air emissions were observed from domestic activities of the local community such as garbage burning, agricultural waste (straws) burning and emission from passing vehicles.

The laboratory analysis results of the ambient air quality measurement are presented in **Table 4-17**. Overall, the analysis results are in compliance with the national and international standards[10]. The project area is surrounded by undulating terrain of hills and valley with a good environmental quality, particularly for ambient air quality due to the limited activities within the area of study, including limited traffic on the road. Therefore, the sources of pollution from human activities can be considered low.

Table 4-17 *Ambient Air Quality Surrounding of Banyuwangi Groundmounted PV (Primary Data)*

Pollutant	24-hour Concentration (µg/m³)			GoI Standards [(a)] (µg/m³)	WHO Guideline [(b)] (µg/m³)
	UA01	UA02	UA03		
SO_2	<23.30	<23.30	<23.30	150	125 (IT-1) 50 (IT-2) 20 (guideline)
NO_2	8.17	7.10	6.95	200	N/A
TSP	30.11	23.14	29.38	230	N/A
PM_{10}	18.65	13.88	18.22	75	150 (IT-1) 100 (IT-2) 75 (IT-3) 50 (guideline)
$PM_{2.5}$	5.29	4.17	5.10	55	75 (IT-1) 50 (IT-2) 37.5 (IT-3) 25 (guideline)

Source: Primary Data, December 2023

Notes:
UA01: Antongan, Kalipuro
UA02: Wr Kopat, Kalipuro
UA03: Lkr Kampung Baru, Bulusan
[(a)] GR 22/2021 Appendix VII for air quality standard;
[(b)] N/A stands for Not Available. Values are taken from Air Quality Guidelines Global Update (World Health Organization (WHO), 2005). *Interim targets (IT-1, IT-2, IT-3) are provided in recognition of the need for a staged approach to achieving the recommended guidelines. IT-2 would be a reasonable and feasible goal for developing countries*

[10] National standard refers to Government Regulation No. 22 of 2021 Appendix VII; International standard refers to WHO's Air Quality Guidelines Global Update (2021)

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A secondary data of the AMDAL baseline results has been reviewed. The ambient air sampling was reported to be taken in the period of 6th to 20th October 2023. Samplings were conducted at three locations, which are one location taken in the Krajan Village, and two locations taken around the project area (Kalipuro Village) by an accredited laboratory using the methodology as per the Indonesian Regulation. Summary of the ambient air analysis results taken from the AMDAL are provided in **Table 4-18** and **Table 4-19** below.

Table 4-18 *Ambient Air Quality Sampling Location Based on AMDAL Secondary Data*

Location Code	Sampling Date	Location	Coordinate (UTM)
AA-1	6-20th October 2023	Wr. Kopat, Kalipuro Village	209125, 9096605
AA-2	6-20th October 2023	Surrounding access to Project Area (Krajan, Kalipuro Village)	209199, 9097063
AA-3	6-20th October 2023	Project Area (Secang Timur, Kalipuro Village)	209449, 9098211

Table 4-19 *Ambient Air Quality Result Based on AMDAL Secondary Data*

Pollutant	24-hour Concentration (µg/m³)			GoI Standards [(a)] (µg/m³)
	AA-1	AA-2	AA-3	
TSP	138.99	98.36	39.89	230
SO_2	88.6	77.3	69.3	150
CO	1,145	1,145	1,145	10000
NO_2	77	69	58	200

Source: Secondary Data, AMDAL Baseline of October 2023, Surveyor Indonesia
[(a)] GR 22/2021 Appendix VII for air quality standard;

The AMDAL Air Ambient quality baseline data above showed compliance with the national standards and is still within the WHO guideline for the applicable parameter (SO_2). Copies of the air quality analysis report from the laboratory are provided in **Appendix E**.

4.1.9 Noise and Vibration

4.1.9.1 Noise

Noise level measurements are conducted within the settlement areas similar to ambient air sampling as they are indicated as sensitive receptors nearby the Project area including transmission line. The measurement covers 24-hour sampling duration as per the Indonesian Regulation requirement and 48-hour sampling duration to supplement the international standard requirements as stipulated in the WBG EHS Guidelines. During the measurement, some noises occurred such as noise from passing vehicles and prayer calls at the mosques, which interrupted the noise measurement although it was only temporary.

The results of noise measurement are provided in **Appendix F**. The day-night (Ldn) noise level measurement of 24-hour sampling duration shows compliance with the national standards. Noise level measurement results for 48-hour sampling duration shows compliance for day-time (Ld) measurement. The result noise quality showed

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exceedance against the WBG EHS Guidelines for night-time (Ln) at NS01 and NS02, while Ln for NS03 (Bulusan) complies with the guideline.

Noise measurements were conducted using the continuous and manual Sound Level Meter (SLM). The continuous SLM logged and recorded noise levels over five-minute period. Day and night averaging values were calculated as per IFC Guidelines; daytime being defined as 7 AM to 10 PM and night-time is defined as 10 PM to 7 AM. The results of these calculations were presented in **Table 4-20** below. The noise level measurement report from the laboratory is provided in **Appendix F**.

Table 4-20 *Result of Noise Level Measurement (48 hours)*

Parameter [a]	Unit	Quality Standards		Measurement Result					
				NS01		NS02		NS03	
		GoI [b]	WHO [c]	Day 1	Day 2	Day 1	Day 2	Day 1	Day 2
Ld	dB(A)	-	55	52.11	51.11	52.94	52.89	43.12	43.07
Ln	dB(A)	-	45	**50.86**	**51.20**	**49.97**	**49.25**	42.32	41.49
Ldn	dB(A)	55	-	53.74	53.52	53.73	53.39	45.01	44.53

Source: Primary Data, December 2023 and January 2024

Notes:

NS01: Antongan, Kalipuro

NS02: Wr Kopat, Kalipuro

NS03: Lkr Kampung Baru, Bulusan

(a) Ld is the A-weighted equivalent continuous sound pressure level for the day time period from 6.00 am to 10.00 pm. Ln is the A-weighted equivalent continuous sound pressure level for the night time period from 10.00 pm to 6.00 am. Ldn is The A-weighted equivalent continuous sound pressure level for day - night time period with 3 decibel penalty applied to night-time levels (refer to Decree of the Environment State Ministry No. 48 of 1996 regarding Ambient Noise Level Standards);

(b) Noise quality standards of the Government of Indonesia (GoI) are based on Decree of the Environment State Ministry No. 48 of 1996 regarding Ambient Noise Level Standards (The Minister of Environment and Forestry of Republic of Indonesia (MoEF), 1996)

(c) Values for WHO standards are taken from Guideline for Community Noise (WHO, 1999).

Measurement at NS01 was conducted within a settlement area, near to a public prayer house (*musholla*) and adjacent to the main road access. Measurement at NS02 was taken within a settlement area and adjacent to the main access road to the project site. During the sampling, noise was observed mainly generated from traffic at the main road junction, recreational activities especially during weekend and prayer calls and recitation although prayer calls are in short duration. NS03 sampling location is located adjacent to the boarding school and residential where noise is mainly generated from prayer calls and recitation (short duration).

Activities observed at NS01 and NS02 were limited to domestic activities with no excessive noise identified. Prayer calls and recitations from the mosque using loudspeakers occurred at certain times (during prayer times only), which is in short duration.

In order to comply with the Ministry of Environmental (MoE) Decree Number 48 of 1996, an ad hoc on the spot measurement was also taken to obtain the day-night noise levels (Lsm). Two ad hoc sampling were taken at the same locations with the 48-hour measurement. Results showed that the ambient day-and-night noise level (Lsm) at all sampling locations were well within the Government standards.

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Table 4-21 *Calculated GoI Day-Night Noise Levels (L_{sm}) at All Sampling Locations*

Location	Location Category	Noise Level Standard [(a)] (L_{sm})	Measurement Result (L_{sm})
NS01	Residential and adjacent with prayer room and main road	55	53.63
NS02	Residential adjacent the public access/main road	55	53.56
NS03	Residential and adjacent with the Islamic Boarding School	55	44.77

Source: Primary Data, December 2023
Notes:
[(a)] Standards were obtained from MoEF Decree No 48 of 1996 about Ambient Noise Level Standards; (The Minister of Environment and Forestry of Republic of Indonesia (MoEF), 1996)

A secondary data of the AMDAL baseline results has been reviewed. The noise sampling was conducted during the same period and at the same location as the air quality sampling. Samplings were conducted in 24-hour sampling duration as per the Indonesian Regulation requirement and by an accredited laboratory using the methodology as per the Indonesian Regulation. Summary of the ambient noise analysis results taken from the AMDAL are provided in **Table 4-22** and **Table 4-23**.

Table 4-22 *Noise Level Measurement Location Based on AMDAL Secondary Data*

c	Sampling Date	Location	Coordinate (UTM)
NSA-1	6-20th October 2023	Wr. Kopat, Kalipuro Village	209125, 9096605
NSA-2	6-20th October 2023	Surrounding access to Project Area (Krajan, Kalipuro Village)	209199, 9097063
NSA-3	6-20th October 2023	Project Area (Secang Timur, Kalipuro Village)	209449, 9098211

Source: Secondary Data, AMDAL Baseline of October 2023, Surveyor Indonesia

Table 4-23 *Noise Level Measurement Result Based on AMDAL Secondary Data*

Location	Location Category	Noise Level Standard [(a)] (L_{sm})	Measurement Result (L_{sm})
NSA-1	Wr. Kopat, Kalipuro Village	55	56.6
NSA-2	Surrounding access to Project Area (Krajan, Kalipuro Village)	70	54.6
NSA-3	Project Area (Secang Timur, Kalipuro Village)	70	52.6

Source: Secondary Data, AMDAL Baseline of October 2023, Surveyor Indonesia
[(a)] MoEF Decree No 48 of 1996 about Ambient Noise Level Standards

The AMDAL noise level measurement baseline data above showed compliance with the national standards and is still within the WBG EHS Guidelines for the noise level standard except noise measurement at NSA-1 (residential area).

4.1.9.2 Vibration

Measurement of vibration level was carried out at three (3) locations within settlement areas near the access road of project site and transmission line. The results of

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measurement are provided in **Table 4-24** where there is no indication of exceedance to the regulatory threshold as set out in Appendix I of the MoE Decree Number 49 of 1996 regarding Vibration Standards. Vibration measurement result report from the laboratory is presented in **Appendix F**.

Table 4-24 *Vibration Measurement Result at All Sampling Locations*

No	Frequency (Hz)	Measurement Result (10^{-6}) m			Vibration Standard (10^{-6}) m [(a)]
		VB01	VB02	VB03	
1	4	<0.0021	<0.0021	<0.0021	<100
2	5	<0.0017	<0.0017	<0.0017	<80
3	6.3	<0.0018	<0.0018	<0.0018	<70
4	8	<0.0020	<0.0020	<0.0020	<50
5	10	0.0035	0.0030	0.0031	<37
6	12.5	0.0037	0.0034	0.0035	<32
7	16	0.0033	0.0032	0.0034	<25
8	20	0.0045	0.0038	0.0040	<20
9	25	<0.0031	<0.0031	<0.0031	<17
10	31.5	0.0049	0.0040	0.0046	<12
11	40	<0.0041	<0.0041	<0.0041	<9
12	50	<0.0028	<0.0028	<0.0028	<8
13	63	<0.0023	<0.0023	<0.0023	<6

Source: Primary Data, December 2023
Notes:
VB01: Antongan, Kalipuro
VB02: Wr Kopat, Kalipuro
VB03: Lkr Kampung Baru, Bulusan
[(a)] Standards were obtained from MoE Decree No 49 of 1996;

4.1.10 Traffic

4.1.10.1 Road Access Condition

As mentioned on Section 3 Project Description, the Project during construction phase will utilize Tanjung Perak Seaport and Banyuwangi seaport and existing road to access the main Project facilities at Kalipuro Subdistrict. The road condition observation at proposed access road is described as below:

1. Raya Banyuwangi – Situbondo Road
   Raya Banyuwangi - Situbondo Road is a national collector road that connects Situbondo Regency and Ketapang Port to Banyuwangi and Jember Regency with road width about 6 m for each line at TR-2 junction, with the road categorized as 2/2D (two-way-two-line divided). While at another segment (nearby the Ketapang Port), the road width is about 7 – 8 m undivided. The road pavement condition of this road is good with asphalts pavement. The road friction or land use type along the road access is identified as mixed use between commercial and settlement, offices, tourism attraction (hotels) and cultivation area/paddy field. The sensitive receptor such as school, worship place, public market, hotel, and government offices was identified as well along the road access (see **Figure 4-11**). The heavy vehicle

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from Ketapang Port direction is not allowed to directly passing Banyuwangi City, therefore the heavy vehicles are redirect to Argopuro Road and Raden Wijaya Road.



(a) Raya Banyuwangi – Situbondo Road condition (TR2)



(b) Junction Raya Banyuwangi – Situbondo and Argopuro Road (TR2)



(c) Road sign of heavy vehicle prohibition at Raya Banyuwangi - Situbondo

Figure 4-11 *Road Condition of Raya Banyuwangi – Situbondo Road (TR2)*

2. <u>Argopuro Road and Raden Wijaya Road</u>

Argopuro Road and Raden Wijaya Road has similar conditions with road width between 7 – 8 m, and road pavement condition of these roads are good with asphalts pavement. The road friction or land use type along the road access is identified as mixed use between commercial and settlement, offices, industrial, and cultivation area/paddy field. The sensitive receptor such as school, worship place, public health facilities and offices was identified along the road access as well as the other facilities such as industry that likely using this road for their heavy vehicle access (see **Figure 4-12**). Some of the heavy vehicles are identified parking at the roadside of Argopuro Road. The railroad was also identified crossing both Argopuro and Raden Wijaya Road. The road signs for the railroad were available at both roads.

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(a) Road condition at Argopuro Road



(b) Railroad at Argopuro Road



(c) Road condition at Raden Wijaya Road



(d) Railroad at Raden Wijaya Road

Figure 4-12 *Road Condition of Argopuro Road and Raden Wijaya Road*

3. Joyoboyo Road

Joyoboyo Road has road width between 4 – 5 m, this road categorized with class IIIC collector road which can accommodate vehicle with maximum vehicle width is 2.1 m, length 9 m, and the heaviest axle load of 8 tonnes. The road pavement condition generally has good asphalt conditions and fair with pavement condition in several segments. This road is an access to the PTPN plantation area (Project area). The bridges were also identified during the traffic observation; the bridges width is about 3.5 – 4 meters. Therefore, the vehicles need to be passing alternately at the bridges. During the traffic observation identified the weekly market (every Wednesday morning) occurred closing the public access, the vehicles need to detour to avoid the morning market. In additions, the sensitive receptor such as school, worship place, public health facilities and offices was identified along the road access (see **Figure 4-13**).

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(a) Joyoboyo Road condition



(b) Heavy vehicles passing Joyoboyo Road



(c) Bridge condition at Joyoboyo Road



(d) Bridge condition at Joyoboyo Road



(e) Joyoboyo Road closure sign due to weekly morning market



(f) Morning weekly market condition at Joyoboyo Road

Figure 4-13 *Road Condition of Joyoboyo Road*

Regarding the road safety perspective, the road sign indicating at sensitive receptor location (school, worship places), speed limit, and turn sign was identified along the existing access road. During the traffic observation, heavy vehicles parking identified parked at the roadside of Argopuro Road. The road user behaviour was also observed does not comply with safety standard such as not wearing helmet and carrying exceed load for motorcycle user. In addition, the traffic accident was observed occurred at the Argopuro Road at the railroad crossing. Based on site observation, the accident occurred due to the break failure of heavy vehicle that cannot control the vehicle speed on the downhill road. There is no injured victim, the accident causes short traffic congestion and delay on train schedule.

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(a) Road sign indicated zebra-cross area at Joyoboyo Road



(b) Heavy vehicles parked at side of the Argopuro Road



(c) Unsafety behaviour (not wearing helmet)



(d) Unsafety behaviour (carrying exceeded load and not wearing helmet)



(e) Traffic accident at Argopuro Road

Figure 4-14 *Road Sign and Unsafety Behaviour along the Existing Road*

In addition, referring to online publish news[11], the traffic accident occurred at Banyuwangi Regency in 2023 recorded 1,304 cases with death victim 220 persons, major injuries 11 persons, and minor injuries 1,476 persons. There is no further information about the detailed of the traffic accident-causing reasons.

[11] https://surabaya.kompas.com/read/2024/01/04/183821778/angka-kecelakaan-di-banyuwangi-meningkat-1304-kejadian-220-korban-jiwa#:~:text=BANYUWANGI%2C%20KOMPAS.com%20%2D%20Angka,2022%20yang%20mencapai%201.187%20kasus.

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4.1.10.2 Traffic Counting

The land traffic component study is associated with vehicle mobilisation of equipment and material during construction phase of the project. The traffic baseline survey was conducted on period 7 and 8 January 2024 capturing weekday and weekend condition at 2 (two) sampling points at existing access road that expected will be use as project access road (please see **Figure 4-15** for traffic counting location). Both Joyoboyo Road and Argopuro Road categorized as collector road, while Banyuwanagi – Situbondo Road is national collector road that connects Situbondo and Banyuwangi Regency.

Table 4-25 *Traffic Counting Location Profile*

Traffic ID	Road Segment	Road Type	Road Status	Road Width	Road Pavement
TR 1	Joyoboyo Road	2/2 UD	Collector	4 - 5 m	Asphalt (Good to fair)
	Argopuro Road	2/2 UD	Collector	7 – 8 m	Asphalt (Good)
TR 2	Banyuwangi – Situbondo Road	2/2 D	National collector	6 m (each way)	Asphalt (Good)

Source: AFRY's Baseline Traffic Survey January 2024

Traffic counting survey was carried out on potential peak time of traffic flow, in the morning (6AM – 8AM), noon (11PM – 1PM), afternoon (4PM – 6PM) to obtain representative traffic data. The purpose of traffic counting survey is to collect field data on traffic volume (V) and road capacity (C) which later be used to analyse road level of service (LoS)[12] at existing road that will be used as proposed project access road.

Table 4-26 *Vehicle Volume at Traffic Sampling Location*

Traffic ID	Road Segment	Time		Volume (Vehicle/hour)					Total Volume
				MC	LV	MHV	LB	LT	
TR 1	Joyoboyo Road	Week-day	Morning	1900	79	15	0	2	1994
			Noon	1074	133	12	0	1	1220
			Afternoon	1511	134	8	0	0	1653
		Week end	Morning	974	65	6	0	0	1045
			Noon	1010	130	9	0	0	1148
			Afternoon	1296	140	5	0	1	1441
	Argopuro Road	Week-day	Morning	1313	130	57	2	19	1520
			Noon	664	167	75	3	25	933
			Afternoon	1049	147	66	0	21	1282
		Week end	Morning	647	79	32	4	15	776
			Noon	541	138	36	3	15	733
			Afternoon	630	117	37	2	9	794
TR 2	Banyuwangi -	Week day	Morning	3114	370	35	2	54	3573
			Noon	1681	543	52	7	69	2351
			Afternoon	2260	556	49	2	78	2944

[12] Level of Service (LoS) is a term used to qualitatively describe the operating conditions of a roadway based on factors such as traffic speed, volume, and density for a highway. Determination of LoS refers to Highway Capacity Manual, which level designated with a letter, from A to F, with A representing the best operating conditions and F the worst.

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Traffic ID	Road Segment	Time		Volume (Vehicle/hour)					Total Volume
				MC	LV	MHV	LB	LT	
	Situbondo Road	Week end	Morning	1894	347	31	10	29	2309
			Noon	1484	580	42	8	29	2142
			Afternoon	1855	556	38	7	29	2484

Source: AFRY's Baseline Traffic Survey January 2024
Notes: MC = Motorcycle; LV = Light Vehicle; MHV = Medium Heavy Vehicle; LB = Large Bus; LT = Large Truck

***Table 4-27** Road Performance Results at Traffic Sampling Location*

Traffic ID	Road Segment	Road Performance			
		Volume (pcu/hour)	Road Capacity (pcu/hour)	V/C ratio	LoS
TR 1	Joyoboyo Road	1160	1989	0.58	A
	Argopuro Road	707	3114	0.23	A
TR 2	Situbondo - Banyuwangi Road	2547	1660	0.77	C

Source: AFRY's Baseline Traffic Survey January 2024
Notes: PCU = Passenger Car Unit; V = Traffic Volume; C = Road Capacity; LoS = Level of Service

The traffic counting results (**Table 4-26** and **Table 4-27**) showed the traffic volume in general during weekdays is high weekends. The highest total vehicle/hour happens during morning and afternoon time on weekdays with dominated by motorcycle indicated this road is used by community as a main access to go to work/school or doing other activities. The road performance LoS level at TR1 (Joyoboyo Road and Argopuro Road) categorized as LoS level A (negligible delay or congestion) free flow traffic with unimpeded maneuverability, stopped delay at signalized intersection is minimal. While, at TR1 (Situbondo – Banyuwangi Road) the LoS level is on category C which delay or congestion likely to occurred, have stable operation with somewhat restriction in making lane changes. The LoS at Situbondo – Banyuwangi Road is understandable because this road is national collector road and become the main road access that connect Ketapang Port and Banyuwangi Regency.

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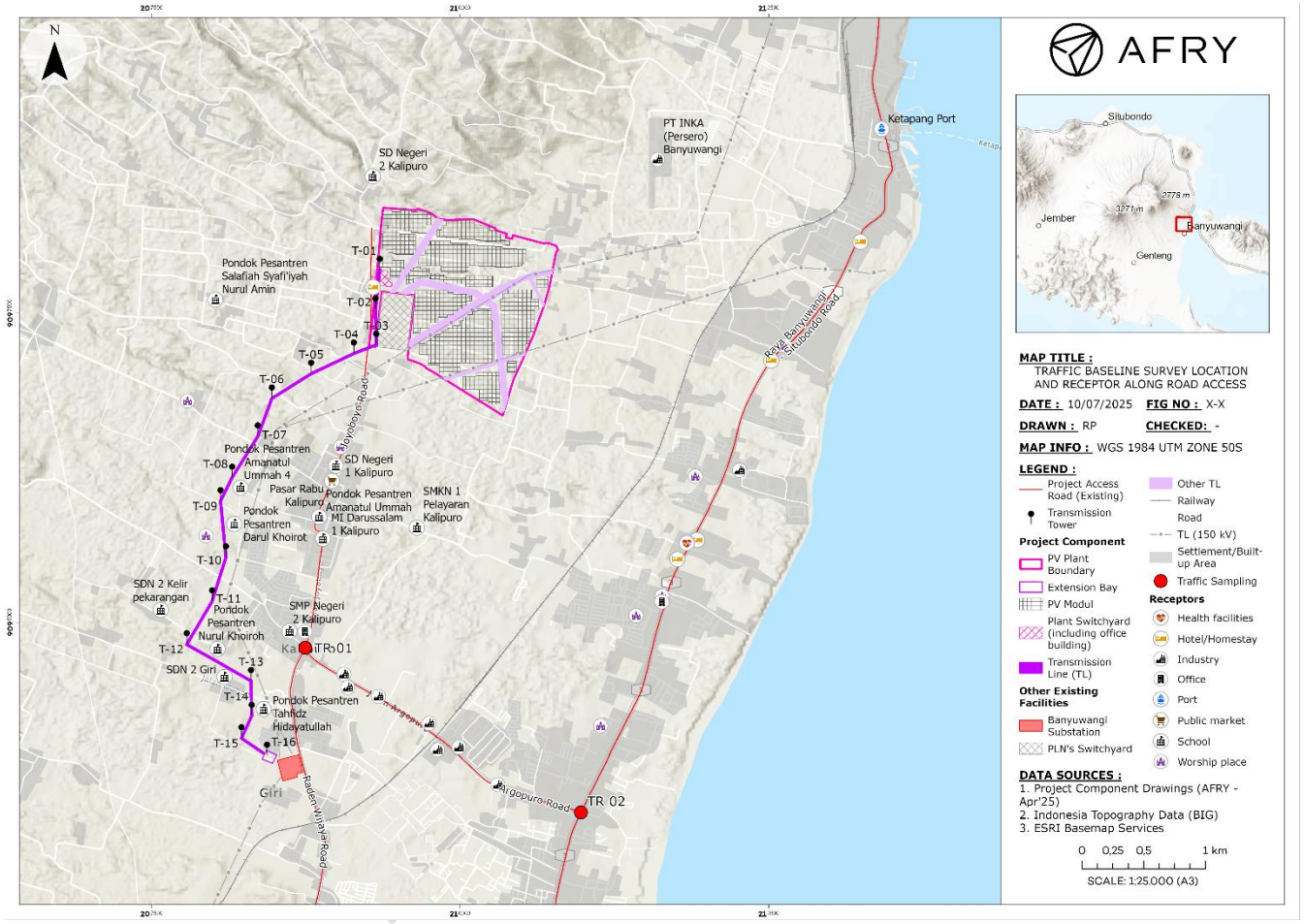


Figure 4-15 *Traffic Counting Location and Sensitive receptor along Proposed Road Access*

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4.1.11 Landscape and Visual

The location of LVIA observation was determined by consideration of ZTV (Zone of Theoretical Visibility) including topographical and land use condition to assess the location of potential visual receptors. The ZTV generated by using Geographic Information System (GIS)-based tool to identify the likely (or theoretical) extent of visibility of a development. The ZTV analysis for this Project was conducted by using ArcGIS Pro software and input data of Digital Elevation Model (DEM) from Indonesia Digital Elevation Model National (DEMNAS) data. The DEMNAS provides elevation information with a spatial resolution of 8 m.

The observation location of LVIA point or visual receptors identified at the settlement, public road, and tourism spots that has significant susceptible of sight towards to Project area. The LVIA observation point location and the ZTV of Solar PV (PV) module and transmission tower are shown in **Figure 4-16** and **Figure 4-17** below. The ZTV assessment did not consider existing screening such as buildings and vegetation cover only consider terrain above ground which indicates the line of sight. The ZTV map show the PV module is visible from the lowest elevation area at the east side of Banyuwangi PV location considering the PV is installed at elevation around 110 m. The transmission tower located within elevation 100 – 160 m, with the highest elevation is at T-01 and the lowest is T-15, resulting the visibility area of transmission tower is visible almost at surrounding area of transmission tower consider the topographic conditions tends to be flat.

The site observation was conducted in January 2024 to capturing the photomontage from visual receptors in human eye level towards the Project site location. The site observation resulting the PV area likely visible from settlement area at the west side of Banyuwangi PV (LV01) and unlikely visible from public road nearby settlement at LV01 due vegetation cover and settlement. In addition, future development of PLN's switchyard (other development activities) is expected will be blocked the view towards PV installation at LV01. The PV visibility is slightly visible from settlement area at East side of Banyuwangi PV (LV02) considering the view from settlement area is covered by vegetation. While the transmission tower area likely to be visible crossing the existing public road and visible from settlement (LV03). The existing transmission line also identified will be parallel to proposed project transmission line. This indicated the community or public road user has been familiar with the view of transmission line or high object visibility. The photomontage results from site observation are shown in **Figure 4-18** below.

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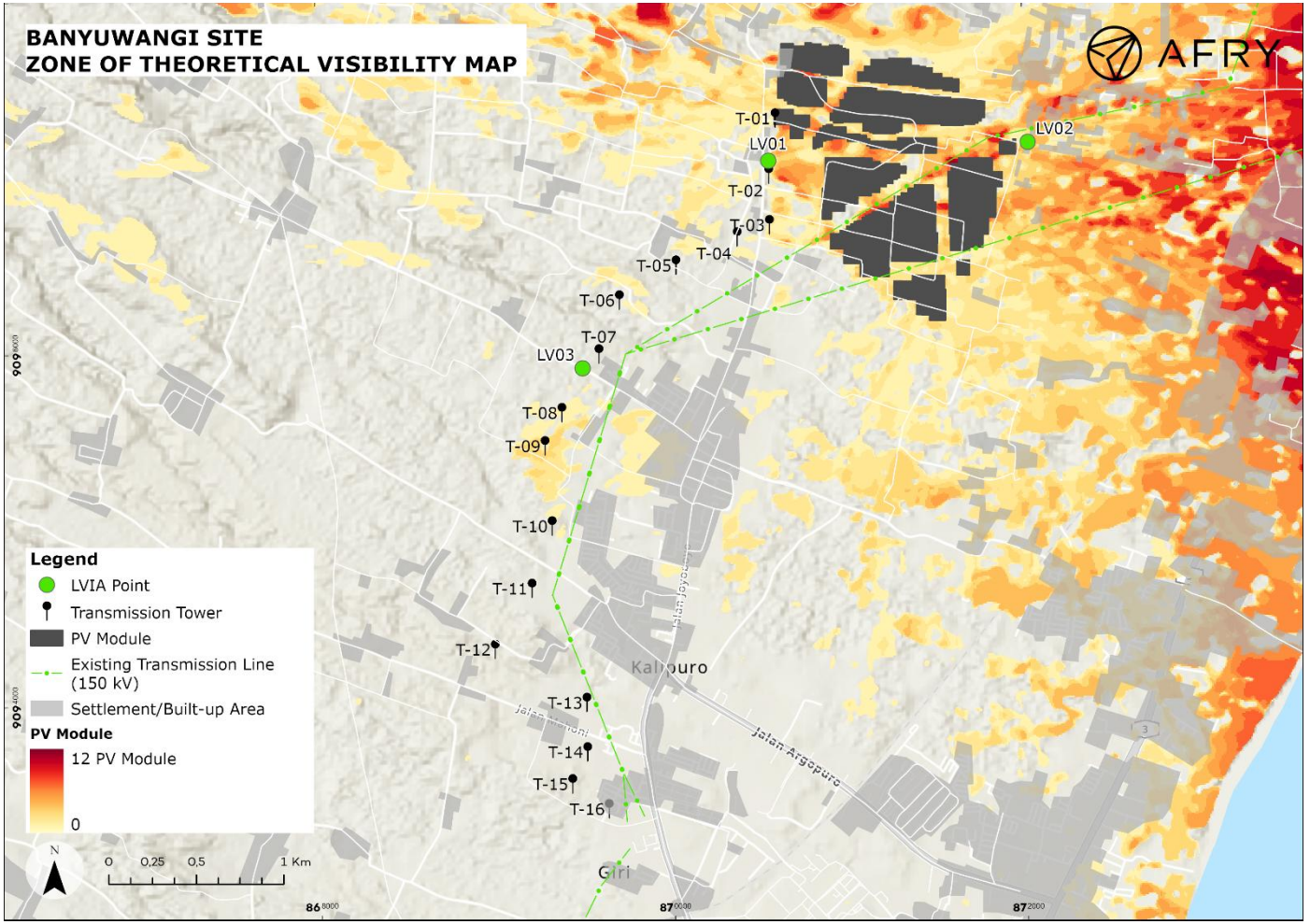


Figure 4-16 *Zone of Theoretical Visibility Map from Solar PV Component*

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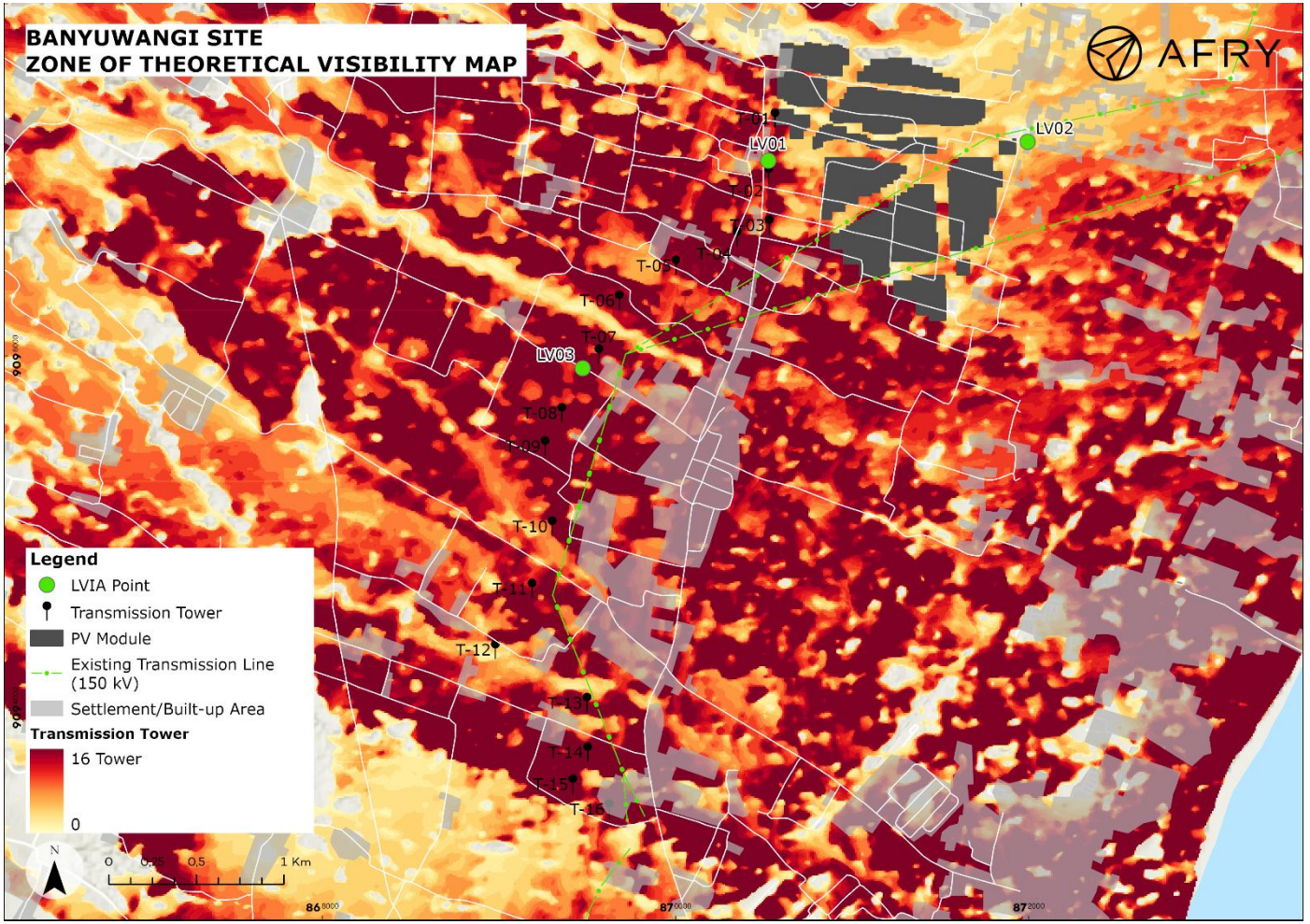


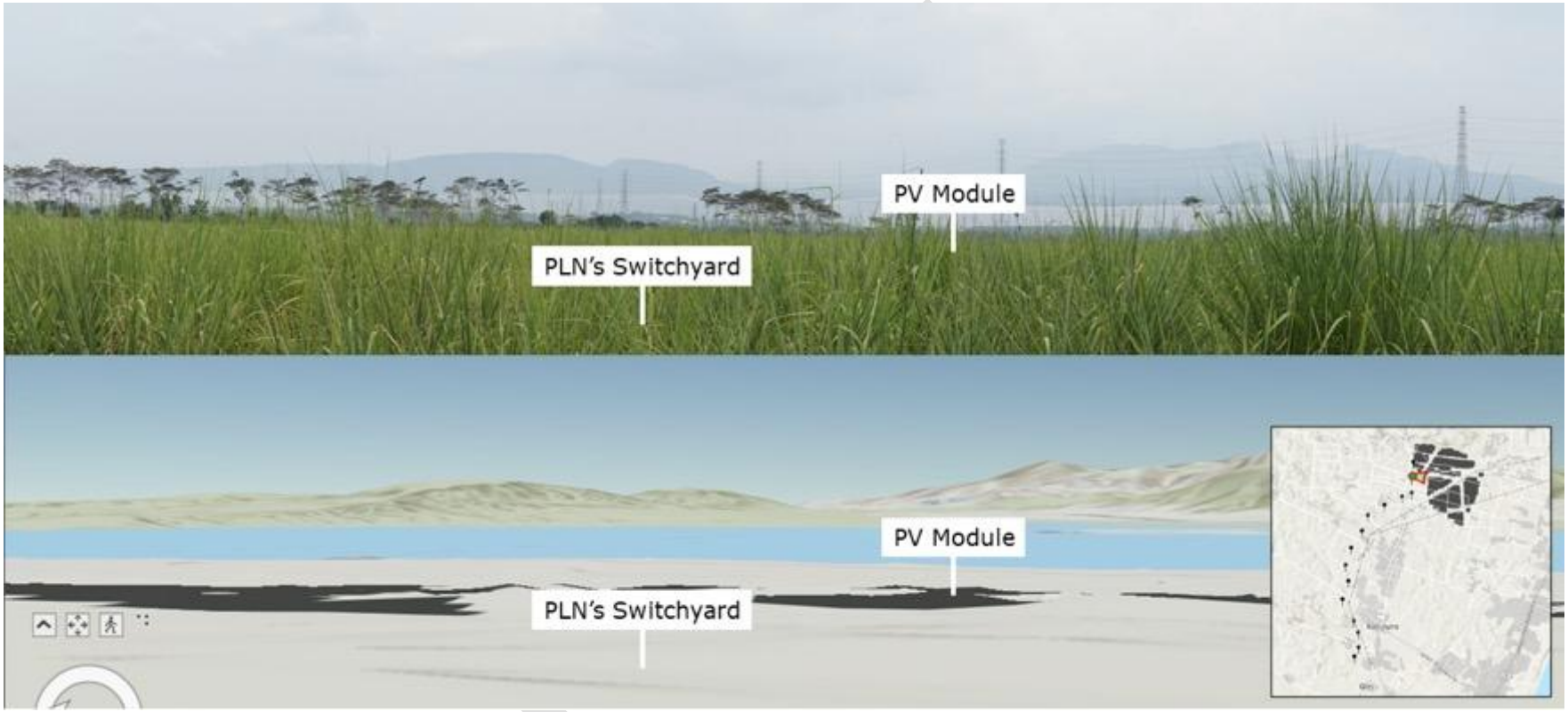
Figure 4-17 *Zone of Theoretical Visibility Map from Transmission Tower Component*

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ID: LV01

Visual Receptor: nearby settlement adjacent with PLN's Switchyard and Banyuwangi PV boundary

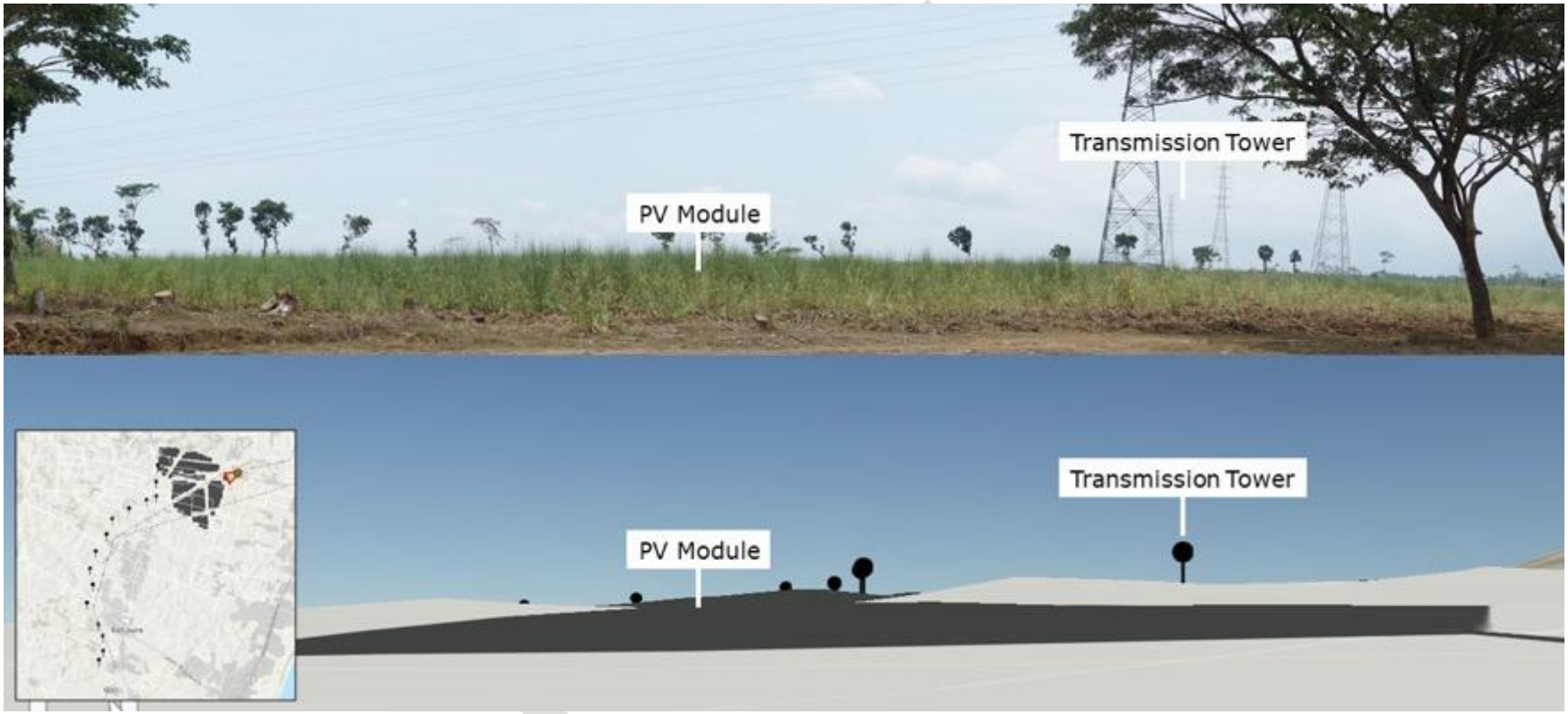


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ID: LV02

Visual Receptor: nearby settlement ± 25 m to the East of PV module



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ID: LV03

Visual Receptor: Road user at transmission tower

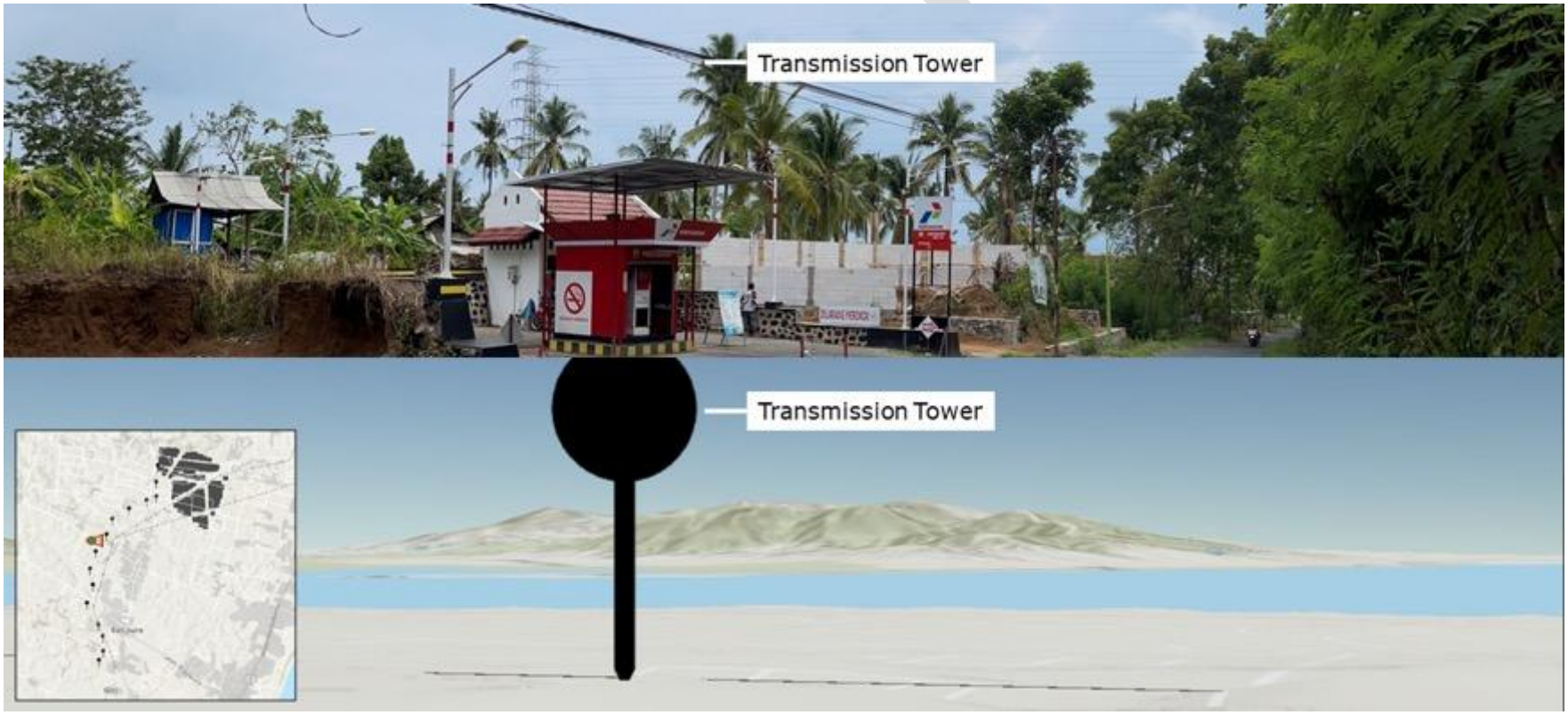


Figure 4-18 *Photomontage View from LVIA Point Towards Project Component (PV Module and Transmission Tower)*

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4.1.12 Biodiversity

4.1.12.1 Biodiversity Hotspot

The proposed Banyuwangi solar PV project site is located within the Sundaland Biodiversity Hotspot. The Sundaland Biodiversity Hotspot covers the western half of the Indonesian archipelago dominated by Borneo, Sumatra, and Java Islands (**Figure 4-19**)[13].



Figure 4-19 *Project sites are within Sundalan Biodiversity Hotspot[14]*

4.1.12.2 Ecoregion

Banyuwangi site is also located in East Java within The Eastern Java-Bali Rain Forests Ecoregion[15] in the Javan-Bali Tropical Rainforests Bioregion[16] (**Figure 4-20**).



Figure 4-20 *Ecoregion within Javan-Bali Tropical Rainforests Bioregion*

[13] CEPF. 2001. Ecosystem Profile: Sumatra Forest Ecosystems of the Sundaland Biodiversity Hotspot, Indonesia.
Source: *https://www.cepf.net/sites/default/files/sundaland-ecosystem-profile-2001-english.pdf*

[14] CEPF. 2001. Explore the Biodiversity Hotspot. Source: *https://www.cepf.net/our-work/biodiversity-hotspots*

[15] Wikramanayake E. Eastern Java-Bali Rainforests. One Earth. Source: *https://www.oneearth.org/ecoregions/eastern-java-bali-rainforests/*

[16] One Earth. Javan-Bali Tropical Rainforest Bioregion. Source: *https://www.oneearth.org/bioregions/javan-bali-tropical-rainforests-im17/*

4.1.12.3 International Recognized Area

4.1.12.3.1 UNESCO World Heritage Site and Biosphere

There is only one natural UNESCO WHS site in Java, namely Ujung Kulon National Park (UKNP), located in the western part of this island. Both Project sites and vicinity did not overlap with UKNP and are located more than 500 km from the project area. Therefore, UKNP is not considered relevant for further assessment of this Project in ESIA.

4.1.12.3.2 Key Biodiversity Area (KBA)

There are four KBAs identified located within radius of 50 km from Banyuwangi PV project site. All KBAs are identified as Important Birds and Biodiversity Area (IBA), with one KBA identified as an Alliance for Zero Extinction (AZE) site. The four KBAs namely Bali Barat, Baluran, Gunung Ijen and Pantai Raung (**Appendix C Table C-1**).

Based on high-level desktop and GIS analysis, there is no contiguous natural habitat between the project site and those KBAs and no direct impact of the project on the existing KBAs. Therefore, the KBAs within radius of 50 km from the project is not considered to be relevant for further assessment of this Project in ESIA assessment.

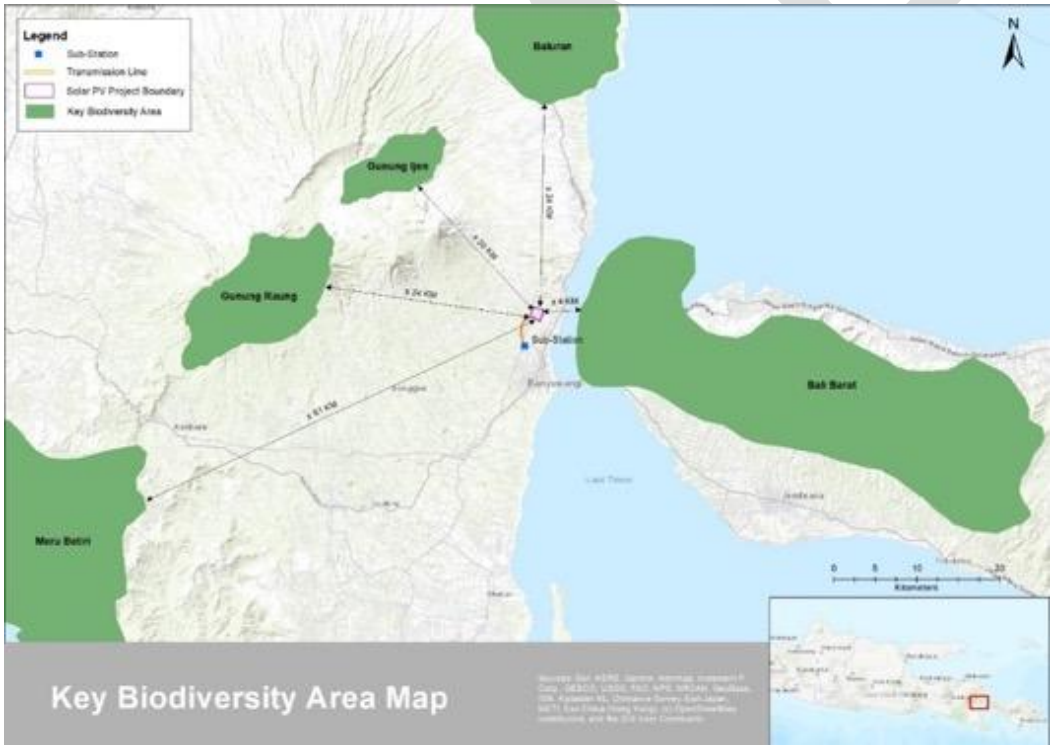


Figure 4-21 *Key Biodiversity Area within 50km of Banyuwangi Site*

4.1.12.3.3 Ramsar Site

The Ramsar sites in Indonesia are Berbak (Ramsar site no. 554), Danau Sentarum (Ramsar site no. 667), Pulau Rambut Wildlife Reserve (Ramsar site no. 1987), Rawa Aopa Watumohai National Park (Ramsar site no. 1944), Sembilang National Park (Ramsar site no. 1945), Tanjung Puting National Park (Ramsar site no. 2192) and Wasur National Park (Ramsar site no. 1624). As none of these seven sites are in Central Java Province or within 50 km of the project area, Ramsar sites are not considered to be relevant for further assessment of this Project in ESIA.

4.1.12.4 Endemic Birds Area

Based on the Endemic Birds Area (EBA) by Birdlife International, Banyuwangi site overlaps with the Javan Coastal Zone (EBA 160)[17] and located around 8 km from the Java and Bali Forest (EBA 161)[18] including the Gunung Raung and Gunung Ijen (**Figure 4-22** Endemic Birds Area within 50km of Banyuwangi Site). There are four restricted-range species on this EBA, including critically endangered Javan lapwing (*Vanellus macropterus*), endangered Javan white-eye (*Zosterops flavus*), vulnerable Javan coucal (*Centropus nigrorufus*), and least concern Javan plover (*Charadrius javanicus*). Indonesian governments protect all of those species.

The restricted-range species inhabiting the Javan Coastal Line are also potentially inhabited Banyuwangi site and its vicinity area. Field survey was conducted during baseline study for assessing potential species triggered Javan Coastal Zone EBA.

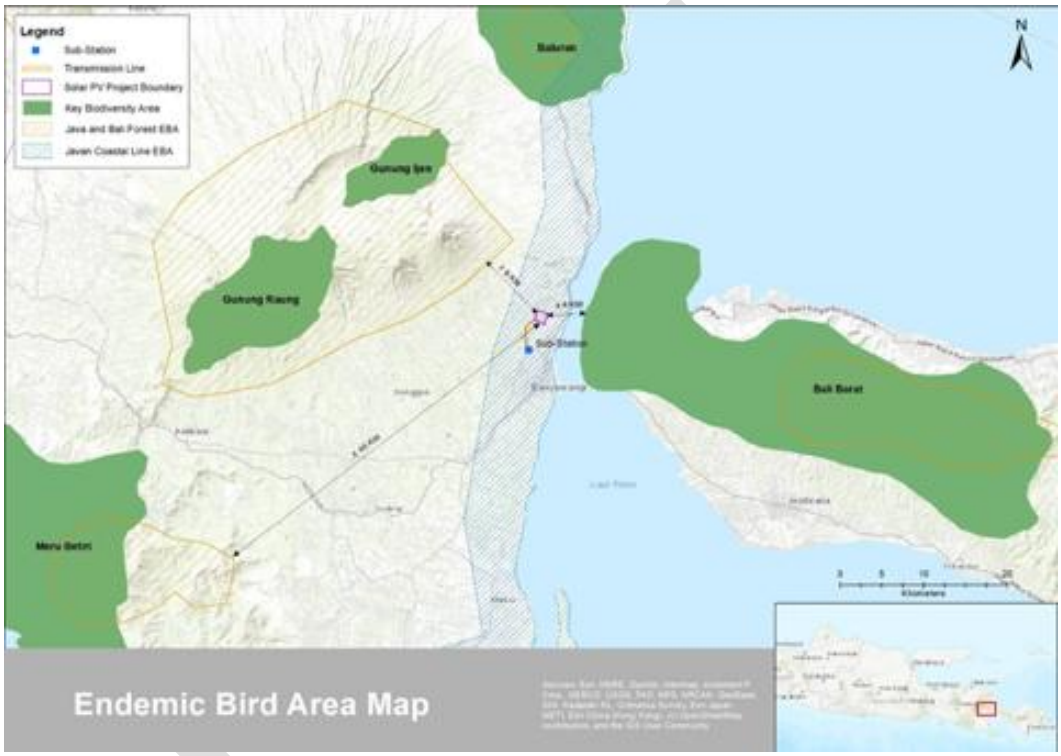


Figure 4-22 *Endemic Birds Area within 50km of Banyuwangi Site*

A list of potential bird species inhabited in the EBA area within 50 km of the project site is presented in **Appendix C Table C-3**. Some of the restricted birds within this EBA might be inhabited within Banyuwangi Site and vicinity. Therefore, the Critical Habitat Screening was conducted for the potential species triggered Java and Bali Forest EBA and Javan Coastal Zone EBA (see Sub Section 4.1.12.6). Furthermore, field observation was conducted during baseline study.

[17] https://datazone.birdlife.org/eba/factsheet/160
[18] https://datazone.birdlife.org/eba/factsheet/161

4.1.12.5 Species of Conservation Significance

The fauna and flora survey results were analyzed and categorized based on their conservation significance. Four different criteria are used to determine conservation significance including.

- Indonesian Law, global policy, migratory, and endemicity. The Indonesian Government protects its flora and fauna by regulation under Government Regulation Number 7 Year 1999. The latest protected flora and fauna list are registered under Ministry of Environment and Forestry Regulation Number P.106/MENLHK/SETJEN/KUM.1/12/2018 as further explanation and technical instructions of GR no 7, year 1999.
- Global policy to conserve flora and fauna refer to the IUCN Red List of Threatened Species. Species with status as Vulnerable (VU), Endangered (EN), and Critically Endangered (CR) on IUCN Red List are considered species with conservation significance.
- Endemicity means flora and fauna species can only be found in a specific area, from national to smaller regions. Some of the endemic species may be include as Restricted range species. Restricted range species are terrestrial species with an estimated extent of occurrence (EOO) of less than 50.000 km^2. Near restricted range are species with EOO between 50.000-100.000 km^2. This is an additional category when no RR species is observed in specific taxa.
- Migratory species is species that move from one habitat to another at different times. They cannot live in the same environment due to seasonal food, sunlight, and temperature limitations. During the wintering season, Indonesia is visited mainly by the migratory bird as a flyway between Asia and Australia, but some spend the wintering season in Indonesia.

Based on the criteria mentioned above, 53 species of flora and fauna are considered species with conservation significance including 47 birds, three mammals, one herpetofauna, and one flora species. A detailed list of species with conservation significance is in the

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Table 4-28 below. This list was develop based on field survey record during the dry season baseline survey and listed species on the scoping stage based on reliable sources that claim the species inhabited within the designated Ecologically Appropriate Areas of Assessment (EAAA). The source of data also refers to list of trigger species and other species not triggering Key Biodiversity Area (KBA) criteria from KBA within radius 50 km from the project site, the trigger species of Alliance for Zero Extinction (AZE) site, and the list species of Java and Bali Forest Endemic Bird Area (EBA). Those species were selected whether or not candidate Critical Habitat-qualifying species using criteria in line with global IUCN criteria and using data on Extent of Occurrence (EOO) in the IUCN Red List dataset. Furthermore, searches for 'endemic' and 'restricted-range' species, migratory/congregatory species in the Project area in reputable literature and online.

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Table 4-28 *List of species with conservation significance in EAAA of Banyuwangi PV Site*

No	Family	Scientific Name	Common Name	Status					Transects			
				IUCN	P.106	M	E	RRS	TB 1	TB 2	TB 3	TB 4
Bird												
1	Accipitridae	*Spilornis cheela*	Crested Serpent-eagle	LC	**P**				VP1		VP3	
2	Cisticolidae	*Orthotomus sepium*	Javan Tailorbird	LC			EJB		TB1		TB3	TB 4
3	Estrildidae	*Lonchura leucogastroides*	Javan Munia	LC			EI		TB1			
4	Halcyonidae	*Halcyon cyanoventris*	Javan Kingfisher	LC			EJB		TB1	TB2	TB3	
5	Meropidae	*Merops philippinus*	Blue-tailed Bee-eater	LC		**M**				TB2		
6	Phasianidae	*Gallus varius*	Green Junglefowl	LC			EI		TB1	TB2		
7	Pittidae	*Hydrornis guajanus*	Javan Banded Pitta	LC	**P**		EJB		TB1			
8	Alcedinidae	*Alcedo euryzona*	Javan Blue-banded Kingfisher	CR								
9	Sturnidae	*Gracupica jalla*	Javan Pied Starling	CR								
10	Charadriidae	*Vanellus macropterus*	Javan Lapwing	CR								
11	Zosteropidae	*Zosterops flavus*	Javan White-eye	EN								
12	Chloropseidae	*Chloropsis sonnerati*	Greater Green Leafbird	EN								
13	Sturnidae	*Acridotheres melanopterus*	Black-winged Myna	EN								
14	Pycnonotidae	*Alophoixus bres*	Brown-cheeked Bulbul	EN								
15	Cuculidae	*Centropus nigrorufus*	Javan Coucal	VU								
16	Campephagidae	*Pericrocotus miniatus*	Sunda minivet	LC			E					
17	Muscicapidae	*Cyanoptila cumatilis*	Zappey's Flycatcher	NT		M						
18	Alcedinidae	*Todiramphus sanctus*	Sacred Kingfisher	LC		M						
19	Meropidae	*Merops leschenaulti*	Chestnut-headed Bee-eater	LC		M						
20	Cuculidae	*Clamator coromandus*	Chestnut-winged Cuckoo	LC		M						
21	Cuculidae	*Cuculus micropterus*	Indian Cuckoo	LC		M						
22	Cuculidae	*Cacomantis sonneratii*	Banded Bay Cuckoo	LC		M						
23	Cuculidae	*Cacomantis merulinus*	Plaintive Cuckoo	LC		M						
24	Cuculidae	*Chalcites basalis*	Horsfield's Bronze-cuckoo	LC		M						
25	Cuculidae	*Chrysococcyx xanthorhynchus*	Violet Cuckoo	LC		M						
26	Cuculidae	*Eudynamys scolopaceus*	Asian Koel	LC		M						
27	Zosteropidae	*Heleia javanica*	Javan Grey-throated White-eye	LC			E					
28	Megalaimidae	*Psilopogon javensis*	Black-banded Barbet	NT			E					
29	Ciconiidae	*Leptoptilos javanicus*	Lesser Adjutant	NT	**P**				From KBA List			
30	Ciconiidae	*Mycteria cinerea*	Milky Stork	EN	**P**				From KBA List			
31	Phasianidae	*Pavo muticus*	Green Peafowl	EN	**P**				From KBA List			

No	Family	Scientific Name	Common Name	Status					Transects			
				IUCN	P.106	M	E	RRS	TB 1	TB 2	TB 3	TB 4
32	Accipitridae	*Nisaetus bartelsi*	Javan Hawk-eagle	EN	**P**		E		From KBA List			
33	Phasianidae	*Arborophila javanica*	Chestnut-bellied Partridge	LC			E		From KBA List			
34	Phylloscopidae	*Phylloscopus grammiceps*	Sunda Warbler	LC			E		From KBA List			
35	Timaliidae	*Mixornis flavicollis*	Grey-cheeked Tit-babbler	LC			E		From KBA List			
36	Columbidae	*Ducula lacernulata*	Dark-backed Imperial-pigeon	LC			E		From KBA List			
37	Timaliidae	*Cyanoderma melanothorax*	Crescent-chested Babbler	LC			E		From KBA List			
38	Timaliidae	*Stachyris thoracica*	White-bibbed Babbler	LC			E		From KBA List			
39	Phasianidae	*Arborophila orientalis*	White-faced Partridge	VU			E		From KBA List			
40	Rhipiduridae	*Rhipidura euryura*	White-bellied Fantail	LC	**P**		E		From KBA List			
41	Megalaimidae	*Psilopogon armillaris*	Flame-fronted Barbet	LC	**P**		E		From KBA List			
42	Fringillidae	*Chrysocorythus estherae*	Mountain Serin	LC			E		From KBA List			
43	Pycnonotidae	*Ixos virescens*	Javan Bulbul	LC			E		From KBA List			
44	Apodidae	*Hydrochous gigas*	Waterfall Swift	NT	**P**		E		From KBA List			
45	Columbidae	*Ptilinopus porphyreus*	Pink-headed Fruit-dove	LC			E		From KBA List			
46	Accipitridae	*Pernis ptilorhynchus*	Oriental Honey-Buzzard	LC	**P**				From Lender's comment			
47	Accipitridae	*Accipiter gularis*	Japanese Sparrowhawk	LC	**P**				From Lender's comment			
48	Accipitridae	*Accipiter soloensis*	Chinese Sparrowhawk	LC	**P**				From Lender's comment			
Mammal												
49	Ceropithecidae	*Macaca fascicularis*	Long-Tailed Macaque	**EN**					TB1			
50	Hystricidae	*Hystrix javanica*	Sunda Porcupine	LC	**P**		EI		TB1			
51	Tupaiidae	*Tupaia javanica*	Horsfield's Treeshrew	LC			EI				TB3	
Herpetofauna												
52	Agamidae	*Bronchocela jubata*	Great Crested Canopy Lizard	LC			EI				TB3	
Flora												
53	Lamiaceae	*Tectona grandis*	Teak	**EN**								TB 4
Notes: CR=Critically Endangered; EN=Endangered; VU=Vulnerable; LC=Least Concern; DD=Data Deficient; P=Protected by Indonesian Government; M=Migratory; EJB=Endemic Java and Bali; EI=Endemic Indonesia; RRS=Restricted Range Species												

Referring to Indonesian Ministry of Environment and Forestry Regulation No. 106 of 2018, there are 14 protected species including 13 birds and one mammal are potentially inhabiting within the 50km radius and EAAA of Banyuwangi PV site.

Referring to the IUCN Red List data, there are three Critical Endangered (CR) bird species; nine Endangered (EN) species including seven birds, one mammal, and one plant; two Vulnerable (Vu) bird species; 11 migratory bird species and 29 endemic bird species. The other observed species are categorized into Least Concern (LC) and Near Threatened (NT).

All recorded species with conservation significance within the designated EAAA of Banyuwangi Solar FPV site were screened further using Critical Habitat (CH) criteria set by International Finance Corporation (IFC) to assess the likelihood of a site being within a critical habitat. The discussion of CH screening results is provided in the next subsection


Long-Tailed Macaque


Blue-tailed Bee-eater


Great Crested Canopy Lizard


Javan Kingfisher

Figure 4-23 *Several observed Species of Conservation Significance in the study area*

4.1.12.6 Critical Habitat Screening

Critical habitat is defined in IFC PS6 as areas with "high biodiversity value, including habitat of significant importance to Critically Endangered and/or Endangered species; habitat of significant importance to endemic and/or restricted-range species; habitat supporting globally significant concentrations of migratory species and/or congregatory species; highly threatened and/or unique ecosystems; and/or areas associated with key evolutionary processes."

Critical habitat is not limited to pristine or highly biodiverse areas. It can include modified and natural habitats supporting the biodiversity values that trigger the critical habitat criterion. Critical habitats can therefore be a subset of both modified natural habitats.

The first stage of the CHA is to undertake a screening exercise where the species of conservation concern or that are range restricted that have been recorded within the Project AoI or those considered to be potentially present are rapidly assessed against the thresholds for determination of CH.

CHA screening has been undertaken for all species considered present or potentially present within the Project AoI that are of global conservation concern; Critically Endangered, Endangered and Vulnerable or that are range restricted, as indicated in the IBAT search or from field surveys. Species with a global conservation status of Near Threatened or below have been excluded from the CHA screening unless they have a significant national or regional conservation status.

Critical habitat criteria are defined in IFC PS6 Guidance Note 6 (GN6), Paragraphs GN69 to GN97 (updated February 2019). Based on potential species inhabited Banyuwangi site and surroundings as presented in **Appendix C Table C-3** and refers to the critical habitat criteria (defined in IFC PS6 Guidance Note 6 (GN6), Paragraphs GN69 to GN97 updated February 2019), the critical habitat can be triggered if one of the species is identified or confirmed inhabit within the proposed Banyuwangi site and vicinity. Critical Habitat screening was conducted during the ESIA based on the listed species in **Appendix C Table C-3** is identified during the baseline survey or any reliable sources (up to date and less than 5 years) that claim the species inhabited within the designated Ecologically Appropriate Areas of Assessment (EAAA – see **Figure 4-24**). Those species were selected whether or not candidate Critical Habitat-qualifying species using criteria in line with global IUCN criteria and using data on Extent of Occurrence (EOO) in the IUCN Red List dataset. Furthermore, searches for 'endemic' and 'restricted range' species, migratory/congregatory species in the IBAT output in the Project area in literature and online.

Table 4-29 details the qualifying requirements for critical habitat criteria 1 to 3 (species level), criteria 4 (ecosystem level) and criteria 5 (landscape level). In addition, details of the likely qualifying interests for Criterions 4 and 5 are defined based on research, expert opinion, and expert justification.

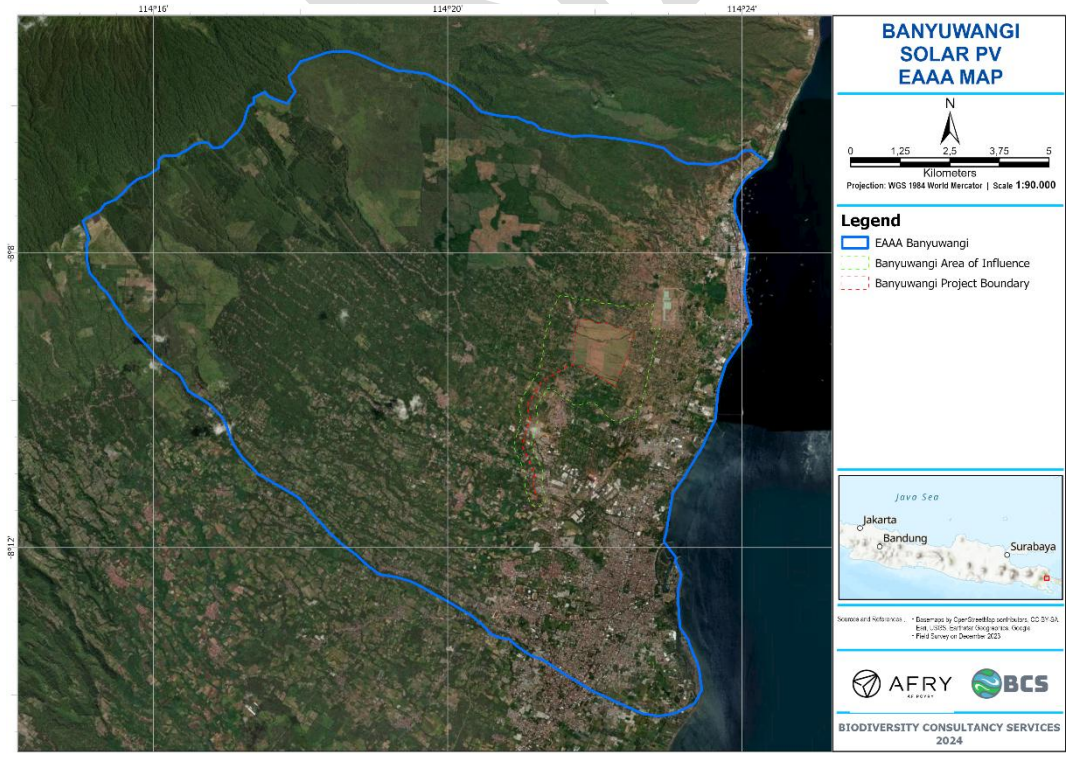


Figure 4-24 *Ecologically Appropriate Area of Analysis of Banyuwangi Site*

Table 4-29 *Critical Habitat Criterion Using IFC PS 6*

Criteria	Description
1	It is triggered by species listed as CR or EN on the International Union for Conservation of Nature (IUCN) Red List, and nationally/regionally listed species assessed using similar criteria. Where uncertainty was present, a precautionary approach was applied, and species were assigned a higher threat level. Species not listed as CR or EN were included under Criterion 1 if compelling evidence indicated that the threat level was high enough to warrant a potential CH designation based on the intent of PS6.
2	It is triggered by habitats of significant importance for endemic or restricted-range species. IFC quantitative definitions (paragraph 80, GN6: IFC 2012b) were used to define restricted-range species. Global extent of occurrence was used to define range and was determined using IUCN data (IUCN 2013), existing literature, and consultation with taxonomic specialists.
3	It is triggered by migratory and/or congregatory species occurring in the CHAA. All migratory or congregatory species were screened to determine if the CHAA contained irreplaceable and/or extremely vulnerable habitats used either periodically or consistently. Migratory birds were identified using information from BirdLife International (2013) and other species were identified using information from IUCN listings (IUCN 2013) and other published literature.
4	It is triggered by ecosystems that are threatened, house unique assemblages of biomerestricted species, or are recognized for high conservation value, including protected areas. Where data permitted, quantitative categories and criteria from Rodriguez et al[19] were applied to evaluate ecosystem status. Ecosystems considered CR or EN were identified as CH, and ecosystems rated as VU were evaluated on an individual basis through consultation with experts. Ecosystems with unique assemblages of species or of high conservation value were evaluated based on field data, literature, and consultation.
5	It applies to landscape-level features that can influence key evolutionary processes. Key landscape features such as unique topography that creates unique habitats and areas important for climate change adaptation were identified using literature review and through expert consultation. Criterion 5 also applies at the species level for "distinct species" which include those coined as "Evolutionarily Distinct and Globally Endangered" (EDGE) (GN 95 IFC 2012b; Zoological Society of London 2013). Species within the CHAA identified as EDGE species were evaluated for critical habitat on a case-by-case basis in consultation with appropriate experts.

Referring to the above criterion, the recorded species of Conservation Significance were screened to (i) to identify the major potential biodiversity risks of a project at an early stage, to facilitate consideration of high-level design changes; and (ii) to focus on-site biodiversity surveys on highest-risk biodiversity. The screening results can be seen in the following table. This CH screening includes all species with conservation significance observed during baseline study survey (see **Table 4-30**) and all species potentially occurred within EAAA.

[19] Rodriguez, J.P., K. M. Rodriguez-Clark, J.e.M. Baillie, N. Ash, J. Benson, T. Boucher, C. Brown, N.D. Burgess, B. Collen, M. Jennings, D.A. Keith, E. Nicholson, C. Revenga, B. Reyers, M. Rouget, T. Smith, M. Spalding, A. Taber, M. Walpole, I. Zager, and T. Zamin. 2011. Establishing IUCN red list criteria for threatened ecosystem. Conservation Biology 25:21-29

Table 4-30 *Critical Habitat Screening Results Using IFC PS 6 Criteria*

No	Scientific Name	Common Name	Status		Transects				CH Qualify Criteria							Justification
			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
BIRDS																
1	*Spilornis cheela*	Crested Serpent-eagle	LC	**P**			VP1		VP	3	X					This species is protected under Indonesian law, although it has a wide distribution range from Sundaland (Java, Sumatra, Borneo) in Indonesia to Asia mainland in China and India with EOO 18,000,000 km^2. *Spilornis cheela* global population size has not been quantified, but the species is described as widespread and common, although locally uncommon (del Hoyo *et al.,* 1992 cited in IUCN Red List (2024). This species has a wide habitat type including forest, savanna, estuaries and artificial habitat. This species is not listed as CR, EN and VU in IUCN Red List. Therefore, *Spilornis cheela* does not qualify for any Critical Habitat (CH) criterions.
2	*Lonchura leucogastroides*	Javan Munia	LC			EJBL	X					X				Based on IUCN geographic range map, *Lonchura leucogastroides* is distributed in Java, Madura, Bali and Lombok Islands with EOO 222,000 km^2. This species inhabits in shrubland, grassland and artificial habitat. This species is not listed as CR, EN and VU in IUCN Red List. Therefore, *Lonchura leucogastroides* does not qualify for any Critical Habitat (CH) criterions.
3	*Halcyon cyanoventris*	Javan Kingfisher	LC			X	X	**X**	X			X				Based on IUCN geographic range map *Halcyon cyanoventris* is distributed in Java and Bali and Lombok Islands with EOO 188,000 km^2. This species inhabits in lowland forest, mangroves, shrubland, wetlands and artificial habitat. This species is not listed as CR, EN and VU in IUCN Red List. Therefore, *Halcyon cyanoventris* does not qualify for any Critical Habitat (CH) criterions.
4	*Merops philippinus*	Blue-tailed Bee-eater	LC		**M**			**X**					X			The Blue-tailed Bee-eater (*Merops philippinus*), classified as Least Concern by the IUCN, is a

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No	Scientific Name	Common Name	Status		Transects				CH Qualify Criteria							Justification
			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																migratory species widely distributed across South and Southeast Asia, including Java, where it primarily appears as a non-breeding visitor. Although this species migrates seasonally and may pass through or stop over in Java, it does not rely on the project site for critical lifecycle stages, such as breeding, feeding, or wintering. The project area consists mostly of agricultural fields and mixed plantations, which do not provide the specific open or sandy habitats by water typically preferred by *Merops philippinus*. Given these factors, *Merops philippinus* does not meet Criterion 3 for Critical Habitat (CH) designation.
5	*Gallus varius*	Green Junglefowl	LC			EJBL	X	**X**				X				This bird is endemic to Java, Bali and Lombok. This species has a very large range. The population trend appears to be stable, and hence the species does not approach the thresholds for Vulnerable under the population trend criterion (>30% decline over ten years or three generations). The population size has not been quantified, but it is not believed to approach the thresholds for Vulnerable under the population size criterion (<10,000 mature individuals with a continuing decline estimated to be >10% in ten years or three generations, or with a specified population structure). For these reasons, IUCN evaluated that the species is Least Concern and Government of Indonesia did not categorize into protected species. Therefore, this species does not qualify for CHA.
6	*Hydrornis guajanus*	Javan Banded Pitta	LC	**P**		EJB	X					X				The Javan Banded Pitta (*Hydrornis guajanus*) is endemic to Java and Bali and typically inhabits lowland and montane forests. While it prefers relatively intact forests, it can also adapt to secondary forests and areas that have

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No	Scientific Name	Common Name	Status		Transects				CH Qualify Criteria							Justification
			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																experienced some disturbance, provided these habitats still offer adequate cover for foraging and nesting. However, the project area consists primarily of agricultural land and mixed plantations, which lack the necessary forest structure and cover for this species. Given the species' stable population and its ability to occupy a range of habitats, including disturbed areas, the project site still does not meet the criteria for Critical Habitat (CH) under Criterion 2, as it does not support essential habitat or a vulnerable population. Therefore, *Hydrornis guajanus* does not qualify for CHA.
7	*Alcedo euryzona*	Javan Blue-banded Kingfisher	CR			EJ					X	X				Endemic to Java, the Javan Blue-banded Kingfisher is critically endangered, with only scattered populations remaining. It has a strong association with slow-flowing streams and dense evergreen forests, which are typically found above 1,000 m. The habitat within the project area—comprising primarily degraded and agricultural land—does not meet this species' specialized requirements, as it requires intact riverine forest ecosystems for survival. Its critical habitat is not found within the project footprint, so this species does not qualify for CHA.
8	*Gracupica jalla*	Javan Pied Starling	CR			EJB					X	X				The Javan Pied Starling (*Gracupica jalla*) was previously a widely distributed species in Java and Bali, inhabiting grasslands, agricultural areas, and urban zones. However, due to the excessive trapping of the species for the songbird trade, the species is now extinct in the wild, with the remaining populations only in captivity. Despite small-scale captive breeding efforts, there have been no significant reintroduction programs, and the species is not legally protected in Indonesia. As *Gracupica jalla* is no longer found in the wild

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																and its historical habitats no longer support viable populations, the project area does not provide critical habitat for the species. Therefore, *Gracupica jalla* does not qualify for any Critical Habitat (CH) criterions.
9	*Vanellus macropterus*	Javan Lapwing	CR	**P**		EJ					X	X				The Javanese Lapwing (*Vanellus macropterus*) is a Critically Endangered bird endemic to Java, Indonesia. Historically, it inhabited coastal wetlands and marshes along the northern coastline of Java. However, the species has not been observed in the wild for several decades, with the last confirmed sightings recorded in the 1940s. The primary cause of its decline is habitat destruction, especially due to coastal reclamation for agricultural and developmental purposes. Given that the Javanese Lapwing is potentially extinct in the wild and there are no confirmed viable populations remaining, it does not meet the criteria for critical habitat.
10	*Zosterops flavus*	Javan White-eye	EN	**P**		EJ					X	X				The Javan White-eye (*Zosterops flavus*) is an Endangered species endemic to Java and nearby islands, typically found in coastal forests, mangroves, and wetland ecosystems. This species has experienced rapid population decline due to habitat loss and illegal trapping for the pet trade, making it highly vulnerable. Its Endangered status (Criterion 1) and range-restricted habitat requirements (Criterion 2) indicate that it could qualify as a Critical Habitat (CH) trigger species if viable populations were present. However, no individuals were observed in the survey area, and there is no evidence that this area provides critical resources, such as key breeding or feeding habitats, essential for the survival of the Javan White-eye. Therefore, while the species itself qualifies as a potential trigger,

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																the specific conditions of the project area do not meet the requirements for Critical Habitat designation.
11	*Chloropsis sonnerati*	Greater Green Leafbird	EN	**P**							X					The Greater Green Leafbird is classified as Endangered due to rapid population declines driven primarily by habitat loss and illegal trapping for the cage bird trade. This species typically inhabits primary and secondary lowland forests. While the species is sensitive to habitat changes, it was not observed in the project area, and no critical breeding or feeding habitats essential to its survival were identified. Although its Endangered status qualifies it under Criterion 1 for potential Critical Habitat, the absence of viable populations and specific habitat dependencies in the project area means it does not trigger Critical Habitat designation.
12	*Acridotheres melanopterus*	Black-winged Myna	EN	**P**	X						X	X				The *Black-winged Myna* (*Acridotheres melanopterus*) is classified as Endangered by the IUCN, primarily due to illegal trapping and habitat loss, which have drastically reduced its population across its limited range in Java and surrounding islands. This species is typically found in open woodlands, agricultural landscapes, and gardens, but it has become increasingly rare in the wild. Although it qualifies under Criterion 1 due to its Endangered status, no individuals of this species were observed in the project area, nor does the area contain critical habitats essential for its survival. The absence of both the species and its key habitats in the region means that the area does not meet the criteria for critical habitat designation.
13	*Alophoixus bres*	Brown-cheeked Bulbul	EN								X					The *Brown-cheeked Bulbul* (*Alophoixus bres*) is classified as Endangered by the IUCN, with a limited distribution in Java and Bali, primarily

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																inhabiting subtropical and tropical forests. This species is threatened by habitat loss due to deforestation. However, the project area does not seem to overlap with its key forest habitats. Although sightings have occurred in agroforestry areas, these may not meet the species' ecological needs for nesting and long-term survival. Given the lack of observations and critical habitats in the study area, it is unlikely that the area would meet the *Critical Habitat (CH)* criteria for the *Brown-cheeked Bulbul*. Therefore, the project area does not trigger CH requirements for this species.
14	*Centropus nigrorufus*	Javan Coucal	VU			EJ					X	X				The Javan Coucal is Vulnerable and endemic to Java, where it inhabits wetlands, marshes, and rice paddies. The species is at risk from habitat loss due to wetland conversion and agricultural expansion. It could potentially qualify under Criteria 1 and 2 due to its Vulnerable status and range restriction. But, the study area is not within the main distribution range of the species, which includes wetlands, marshes, and rice paddies in other regions of Java. While there may be some potential habitat nearby, there is no evidence to suggest that this area serves as a primary or significant habitat for the species. Therefore, this species does not qualify for CHA.
15	*Pericrocotus miniatus*	Sunda minivet	LC			EI					X					The *Sunda Minivet* (*Pericrocotus miniatus*) is endemic to Indonesia, found mainly in the secondary forests of Sumatra and Java. It thrives in both natural and modified habitats, including agricultural areas, and has a stable population. Classified as Least Concern by the IUCN, the species is not at risk of extinction. Given its stable status and absence of major threats, the project area does not contain critical

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																habitats for this species. No individuals have been observed in the area, and the project site does not support a vulnerable population or contain essential habitats. Therefore, the Sunda Minivet does not qualify for critical habitat designation.
16	*Cyanoptila cumatilis*	Zappey's Flycatcher	NT		X								X			The *Zappey's Flycatcher* (*Cyanoptila cumatilis*) is classified as *Near Threatened* by the IUCN and is primarily found in forested areas across Southeast Asia, with breeding sites in China and migratory patterns extending to Sumatra and Java. While the species faces habitat loss, it is not at immediate risk of extinction. The project area does not overlap with critical habitats for the species, as *Cyanoptila cumatilis* prefers undisturbed forests and is rarely found in modified landscapes like agricultural fields and mixed plantations. Given the habitat composition of the project site, it is unlikely that the species is present. Therefore, *Cyanoptila cumatilis* does not qualify for Critical Habitat (CH) designation within the project area.
17	*Todiramphus sanctus*	Sacred Kingfisher	LC		X								X			The *Sacred Kingfisher* (*Todiramphus sanctus*) is a migratory species found across Australia, New Zealand, and parts of Southeast Asia, including Indonesia. In Indonesia, it migrates from breeding areas in Australia and New Guinea to regions like Java during the non-breeding season, driven by the need to access suitable habitats such as coastal areas and wetlands. However, the project area, which consists primarily of mixed plantations and agricultural fields, does not provide the ideal habitat for this species. Given that the species is not commonly found in human-modified landscapes, and no critical or breeding habitats have been identified

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																in the area, the project site does not meet the requirements for critical habitat designation. Therefore, this species does not qualify for CHA accoring to Criteria 3.
18	*Merops leschenaulti*	Chestnut-headed Bee-eater	LC		X								X			The Chestnut-headed Bee-eater (*Merops leschenaulti*) is classified as Least Concern by the IUCN and is widely found across Southeast Asia, including Java and Sumatra. It prefers open woodlands and savanna-like habitats and migrates seasonally between southern Asia and Indonesia. Due to its LC status and lack of significant threats, *Merops leschenaulti* does not meet CH criteria. The project area consists mainly of agricultural fields and mixed plantations, which do not provide the suitable habitat for this species. Additionally, there are no identified critical habitats for this species in the region, so it does not qualify for CH designation within the project site.
19	*Clamator coromandus*	Chestnut-winged Cuckoo	LC		X								X			The Chestnut-winged Cuckoo (*Clamator coromandus*) is classified as Least Concern by the IUCN and migrates across South and Southeast Asia, including Indonesia. It breeds in the Himalayas and migrates to southern India and Southeast Asia, including Java and Sumatra, during the non-breeding season. This species is found in a variety of habitats, such as wooded areas, gardens, and parks, rather than specialized or vulnerable ecosystems. The project site, consisting mainly of mixed plantations and agricultural fields, does not provide suitable habitat for the species. Therefore, *Clamator coromandus* does not meet the criteria for CH designation in the project site.

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
20	*Cuculus micropterus*	Indian Cuckoo	LC		X								X			The Indian Cuckoo (*Cuculus micropterus*) is classified as Least Concern (LC) by the IUCN, indicating a stable population. It is a migratory species, breeding in temperate regions like China, Siberia, and the Indian Subcontinent, and migrating south to Southeast Asia during the non-breeding season. The species is found in forests, garden edges, and parks, but not in specialized or vulnerable ecosystems. The project site, consisting of mixed plantations and agricultural fields, does not provide suitable breeding habitat for the species. As such, the Indian Cuckoo does not meet the criteria for CH designation here.
21	*Cacomantis sonneratii*	Banded Bay Cuckoo	LC		X								X			*Cacomantis sonneratii* (Banded Bay Cuckoo) is classified as Least Concern by the IUCN, with a stable population and broad distribution across South and Southeast Asia. This migratory species breeds in forests and cultivated areas, including regions like India, Sri Lanka, and Southeast Asia, and typically migrates during the monsoon season. Although it is migratory, the species was not observed in the project area during surveys, suggesting it does not currently use the habitat there. With its broad habitat range and stable population, *Cacomantis sonneratii* is unlikely to be significantly impacted by the project. Therefore, this species does not qualify for CHA.
22	*Cacomantis merulinus*	Plaintive Cuckoo	LC		X								X			*Cacomantis merulinus*, (Plaintive Cuckoo) is classified as Least Concern by the IUCN, reflecting a stable population across its range. This migratory species is found from northeastern India to Southeast Asia, including Indonesia. It occupies a variety of habitats such as forests, forest edges, mangroves, parks, and gardens. Although it was not recorded in the project site

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																during the survey, this species does not typically inhabit mixed plantations or agricultural fields, which are the main land use at the site. The species is migratory, with different subspecies found in regions like the Philippines, Malaysia, and Java, often migrating south for the winter. With its broad habitat range and stable population, the species does not meet the criteria for CH designation on the project site.
23	*Chalcites basalis*	Horsfield's Bronze-cuckoo	LC		X								X			*Chalcites basalis* (Horsfield's Bronze-Cuckoo) is classified as Least Concern by the IUCN, indicating a stable population and broad distribution across Australia, the Malay Peninsula, and parts of Indonesia. This migratory species moves between northern and southern Australia, occupying a range of habitats including woodlands, forests, and farmland. Although not observed during surveys in the study area, the species' broad habitat preferences suggest that the project site does not provide critical or unique conditions for it. Given its stable population and the absence of the species in the area, *Chalcites basalis* does not meet the criteria for Critical Habitat (CH) designation.
24	*Chrysococcyx xanthorhynchus*	Violet Cuckoo	LC		X								X			*Chalcites basalis* (Horsfield's Bronze-Cuckoo) is classified as Least Concern by the IUCN, indicating a stable population and broad distribution across Australia, the Malay Peninsula, and parts of Indonesia. This migratory species moves between northern and southern Australia depending on the season and inhabits woodlands, forests, farmland, and urban parks. Although not recorded during surveys in the study area, its broad habitat range suggests that the project site does not offer unique conditions for the species. Given its migratory nature, widespread

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																distribution, and Least Concern status, *Chalcites basalis* does not meet the criteria for CH designation in the area.
25	*Eudynamys scolopaceus*	Western Koel	LC		X								X			The Asian Koel (*Eudynamys scolopaceus*) is classified as Least Concern by the IUCN and is considered migratory in parts of its range, particularly moving between northern regions like the Himalayas and India to lower-altitude areas. While in Java, Indonesia, it may not exhibit long-distance migration, it can still show seasonal movement within local areas, especially during breeding times. Though not observed in the project area during surveys, its wide distribution and migratory nature across its range suggest that the species is not dependent on the specific habitat of the project site. Therefore, *Eudynamys scolopaceus* does not meet the criteria for CH designation in this project site.
26	*Heleia javanica*	Javan Grey-throated White-eye	LC			EJ						X				The Javan Grey-throated White-eye (*Heleia javanica*) is classified as Least Concern by the IUCN and is endemic to Java. It occupies montane forests from foothills to higher elevations. While the species is stable within its range, the survey at the project site revealed no evidence of its presence, indicating that the habitat there is not crucial for its survival. It does not inhabit specialized or vulnerable ecosystems, and its population remains stable within its natural range in Java. Therefore, the project area is not considered to trigger critical habitat for this species.
27	*Psilopogon javensis*	Black-banded Barbet	NT			EJ						X				The black-banded barbet (*Psilopogon javensis*) is classified as Near Threatened (NT) by the IUCN and is endemic to Java. This designation reflects the fact that its range is restricted to this island in Indonesia. It primarily inhabits lowland and

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																montane forests across Java. While the species is currently restricted to Java, its presence in specific habitats within the island is crucial for its continued survival. However, the survey for this project did not yield any observations of the species, which suggests that the habitat in the study area is not critical for this species. Furthermore, while the species is endemic, its conservation status as Near Threatened does not automatically result in the designation of Critical Habitat for this site. This is because the project area does not support the species' primary habitats, which are typically found in more specific or intact forest regions on the island. Therefore, the project area is not considered to trigger CH for this species.
28	*Leptoptilos javanicus*	Lesser Adjutant	NT	**P**			From KBA List				X					The Lesser Adjutant (*Leptoptilos javanicus*) is widely distributed across South and Southeast Asia, including Indonesia's islands of Sumatra, Borneo, and Java. Although it is protected under Indonesia's P.106 regulation, its broad geographic range indicates it does not depend on any specific area within Indonesia for survival. Given its wide distribution and Near Threatened status on the IUCN Red List, this species does not meet any criteria for Critical Habitat. Therefore, *Leptoptilos javanicus* does not qualify for CHA.
29	*Mycteria cinerea*	Milky Stork	EN	**P**			From KBA List				X					The Milky Stork (*Mycteria cinerea*) is distributed across Southeast Asia, including Cambodia and Indonesia (extant resident), Malaysia and Singapore (extant, introduced resident), and Thailand (extant, non-breeding). In Indonesia, this species is found in Sumatra, Java, and Sulawesi, primarily as a coastal resident inhabiting mangroves and adjacent low-salinity

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																swamps (Iqbal et al. 2008, 2009, as cited in the IUCN Red List, 2024). The project site consists of mixed plantation and agricultural fields, habitats that are likely unsuitable for this species. Consequently, *Mycteria cinerea* is unlikely to be present at the project site and does not meet the criteria for Critical Habitat.
30	*Pavo muticus*	Green Peafowl	EN	**P**			From KBA List				X					The Green Peafowl (*Pavo muticus*) is widely distributed across Southeast Asia, including Myanmar, China, Vietnam, Thailand, Laos, Cambodia, and Indonesia, where it is found only in Java. This species inhabits diverse environments, including primary and secondary tropical forests, swamp forests, open woodlands, and grasslands, typically at elevations up to 2,100 meters. Recent records, however, show a preference for dry deciduous forests, particularly near undisturbed rivers and wetlands, where population densities are highest (Brickle 2002, cited in IUCN Red List 2024). The project area and EAAA consists of mixed plantation and agricultural field that likely not suitable for this species. Given its habitat preferences and the absence of suitable conditions in the project site, *Pavo muticus* is unlikely to be present and does not meet the criteria for Critical Habitat.
31	*Nisaetus bartelsi*	Javan Hawk-eagle	EN	**P**		EJ	From KBA List				X	X				*Nisaetus bartelsi* is found on the island of Java, Indonesia. This species frequents primary humid forest, although individuals and even nests have been recorded in secondary forest, production forest and tropical semi-deciduous forest, preferring rugged slopes with high vegetation cover. The project area and EAAA consists of mixed plantation and agricultural field that likely not suitable for this species. This species is unlikely presence in the project site. Therefore,

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																Nisaetus bartelsi does not qualify for CHA.
32	*Arborophila javanica*	Chestnut-bellied Partridge	LC			EJ	From KBA List					X				*Arborophila javanica* is endemic to Java, Indonesia, where it occurs in montane forests as far east as Mt Semeru (BirdLife International (2024). This species occurs in tropical mist montane. The project area and EAAA consists of mixed plantation and agricultural field that likely not suitable for this species. In addition, according to IUCN geographic range map, the EAAA and the project area were not located in distribution area of this species. Therefore, *Arborophila javanica* does not qualify for CHA.
33	*Phylloscopus grammiceps*	Sunda Warbler	LC			EJ	From KBA List					X				Based on the IUCN geographic range map, *Phylloscopus grammiceps* is distributed to Java and Bali, Indonesia with extent of occurrence 148,000 km^2. This species inhabits in tropical moist montane forest (BirdLife International (2024)). The project area and EAAA consists of mixed plantation and agricultural field that likely not suitable for this species. This species is unlikely presence in the project site. Therefore, *Phylloscopus grammiceps* does not qualify for CHA.
34	*Mixornis flavicollis*	Grey-cheeked Tit-babbler	LC			EJ	From KBA List					X				Based on the IUCN geographic range map *Mixornis flavicollis* is distributed to Java, Indonesia with extent of occurrence 61,700 km^2. This species inhabits in tropical moist lowland forest and tropical dry forest (BirdLife International (2024)). The project area and EAAA consists of mixed plantation and agricultural field that likely not suitable for this species. This species is unlikely presence in the project site. Therefore, *Mixornis flavicollis* does not qualify for CHA.
35	*Ducula*	Dark-backed	LC			EJB	From KBA List					X				Based on the IUCN geographic range map *Ducula*

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
	lacernulata	Imperial-pigeon														*lacernulata* is distributed to Java, Bali and several islands of Lesser Sunda, Indonesia, with extent of occurrence 255,000 km^2. This species inhabits in tropical moist lowland forest, tropical moist lowland forest and tropical heavily degraded former forest (BirdLife International (2024)). The project area and EAAA consists of mixed plantation and agricultural field. This species is likely presence in the project site since this species can inhabit in artificial habitat (tropical heavily degraded former forest) such as mixed plantation. Therefore, *Ducula lacernulata* does not qualify for CHA.
36	*Cyanoderma melanothorax*	Crescent-chested Babbler	LC			EJB	From KBA List					X				Based on the IUCN geographic range map *Cyanoderma melanothorax* is distributed to Java and Bali, Indonesia, with extent of occurrence 142,000 km^2. This species inhabits in tropical moist lowland forest, tropical moist montane forest and tropical moist shrubland (BirdLife International (2024)). The project area and EAAA consists of mixed plantation and agricultural field that likely not suitable for this species. This species is unlikely presence in the project site. Therefore, *Cyanoderma melanothorax* does not qualify for CHA.
37	*Stachyris thoracica*	White-bibbed Babbler	LC			EJB	From KBA List					X				Based on the IUCN geographic range map *Stachyris thoracica* is distributed to Java and Bali, Indonesia, with extent of occurrence 142,000 km^2. This species inhabits in tropical moist lowland forest and tropical moist lowland forest (BirdLife International (2024)). The project area and EAAA consists of mixed plantation and agricultural field that likely not suitable for this species. This species is unlikely presence in the project site. Therefore, *Stachyris thoracica* does not qualify for CHA.

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
38	*Arborophila orientalis*	White-faced Partridge	VU			EJ	From KBA List				X	X				This species is endemic to the eastern part of East Java, Indonesia, where it is known from only three areas (west to east): Dataran Tinggi Hyang (Yang Highlands), Meru Betiri and Mt Ijen with EOO 5000 km^2. *Arborophila orientalis* inhabits the interior of montane evergreen forest between 600 m and 2,200 m (Eaton et al. 2021 cited in IUCN Red List (2021)). The project area and EAAA consists of mixed plantation and agricultural field that likely not suitable for this species. This species is unlikely presence in the project site. Therefore, *Arborophila orientalis do*es not qualify for CHA.
39	*Rhipidura euryura*	White-bellied Fantail	LC	**P**		EJ	From KBA List					X				Based on the IUCN geographic range map *Rhipidura euryura* is distributed to Java, Indonesia, with extent of occurrence 53,400 km^2. This species inhabits in tropical moist montane forest from 900 to 2,750 metres (BirdLife International (2024)). The project area and EAAA consists of mixed plantation and agricultural field that likely not suitable for this species. This species is unlikely presence in the project site. Therefore, *Rhipidura euryura do*es not qualify for CHA.
40	*Psilopogon armillaris*	Flame-fronted Barbet	LC	**P**		EJ	From KBA List					X				*Psilopogon armillaris* is distributed to Java, Indonesia, with extent of occurrence 83,900 km^2. This species inhabits in tropical moist montane forest, tropical moist lowland, plantations and rural gardens. The known upper elevation limit is approx. 2,500 metres (BirdLife International (2024)). The project area and EAAA contains a suitable for this species such as mixed plantations. This species is likely presence in the project site and EAAA. Since the EOO of this species >50,000 km^2, Therefore, *Psilopogon armillaris do*es not qualify for CHA criteria 2.

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
41	*Chrysocorythus estherae*	Mountain Serin	LC			EJSS	From KBA List					X				Based on the IUCN geographic range map *Chrysocorythus estherae* is distributed to scattered patch in mountains of Java, mountains of northern part of Sumatra, and mountains in Central Sulawesi, Indonesia, with extent of occurrence 1,940,000 km^2. This species inhabits in tropical moist montane forest, tropical moist lowland forest, and tropical high-altitude grassland from 1,300 to 3,500 metres (BirdLife International (2024)). The project area and EAAA consists of mixed plantation and agricultural field that likely not suitable for this species. This species is unlikely presence in the project site. Therefore, *Chrysocorythus estherae doe*s not qualify for CHA.
42	*Ixos virescens*	Javan Bulbul	LC			EJ	From KBA List					X				Based on the IUCN geographic range map *Ixos virescens* is distributed to Java, Indonesia, with extent of occurrence 65,800 km^2. This species inhabits in tropical moist montane forest, tropical moist lowland forest, and tropical heavily degraded former forest from 800 to 3,000 metres (BirdLife International (2024)). The project area and EAAA consists of mixed plantation and agricultural field in low altitude than altitude range for this species that likely not suitable for this species. This species is unlikely presence in the project site. Therefore, *Ixos virescens* does not qualify for CHA.
43	*Hydrochous gigas*	Waterfall Swift	NT	**P**			From KBA List				X	X				*Hydrochous gigas* occurs highly sporadically in the Main Range, Peninsular Malaysia, the mountains of Sumatra and West Java, Indonesia, and appears to be numerous on Gunung Kinabalu, Borneo (Collar et al. 2000, D. Bakewell in litt. 2016 cited in IUCN Red List (2024)). According to IUCN geographic range map, the EAAA and project area were not located in the

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			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																species distribution range. So, this species unlikely presence in the EAAA and the project area. Therefore, this *Hydrochous gigas* does not qualify for CHA
44	*Ptilinopus porphyreus*	Pink-headed Fruit-dove	LC			EJS	From KBA List					X				Based on the IUCN geographic range map *Ptilinopus porphyreus* is distributed to Java and Sumatra Indonesia, with extent of occurrence 361,000 km^2. This species inhabits in tropical moist montane forest and tropical high-altitude shrubland from 1,400 to 2,200 metres (BirdLife International (2024)). The project area and EAAA consists of mixed plantation and agricultural field in low altitude than altitude range for this species that likely not suitable for this species. This species is unlikely presence in the project site. Therefore, *Ptilinopus porphyreus* does not qualify for CHA.
45	*Pernis ptilorhynchus*	Oriental Honey-Buzzard	LC	**P**			From Lender's comment						X			*Pernis ptilorhynchus* classified as Least Concern by the IUCN, is a migratory species widely distributed across middle east, Russia, China, East, South and Southeast Asia. In Java, it primarily appears as a non-breeding visitor. This species migrates to/through Java and Bali in autumn and spring, with numbers recorded in north-west Bali by Bali Barat National Park staff high enough to potentially meet Critical Habitat thresholds for Criterion 3. While the project area consists mostly of agricultural fields and mixed plantations, which are not optimal habitat for this species, the Project EAAA might possibly also qualify as Critical Habitat for *Pernis ptylorhynchus* under Criterion 3.
46	*Accipiter gularis*	Japanese Sparrowhawk	LC	**P**			From Lender's comment						X			*Accipiter gularis* classified as Least Concern by the IUCN, is a migratory species widely distributed across Russia, China, East, South and Southeast Asia. In Java, it primarily appears as a

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No	Scientific Name	Common Name	Status		Transects				CH Qualify Criteria							Justification
			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																non-breeding visitor. This species migrates to/through Java and Bali in autumn and spring, with numbers recorded in north-west Bali by Bali Barat National Park staff high enough to potentially meet Critical Habitat thresholds for Criterion 3. The project area consists mostly of agricultural fields and mixed plantations, which likely provide the suitable habitat for this species. Given these factors, the Project EAAA might possibly also qualify as Critical Habitat for *Accipiter gularis* under Criterion 3.
47	*Accipiter soloensis*	Chinese Sparrowhawk	LC	**P**			From Lender's comment						X			*Accipiter soloensis* classified as Least Concern by the IUCN, is a migratory species widely distributed across Russia, China, East, and Southeast Asia. In Java, it primarily appears as a non-breeding visitor. This species migrates to/through Java and Bali in autumn and spring, with numbers recorded in north-west Bali by Bali Barat National Park staff high enough to potentially meet Critical Habitat thresholds for Criterion 3. The project area consists mostly of agricultural fields and mixed plantations, which likely provide the suitable habitat for this species. Given these factors, the Project EAAA might possibly also qualify as Critical Habitat for *Accipiter soloensis* under Criterion 3.
MAMMAL																
48	*Macaca fascicularis*	Long-Tailed Macaque	**EN**				TB1				X					*Macaca fascicularis* is widely distributed across South and Southeast Asia (Fooden 1995, Gumert 2011 cited in IUCN Red List (2024)). The population of this species has declined as a result of conflicts with people, trade for pets and for the medical industry[20]. The species is a generalist and

[20] Hansen et al., 2019, *Conservation Science and Practice*, 1, e88

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No	Scientific Name	Common Name	Status		Transects				CH Qualify Criteria							Justification
			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																opportunist and has adapted to living in a wide range of habitats, including forests, coasts, hills, and mountains (Fooden 1995 cited in IUCN Red List (2024)). They occur most commonly in mangroves and swamp forests, particularly in riverine habitats; however, they are also commonly found in human-altered habitats, which include temples, roadsides, agricultural areas, and rural/urban settlements (Gumert 2011 cited in IUCN Red List (2024)). No exact amount of the global population of this species. Likewise for population data at the national level in Indonesia. However, considering the generalist characteristic of this species and the wide range of habitat and distribution, the EAAA and project area unlikely contains the population that meet with criteria 1 for critical habitat. Therefore, *Macaca fascicularis* is not qualified for CHA.
49	*Hystrix javanica*	Sunda Porcupine	LC	**P**		EI	TB1					X				The Sunda Porcupine (*Hystrix javanica*) is classified as Least Concern species by the IUCN and is endemic to Indonesia. It is adaptable to various habitats, including human-modified landscapes. While it faces local threats, it is legally protected under Indonesian law (P.106/2018). However, the species does not rely on specialized habitats and is capable of thriving in common landscapes. Given its adaptability and the lack of significant threats in the project area, *Hystrix javanica* does not meet the criteria for Critical Habitat designation.
50	*Tupaia javanica*	Horsfield's Treeshrew	LC			EI			TB3			X				*Tupaia javanica*, the Javan Tree Shrew, is endemic to Indonesia, found across Java, Bali, Sumatra, and Nias. It is classified as "Least Concern" by the IUCN due to its stable population and wide distribution. The species primarily inhabits primary forests and is not facing major

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No	Scientific Name	Common Name	Status		Transects				CH Qualify Criteria							Justification
			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																threats such as habitat destruction or fragmentation. Although endemic, *Tupaia javanica* does not meet CHA Criterion 2, which applies to species with restricted ranges facing significant threats. The species is not experiencing significant declines or threats, and its population remains stable. Therefore, *Tupaia javanica* is not qualified for CHA..
HERPETOFAUNA																
51	*Bronchocela jubata*	Great Crested Canopy Lizard	LC			EI			TB3			X				The Great Crested Canopy Lizard (*Bronchocela jubata*) is endemic to Indonesia, primarily found in Java, Bali, and Sumatra. It is classified as Least Concern species by the IUCN, reflecting its stable population and absence of significant threats. Although the species is restricted to Indonesia, it does not face immediate risks such as severe habitat loss or fragmentation, which are necessary to trigger Critical Habitat designation under Criterion 2. As a result, *Bronchocela jubata* does not meet the criteria for CHA.
FLORA																
52	*Tectona grandis*	Teak	**EN**							TB4	X					*Tectona grandis* (teak) is an Endangered species on the IUCN Red List, primarily due to habitat loss and unsustainable logging. However, it does not meet CHA Criterion 1, as teak is widely cultivated in plantations across Indonesia, including within the EAAA region. These plantations, established by PTPN XII since the 1960s, are managed for wood production and support the timber industry. While its natural forests are discontinuous and fragmented, the species is now actively managed in plantation systems, with stable populations that do not face

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No	Scientific Name	Common Name	Status		Transects				CH Qualify Criteria							Justification
			IUCN	P.106	M	E	TB1	TB2	TB3	TB4	1	2	3	4	5	
																imminent extinction threats. Therefore, teak does not qualify for CHA.
ICHTYOFAUNA																
53	*Rasbora baliensis*	Bali Rasbora	**LC**									X				*Rasbora baliensis* species is endemic to Bali; apparently endemic to Lake Bratan, a crater lake at 1231 m above sea level. It was identified in Penawar River during baseline study, so is a-non endemic species to the study area. This finding shows that this fish has been introduced in this area. In terms of conserving critical habitat, Lake Bratan is the preferred location for the conservation of this fish. Therefore, this species is not considered as qualified species for CHA at study area.

Note:
TB1: Representing outside of Project Site Boundary
TB2: Representing area within Project Site Boundary
TB3: Representing Power Transmission Line Right of Way
TB4: Representing Power Transmission Line Right of Way

IUCN Conservation Status: EN (Endangered), NT (Near Threatened), VU (Vulnerable), LC (Least Concern)
P = Protected by Indonesian Environmental Minister Regulation No.108 of 2018
M = Migratory, E = Endemic

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48 bird species, three mammal species, one herpetofauna species, one ichthyofauna species, and 1 flora species were screened for critical habitat assessment. The CH screening results advised that three migratory birds (Oriental Honey-Buzzard, Japanese Sparrowhawk, and Chinese Sparrowhawk) might possibly qualify the Project EAAA as Critical Habitat under Criterion 3. Given this, and insufficient surveys to demonstrate otherwise, a precautionary approach has been taken to impact assessment and mitigation in subsequent sections such as to install BFD and to undertake the PCFM as agreed by the client in the ESMP and ESAP (Environmental and Social Action Plan).

4.1.12.7 Description of Terrestrial Habitat

The habitats within the Area of Interest (AoI) are divided based on vegetation coverage into mixed plantation and agricultural land.

Mixed Plantation

Mixed plantation or commonly referred as "kebun" by the community is agricultural land that is usually planted with annual commodities. Sometimes also mix-cropped with other commodities, while maintaining trees or other useful existing plants. The main commodity of this habitat in the study area are *Gmelina arborea, Albizia chinensis,* and coconut (*Cocos nucifera*). While other plants found around the garden are mango, banana and coffee. This habitat was found at TB1, TB3, and TB4.

Agricultural Land

The existing agricultural land found at TB1 and TB2 transects is dominated by sugar cane (*Saccarum officinarum*). Another tree was also found on the side of the road is *Albizia chinensis*.

The locations of biodiversity survey can be seen in the following figures.

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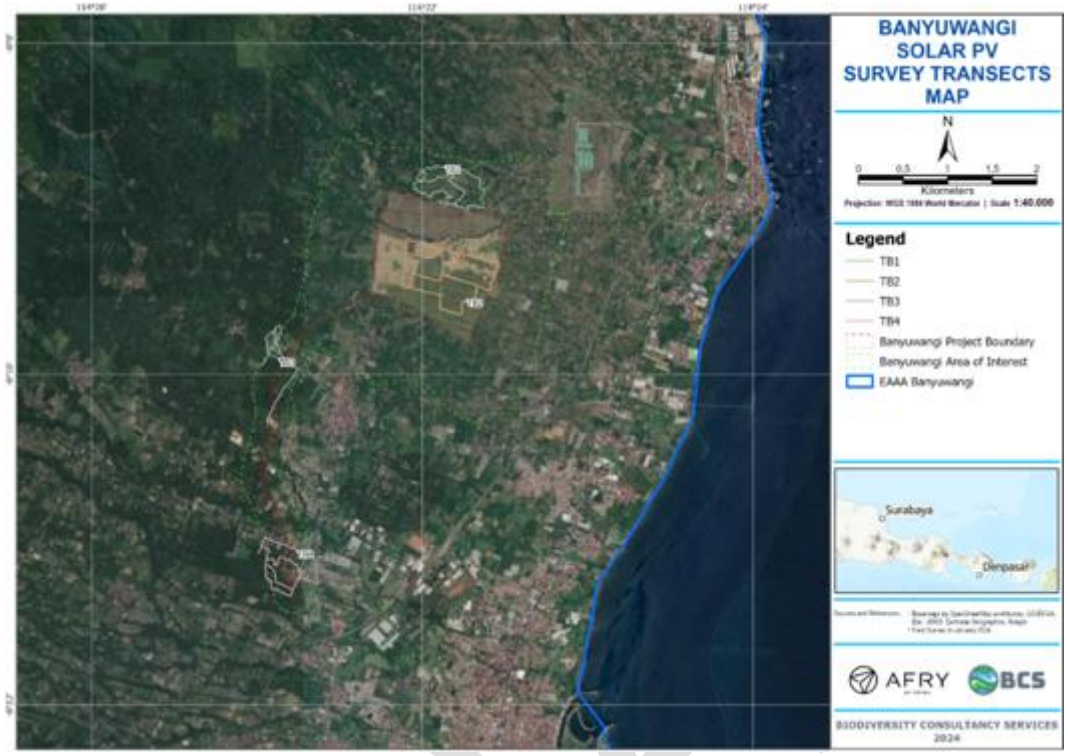


Figure 4-25 *Terrestrial Biodiversity Survey Transects Map of Banyuwangi Ground Mounted Solar PV*

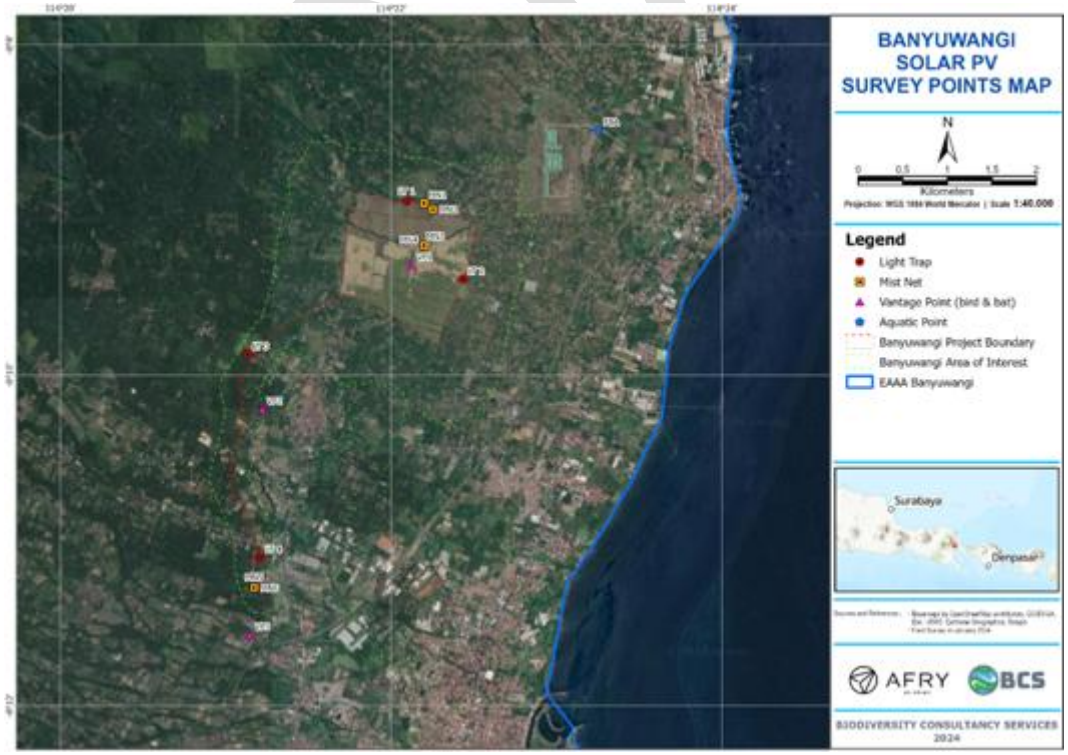


Figure 4-26 *Terrestrial and Aquatic Biodiversity Survey Locations of Banyuwangi Ground Mounted Solar PV*

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TB1 - This transect is in the north of the proposed main project location where the solar PV will be installed. It is situated in the slope of the hill, covered by agricultural land and mixed plantation. Several shrublands and settlement were presence in the eastern part of the transect.

TB2 - TB2 is in the proposed main project site where the solar PV will be installed. It is in the sugarcane field with various growing stages, from the newly planted, mature, and the harvested one. This transect was lacked of canopy cover and only small numbers of biodiversity species observed in this area.

TB3 - This transect is situated in the agricultural area, representing the planned transmission line area. TB3 has various habitats but mostly dominated by coconut plantation. Several shrubland and settlement also observed in this transect.

TB4 - TB4 was also designated to represent the planned transmission line area that will be connected to the substation. It was located in the agricultural field and mostly also coconut plantation, but with more variation of other tree and plant species compared to TB3. The settlement was also larger than one in TB3, and there was also a cemetery in the northern part of the transect.

4.1.12.7.1 Terrestrial Flora Diversity

41 plant species of 26 different families were identified during the field survey. In general, the Fabaceae is the dominant family with 5 species, followed by Moraceae with 4 species. A complete list of the flora observed in the survey is presented in **Appendix C**. Given the study area is modified habitat dominated by agricultural land and mixed plantation, the flora diversity is low compared to the area where the anthropogenic activities are less. Field observation advised that the lowest flora diversity was found at TB2 where the proposed solar PV will be installed. This area is dominated by sugar cane plantation.

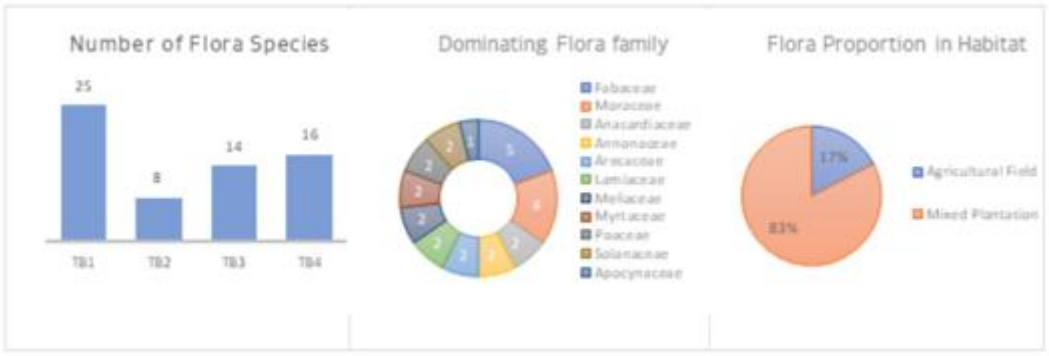


Figure 4-27 *Number of flora species and dominant flora family*

The highest number of plant species was observed in TB1, with 25 species. TB1 is the only transect that has agricultural land and mixed plantation habitat in it, so it has more plant species than other transects. It is different with TB2 where the existing vegetation is more likely homogen, therefore only eight species were found including sugar cane as the dominant species.

As mentioned above, Fabaceae is the most common plant family in the study area, with 5 species. Fabaceae, commonly known as the legume, pea, or bean family, is a large and agriculturally important family of flowering plants. The family is widely distributed

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and is the third-largest land plant family in the number of species, with about 765 genera and nearly 20.000 known species.

About 83% of the total plant species are in the mixed plantation habitat. The character of the mixed plantation that introduces crops while maintaining valuable wild plant species causes a high diversity of plants in the plantation. Apart from that, the growth of understory plants and seedlings caused by the opening of the tree canopy above also adds to the plant species observed.

Bioprospection

A total of 36 flora species from 41 species observed in this study are known as beneficial flora and are used by people globally. Those useful flora can be categorized into eight kinds of use: medicine, food, ecology, feed, ornament, building material, essential oil, and other uses. A list of all beneficial flora can be seen in **Appendix C**.

Most plants have several functions for humans, so the percentage calculation is done by breaking down each function of each plant and combining them according to their utilization function. For example, Coconut (*Cocos nucifera*) parts can be used for almost all categories of utilization. Of all the plant species found during the survey, 30% are used as food, such as Cashew nut (*Anacardium occidentale*), Mango (*Mangifera indica*), and Soursop (*Annona muricata*). Followed by 24% plant species are more likely used as medicine, such as False ashoka (*Polyalthia longifolia*), Crown flower (*Calotropis gigantea*), and Sugar palm (*Arenga pinnata*).

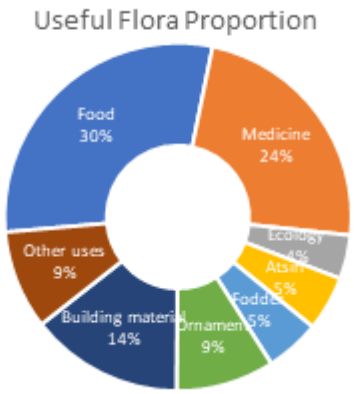


Figure 4-28 *The proportion of beneficial flora in the study location*

Alien Invasive Species

This study area is in an area with a high level of disturbance, dominated by community agricultural field and mixed plantations spread across all transects. Based on field observations, nine invasive flora species were found. **Table 4-31** below shows the invasive flora species in the study area.

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Table 4-31 *List of invasive species in survey location*

No	Family	Scientific Name	Local Name	Transect				Invasiveness	
				TB1	TB2	TB3	TB4	Global	P.94/2016
1	Anacardiaceae	*Anacardium occidentale*	Cashew nut			TB3		Alien	
2	Anacardiaceae	*Mangifera indica*	Mango	TB1		TB3	TB4		Invasive
3	Annonaceae	*Annona muricata*	Soursop	TB1		TB3		Alien	
4	Arecaceae	*Cocos nucifera*	Coconut tree			TB3	TB4	Potential	Invasive
5	Caricaceae	*Carica papaya*	Papaya	TB1					Invasive
6	Euphorbiaceae	*Manihot esculenta*	Bitter cassava			TB3	TB4		Invasive
7	Muntingiaceae	*Muntingia calabura*	Jamaican cherry	TB1					Invasive
8	Myrtaceae	*Syzygium cumini*	Plum tree black	TB1			TB4	Native	Invasive
9	Verbenaceae	*Lantana camara*	Tickberry	TB1	TB2			Alien	Invasive

TB1 transect has the highest number of invasive species, with six invasive alien species found. A high disturbance in the study area has caused all transects to have relatively equal amounts of invasive flora, except TB2. As previously mentioned, in TB2 only eight plant species were found, where only one of them was considered invasive. Among the invasive species above, *Lantana camara* is a type that needs serious management. *Lantana camara* is native to the American tropics, but it has spread to tropical areas worldwide, establishing itself as a notorious weed. This plant can outcompete native species, leading to a reduction in biodiversity. It can survive in a wide range of climatic conditions, including drought, different soil types, heat, humidity, salt, and even fire tolerance, but it lacks shade tolerance.

4.1.12.7.2 Terrestrial Fauna Diversity

Birds

Based on observations made using various methods, a total of 87 species belong to 44 families of birds were found. Below is a complete list of all observed bird species during field observation.

Table 4-32 *List of observed birds in the survey location*

No	Family	Scientific Name	English Name	Transect				Habitat		
				TB1	TB2	TB3	TB4	AF	MP	PF
1	Aegithinidae	*Aegithina tiphia*	Common Iora	TB1		TB3	TB4		MP	
2	Alcidinidae	*Todiramphus chloris*	Collared Kingfisher	TB1		TB3	TB4		MP	
3	Apodidae	*Aerodramus vanikorensis*	Uniform Swiftlet	TB1	TB2	TB3	TB4	AF	MP	

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No	Family	Scientific Name	English Name	Transect				Habitat		
				TB1	TB2	TB3	TB4	AF	MP	PF
4	Artamidae	*Artamus leucorynchus*	White-breasted Woodswallow	TB1	TB2			AF	MP	
5	Campephagidae	*Lalage nigra*	Pied Triller	TB1	TB2	TB3	TB4	AF	MP	
6	Campephagidae	*Pericrocotus cinnamomeus*	Small Minivet	TB1	TB2			AF	MP	
7	Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola	TB1	TB2			AF	MP	
8	Cisticolidae	*Orthotomus sepium*	Javan Tailorbird	TB1		TB3	TB4		MP	
9	Cisticolidae	*Orthotomus sutorius*	Common Tailorbird	TB1	TB2	TB3	TB4	AF	MP	
10	Cisticolidae	*Prinia inornata*	Plain Prinia	TB1	TB2		TB4	AF	MP	
11	Columbidae	*Geopelia striata*	Zebra dove	TB1	TB2	TB3	TB4	AF	MP	
12	Columbidae	*Spilopelia chinensis*	Eastern Spotted Dove	TB1	TB2	TB3		AF	MP	
13	Cuculidae	*Centropus bengalensis*	Lesser Coucal	TB1	TB2			AF	MP	
14	Cuculidae	*Surniculus lugubris*	Drongo Cuckoo	TB1			TB4		MP	
15	Cuculidae	*Cacomantis merulinus*	Plaintive Cuckoo	TB1					MP	
16	Dicaeidae	*Dicaeum trochileum*	Scarlet-headed Flowerpecker	TB1		TB3	TB4		MP	
17	Estrildidae	*Lonchura leucogastroides*	Javan Munia	TB1					MP	
18	Estrildidae	*Lonchura punctulata*	Scaly-breasted Munia	TB1	TB2			AF	MP	
19	Halcyonidae	*Halcyon cyanoventris*	Javan Kingfisher	TB1	TB2	TB3		AF	MP	
20	Hemiprocnidae	*Hemiprocne longipennis*	Gray-rumped Treeswift	TB1					MP	
21	Hirundinidae	*Hirundo tahitica*	Pasific Swallow		TB2		TB4	AF	MP	
22	Laniidae	*Lanius schach*	Long-tailed Shrike		TB2			AF		
23	Meropidae	*Merops philippinus*	Blue-tailed Bee-eater		TB2			AF		
24	Meropidae	*Merops leschenaulti*	Chestnut-headed Bee-eater	TB1	TB2			AF	MP	
25	Motacillidae	*Anthus rufulus*	Paddyfield Pipit		TB2			AF		
26	Nectariniidae	*Anthreptes malacensis*	Brown-throated Sunbird	TB1	TB2	TB3	TB4	AF	MP	

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No	Family	Scientific Name	English Name	Transect				Habitat		
				TB1	TB2	TB3	TB4	AF	MP	PF
27	Nectariniidae	*Cinnyris ornatus*	Ornate Sunbird	TB1	TB2	TB3	TB4	AF	MP	
28	Pellorneidae	*Malacocincla sepiaria*	Horsfield's Babbler	TB1					MP	
29	Phasianidae	*Gallus varius*	Green Junglefowl	TB1	TB2			AF	MP	
30	Picidae	*Dendrocopos analis*	Freckle-breasted Woodpecker	TB1	TB2			AF	MP	
31	Pittidae	*Hydrornis guajanus*	Javan Banded Pitta	TB1					MP	
32	Pycnonotydae	*Pycnonotus aurigaster*	Sooty-headed Bulbul	TB1	TB2	TB3	TB4	AF	MP	
33	Pycnonotydae	*Pycnonotus goiavier*	Yellow-vented Bulbul	TB1	TB2		TB4	AF	MP	
34	Strigidae	*Otus lempiji*	Sunda Scops Owl				TB4		MP	
35	Sturnidae	*Aplonis panayensis*	Asian Glossy Starling	TB1		TB3			MP	
Notes: AF=Agricultural Field; MP=Mixed Plantation; PF=Plantation Forest; ST=Settlement										

There are several bird species that commonly be found on all transects, namely Uniform swiftlet, Pied triller, Common tailorbird, Zebra dove, Brown-throated sunbird, Ornate sunbird, and Sooty-headed bulbul. These birds have a wide distribution with high adaptability, so they are often found around human disturbed environment. But among all these species, the Sooty-headed bulbul is the species with the largest number of individuals.

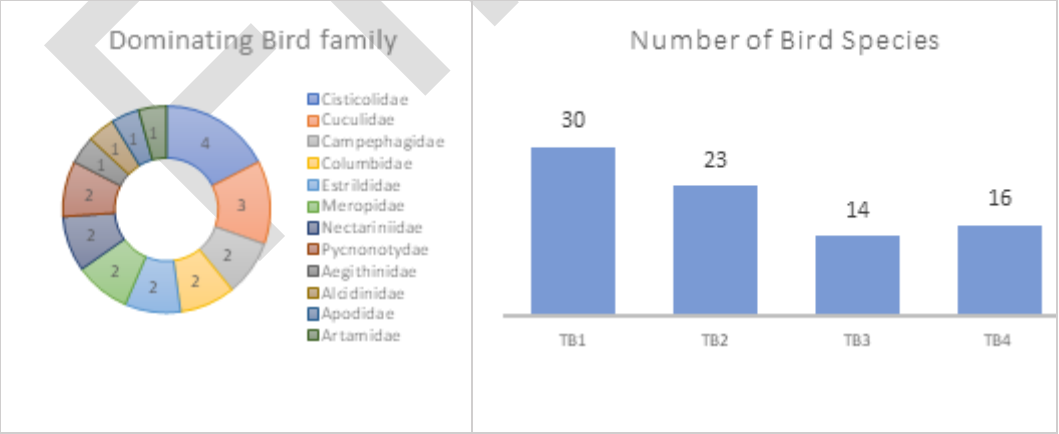


Figure 4-29 *Dominating bird family and number of bird species in different transects*

Cisticolidae is the bird family with the most numerous species found during the survey, with nine species. The Cisticolidae probably originated in Africa, which has most species, but there are representatives of the family across tropical Asia into Australasia, and one species in Europe. They are found in open country such as grassland or scrub, but often difficult to see. This family is not a large family, with an estimated number of members

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of around 157 species throughout the world. Nine of these species can be found on the island of Java, and four of them can be found in the study area (Eaton et al. 2021).

TB1 is the transect with the highest number of bird species encounters, with a total of 30 species. This transect is dominated by secondary forest which is quite dense, equipped with open shrubland habitat and mixed plantation that containing several fruit trees as a food source. For this reason, more bird species were found due to the sufficient availability of various types of habitats for various types of birds.

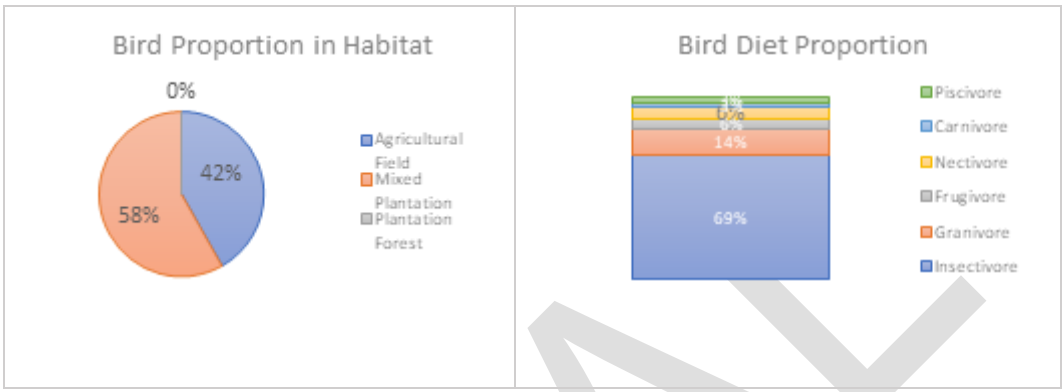


Figure 4-30 *The proportion of bird species in various land classes and feeding types of bird*

Based on the data above, it is known that most birds choose to be in mixed plantation habitats which have more plant species and thus provide a more diverse diet. As shown in Figure above, more than half, or more precisely 69% of the bird species found during the survey used insects as their main food. Most bird species are insectivores, and all insectivorous birds are estimated consumed 400 million of insects annually (Nyffeler 2018). Thus, the role of insectivorous birds is very large for agriculture and life in the world in general.

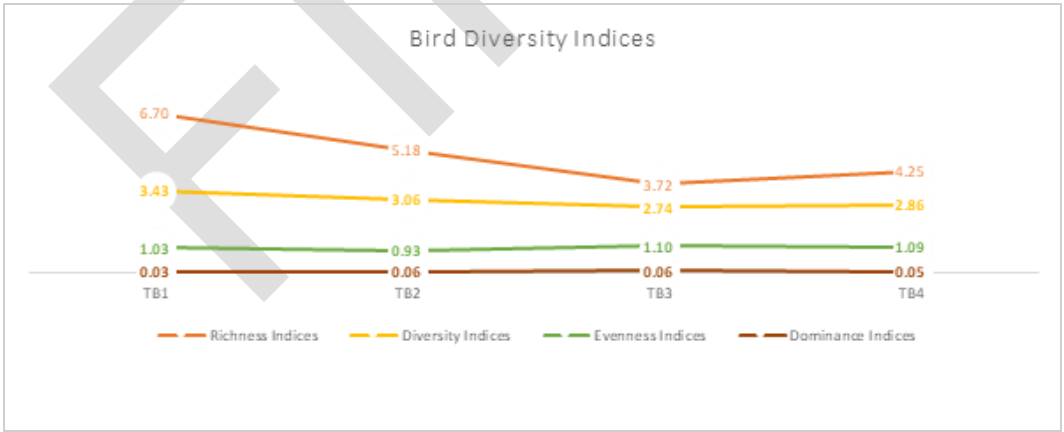


Figure 4-31 *Diversity, evenness, and richness indices of mammal species*

Having the highest number of bird species automatically makes the TB1 transect occupy the highest position in the diversity and species richness index values. Apart from that, this transect also has a fairly high evenness value and the lowest dominance value. With an evenness value of more than 1 means that the distribution of individuals of each species is evenly distributed (Odum 1993). Then, a low dominance value means that no species is considered dominant in the bird community in this transect. Based on the graph above, it can also be seen that other transects also have almost equal evenness

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and dominant index values. So, in general all transects in the study area have good bird communities, although the number of species varies depending on the habitat within them.

The results of vantage point observations during 1st baseline study found eleven bird species belonging to ten families. Only Meropidae that have two species, while the other are only one species from each family. The study area was already heavily modified and only limited number of species that can adapt to the existing environment.

The vantage point survey was aimed at analyzing several bird species that might be impacted by the solar PV and the transmission line. For the ground mounted solar PV, the vantage point survey focused on the high-flying birds that can hit the transmission line. Below is the list of observed birds from the vantage point survey.

Table 4-33 *List of birds observed from vantage point survey in the study area*

No.	Family	Scientific Name	English Name	Vantage Points			Height Band
				VP1	VP2	VP3	
1	Accipitridae	*Spilornis cheela*	Crested Serpent-eagle	VP1		VP3	2,3
2	Alcidinidae	*Todiramphus chloris*	Collared Kingfisher	VP1	VP2	VP3	1
3	Apodidae	*Collocalia linchi*	Cave Swiftlet	VP1	VP2		1
4	Ardeidae	*Ardeola speciosa*	Javan Pond Heron			VP3	1
5	Artamidae	*Artamus leucoryn*	White-breasted Woodswallow	VP1	VP2	VP3	1
6	Cuculidae	*Centropus bengalensis*	Lesser Coucal	VP1		VP3	1
7	Halcyonidae	*Halcyon cyanoventris*	Javan Kingfisher		VP2		1
8	Meropidae	*Merops leschenaulti*	Chestnut-headed Bee-eater	VP1			1
9	Meropidae	*Merops philippinus*	Blue-tailed Bee-eater	VP1			1
10	Picidae	*Dendrocopos analis*	Freckle-breasted Woodpecker		VP2		1
11	Pycnonotydae	*Pycnonotus goiavier*	Yellow-vented Bulbul		VP2		1

Notes: height band 1= <30 meters, 2= 30-100 meters, 3= >100 meters

The result shows that Crested Serpent-Eagle is the only bird that observed fly in Band 2 and 3, the approximate height of the transmission line. Other birds fly in band 2, including the cave swiftlet, Javan pond heron, white-breasted wood swallow, and Javan Kingfisher, were observed only fly within Band 1.

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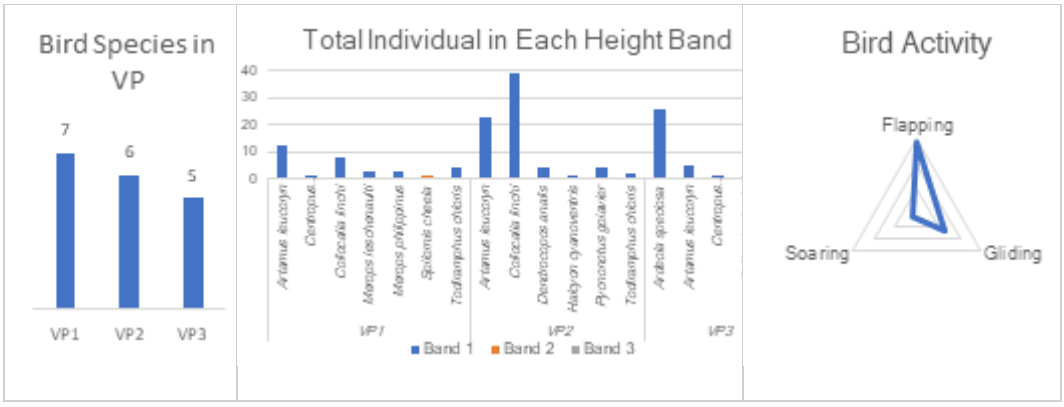


Figure 4-32 *Bird Species in VP, Total Individual in Each Height Band and Bird Activity*

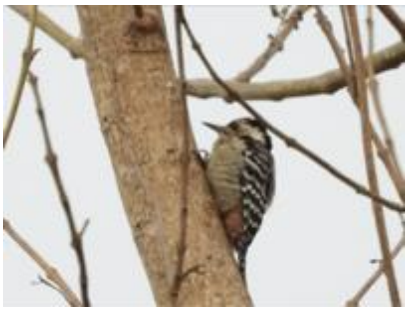
Considering the small number of species that were observed during the 1st baseline study, the birds in three VPs were almost distributed evenly. VP1 has the highest number with seven species, followed by VP2 and VP3 with six and five species. VP1 is in the TB1 transect within the sugarcane plantation. This area has the widest viewpoint since it was in the recently harvested area. VP2 and VP3 have relatively similar setting, but VP3 is closer to the settlement.

Almost all the birds were observed while flapping during the vantage point survey. Gliding was only observed from two species, namely white-breasted wood swallow and cave swiftlet. Meanwhile, soaring crested serpent-eagle was observed twice only. Soaring is a distinct flying activity by birds of prey to conserve their energy while hunting. They usually utilize the thermal draft to push them upward without consuming much energy.

The 2nd baseline survey has been conducted in March 2025. The main objective of this survey is to collect sufficient information regarding the utilization of air space at Band 2 especially at the proposed location of transmission line for assessing the risk of bird collision/electrocution. Two locations (VP1 and VP2) were selected for VP survey based on their feasibility. Ideally, VP survey location has a characteric to let observers in conducting visual observation in radius 500 m without any obstacles.



Zebra dove



Freckle-breasted Woodpecker

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Gray-rumped Treeswift



Common Iora

Figure 4-33 *Birds observed in the study area*

The 2nd biodiversity survey was carried out during rainy season (March 19 to 21) using vantage point (VP) survey. The main objective of the survey is to observe bird flight frequency (particularly species with conservation significance) on the location of proposed overhead transmission line (OHTL). Two VPs were selected (VP 1 and VP2) for the three-days survey (36 hours). Both VPs are situated within dryland agricultural areas, with some settlements present within the survey radius. Specifically, VP1 is between Transmission Towers T-06 and T-07, while VP2 is between Transmission Towers T-11 and T-12. **Figure 4-34** below presents the general condition of VP1 and VP2. The VP1 and VP2 location related to the Banyuwangi Solar PV project is presented in **Figure 4-35**). Detailed VP survey data sheet of 2nd biodiversity assessment is provided in **Appendix C 7**.



Figure 4-34 *General Field Condition of VP1 (Left) and VP 2 (Right)*

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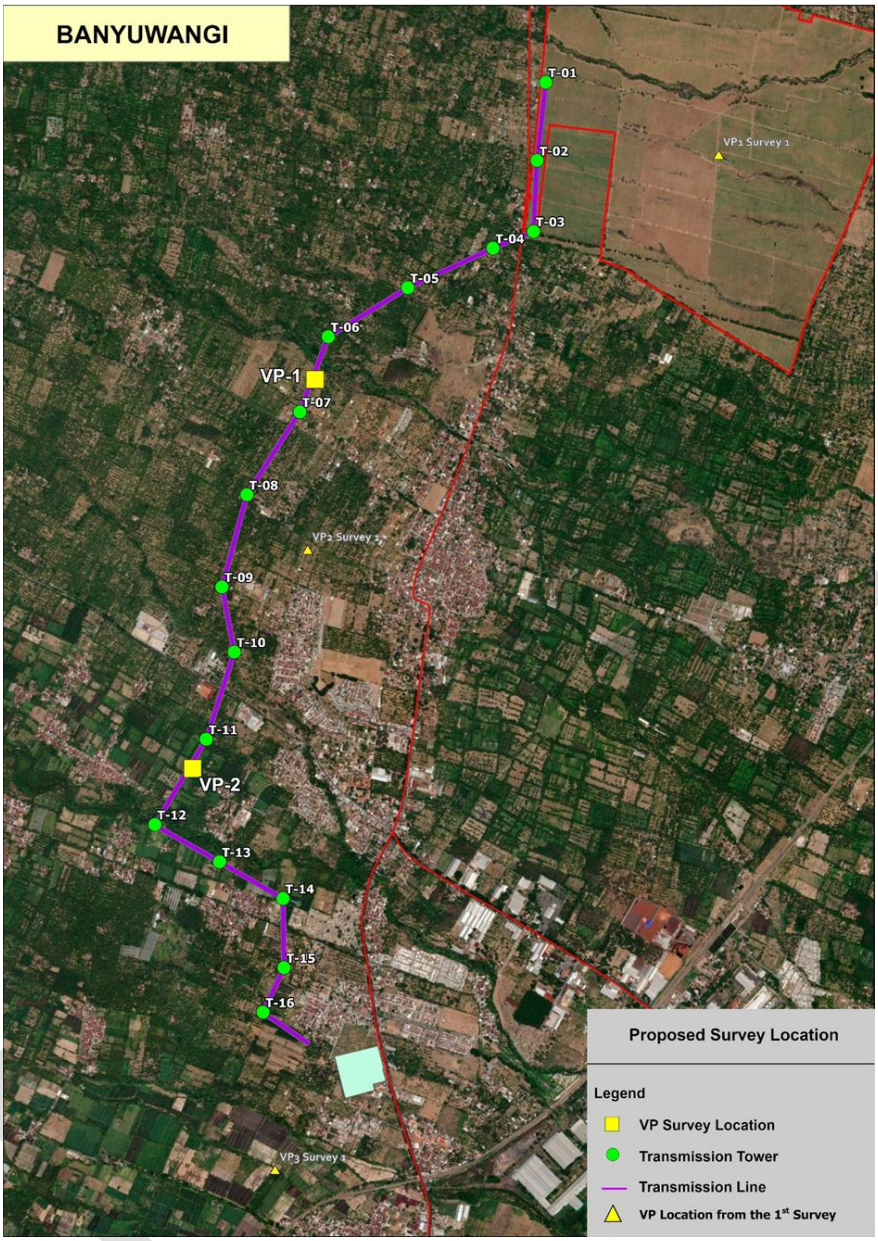


Figure 4-35 *Vantage Point Survey Locations*

Based on the survey, 40 bird species were observed crossing or inhabiting the habitat along the transmission line. Of these, 33 species were recorded within the VP1 area and 25 within the VP2 area. The observed bird species are listed in table below.

Table 4-34 *List of Bird Species observed during 2nd Baseline Study*

No	Family	*Species*	Common Name	Conservation Status					VP1	VP2
				IUCN	CITES	Protected	Migratory	Endemic		
1	Accipitridae	*Accipiter soloensis*	Chinese Sparrowhawk	LC	II	P	M			VP2
2	Accipitridae	*Pernis ptilorhynchus*	Crested Honey Buzzard	LC	II	P	M		VP1	
3	Aegithinidae	*Aegithina tiphia*	Common Iora	LC				E	VP1	VP2

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No	Family	*Species*	Common Name	Conservation Status					VP1	VP2
				IUCN	CITES	Protected	Migratory	Endemic		
4	Alcedinidae	*Alcedo meninting*	Blue-eared Kingfisher	LC						VP2
5	Alcedinidae	*Halcyon cyanoventris*	Javan Kingfisher	LC					VP1	VP2
6	Alcidinidae	*Todiramphus chloris*	Collared Kingfisher	LC					VP1	VP2
7	Apodidae	*Aerodramus maximus*	Black-nest Swiftlet	LC					VP1	VP2
8	Apodidae	*Apus nipalensis*	House Swift	LC					VP1	VP2
9	Apodidae	*Collocalia linchi*	Cave Swiftlet	LC						VP2
10	Ardeidae	*Ardeola speciosa*	Javan Pond Heron	LC						VP2
11	Artamidae	*Artamus leucoryn*	White-breasted Woodswallow	LC					VP1	VP2
12	Campephagidae	*Lalage nigra*	Pied Triller	LC					VP1	VP2
13	Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola	LC					VP1	
14	Cisticolidae	*Cisticola juncidis*	Zitting Cisticola	LC					VP1	
15	Cisticolidae	*Orthotomus sepium*	Olive-backed Tailorbird	LC				E	VP1	
16	Cisticolidae	*Prinia inornata*	Plain Prinia	LC					VP1	
17	Columbidae	*Geopelia striata*	Zebra dove	LC					VP1	VP2
18	Columbidae	*Spilopelia chinensis*	Eastern Spotted Dove	LC					VP1	VP2
19	Cuculidae	*Centropus bengalensis*	Lesser Coucal	LC					VP1	
20	Dicaeidae	*Dicaeum trochileum*	Scarlet-headed Flowerpecker	LC				E	VP1	VP2
21	Estrildidae	*Lonchura leucogastroides*	Javan Munia	LC				E	VP1	VP2
22	Estrildidae	*Lonchura maja*	White-headed Munia	LC						VP2
23	Estrildidae	*Lonchura punctulata*	Scaly-breasted Munia	LC					VP1	VP2
24	Falconidae	*Falco peregrinus*	Peregrine Falcon	LC	I	P	M			VP2
25	Hemiprocnidae	*Hemiprocne longipennis*	Gray-rumped Treeswift	LC					VP1	VP2
26	Hirundinidae	*Hirundo javanica*	House Swallow	LC					VP1	VP2
27	Megalaimidae	*Psilopogon haemacephalus*	Coppersmith Barbel	LC					VP1	
28	Meropidae	*Merops leschenaulti*	Chestnut-headed Bee-eater	LC					VP1	
29	Meropidae	*Merops philippinus*	Blue-tailed Bee-eater	LC			M			VP2
30	Nectariniidae	*Anthreptes malacensis*	Brown-throated Sunbird	LC					VP1	VP2
31	Nectariniidae	*Cinnyris jugularis*	Ornate Sunbird	LC					VP1	
32	Phasianidae	*Gallus varius*	Green Junglefowl	LC				E	VP1	
33	Picidae	*Dendrocopos analis*	Freckle-breasted Woodpecker	LC					VP1	VP2

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No	Family	*Species*	Common Name	Conservation Status					VP1	VP2
				IUCN	CITES	Protected	Migratory	Endemic		
34	Picidae	*Picoides moluccensis*	Sunda Pygmy Woodpecker	LC					VP1	
35	Pycnonotydae	*Pycnonotus aurigaster*	Sooty-headed Bulbul	LC					VP1	VP2
36	Pycnonotydae	*Pycnonotus goiavier*	Yellow-vented Bulbul	LC					VP1	
37	Sturnidae	*Acridotheres javanicus*	Javan Myna	VU					VP1	
38	Sturnidae	*Aplonis panayensis*	Black-nest Swiftlet	LC					VP1	
39	Turnicidae	*Turnix suscitator*	Barred Buttonquail	LC					VP1	VP2
40	Turnicidae	*Turnix sylvaticus*	Common Buttonquail	LC					VP1	
Notes: LC=Least Concern; P=Protected; M=Migratory; E=Endemic										

The recording of the flight path used by the birds was categorised into three altitude bands: Band 1 (0–10 meters), Band 2 (10–35 meters), and Band 3 (above 35 meters). Observations showed that Band 1 in VP1 and VP2 was the most frequently used flight zone, where a variety of bird species were commonly seen flying. Band 2 followed with fewer sightings, while Band 3 had the least number of bird flights recorded (**Figure 4-36**).

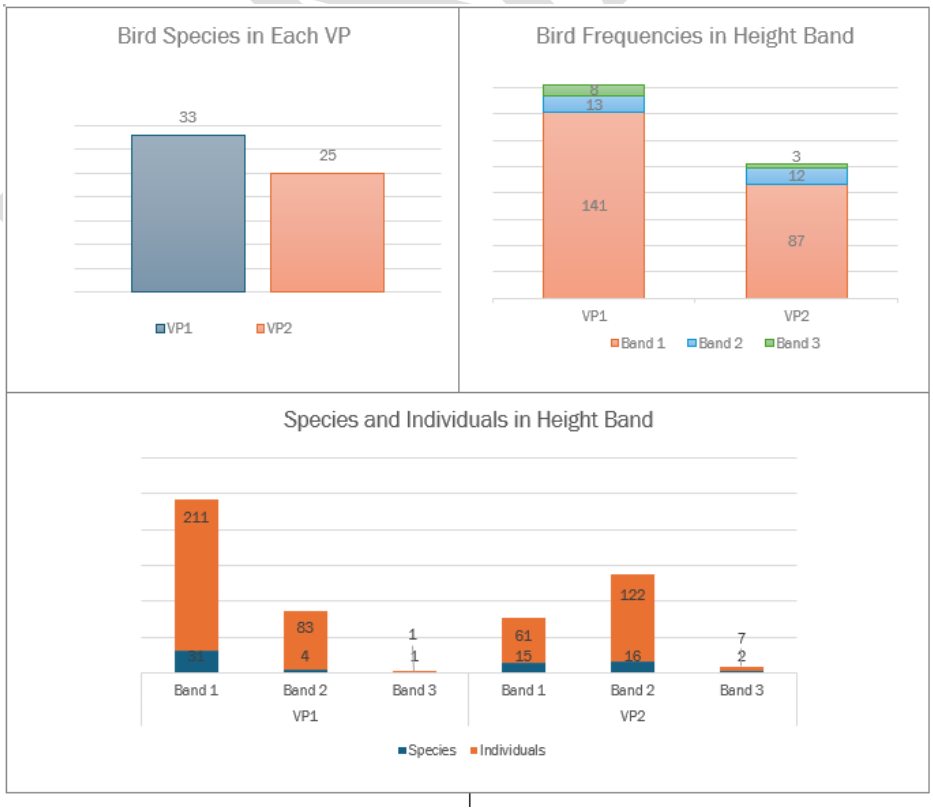


Figure 4-36 *Species number, frequencies, and individuals in height band in each VP*

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The survey results indicated that the most of birds exhibited a preference for lower altitude (Band 1) flight at both survey locations during the observation period. Over the course of three days, a total of 141 flight movements were recorded within Band 1 at observation point VP1, while 87 movements were documented in the same altitude band at VP2. Birds that occupy Band 2 only contribute 13 flight movements in VP1 and 12 in VP2.

VP1 observation point exhibited a higher frequency of species observations compared to VP1, with a greater overall observation rate. Based on the general site conditions, it is hypothesised that VP2, along with its surrounding area, serves as a foraging habitat for a majority of the species. These species likely originate from the VP1 direction and other areas, contributing to the higher diversity observed at VP2.

Band 2, defined by an altitude range of 10–35 meters, represents the primary observation zone for this study, as it corresponds with the height span of the transmission infrastructure. Specifically, this range encompasses the vertical space between the lowest cable suspension point and the standard operational height of 150 kV transmission lines. In the surveyed area, Band 2 includes zones with tree-dominated vegetation, comprising mixed plantations and agricultural landscapes with scattered tree species.

Focusing on Band 2 (with an altitude range of 10–35 meters), which aligns with the estimated height of the transmission line, a total of 17 bird species were recorded utilising this vertical space. At VP1, bird use of Band 2 was relatively limited, with only 4 species observed flying within this zone. These accounted for a total of 11 flight movements involving 81 individual birds throughout the survey period. In contrast, VP2 showed significantly higher activity within Band 2, with 16 species recorded, comprising 38 flight movements and involving 122 individual birds. The detailed data on bird utilisation of the Band 2 zone is presented in **Table 4-35**.

Table 4-35 *Individual number of bird species in height Band 2*

No.	Family	Species Name	Common Name	Frequencies		Individuals	
				VP1	VP2	VP1	VP2
1	Accipitridae	*Pernis ptilorhynchus*	Crested Honey Buzzard	2		2	
2	Apodidae	*Aerodramus maximus*	Black-nest Swiftlet	1	2	6	10
3	Apodidae	*Apus nipalensis*	House Swift	7	1	73	2
4	Apodidae	*Collocalia linchi*	Cave Swiftlet		7		45
5	Ardeidae	*Ardeola speciosa*	Javan Pond Heron		2		2
6	Artamidae	*Artamus leucoryn*	White-breasted Woodswallow		5		5
7	Columbidae	*Geopelia striata*	Zebra dove		1		2
8	Columbidae	*Spilopelia chinensis*	Eastern Spotted Dove		1		1
9	Dicaeidae	*Dicaeum trochileum*	Scarlet-headed Flowerpecker		1		1
10	Estrildidae	*Lonchura leucogastroides*	Javan Munia		2		6
11	Estrildidae	*Lonchura punctulata*	Scaly-breasted Munia		6		34
12	Falconidae	*Falco peregrinus*	Peregrine Falcon		2		2
13	Halcyonidae	*Halcyon cyanoventris*	Javan Kingfisher		2		4
14	Hemiprocnidae	*Hemiprocne longipennis*	Gray-rumped Treeswift		1		1
15	Hirundinidae	*Hirundo javanica*	House Swallow	1	2	2	3

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No.	Family	Species Name	Common Name	Frequencies		Individuals	
				VP1	VP2	VP1	VP2
16	Meropidae	*Merops philippinus*	Blue-tailed Bee-eater		2		3
17	Picidae	*Dendrocopos analis*	Freckle-breasted Woodpecker		1		1

The observation at VP2 indicate a higher richness of species compared to VP1. This suggests that VP2 provides more suitable or attractive habitat conditions for bird species utilising mid-altitude flight paths. The difference in bird activity between the two locations may be attributed to variations in landscape features or proximity to key foraging areas. In addition, human activities, including agricultural practices and hunting, may also influence the bird diversity at these locations.

Based on field observation in both locations, the majority of species did not fly at significantly high elevations, instead remaining close to or slightly above the canopy level. This is likely due to the presence of mature vegetation in the area, with tree stands exceeding 10 meters in height, which continue to serve as suitable habitat for various bird species, including those listed in above table. For example, several bird species, such as the Javan Kingfisher and Zebra Dove, are commonly observed flying at the treetop level as they move among the trees.

Consistent with the previous discussion, observations at both VP1 and VP2 indicate that bird movements within Band 2 generally exhibit random patterns with no clear dominant flight direction. This randomness is especially evident among species that display circular or rotational flight behaviours, such as the house swift, barn swallow, crested honey buzzard, and black-nest swiftlet. At VP2, however, some bird species were observed flying in linear patterns, moving from one direction to another. Despite this, these straight flight paths were relatively short, as most birds typically perched and moved between individual trees rather than engaging in prolonged flight within the Band 2 zone.

Such random flight movements are common in modified habitats, including agricultural lands and plantations, where multiple factors influence avian behaviour. These factors include various human activities and the specific types of crops being cultivated. Each type of crop offers distinct ecological functions, particularly regarding food sources and nesting sites, which are important for different bird species.

Illustrations of Band 2 airspace utilisation within the radius of 100-200m by various bird species in both areas are presented in figures below.

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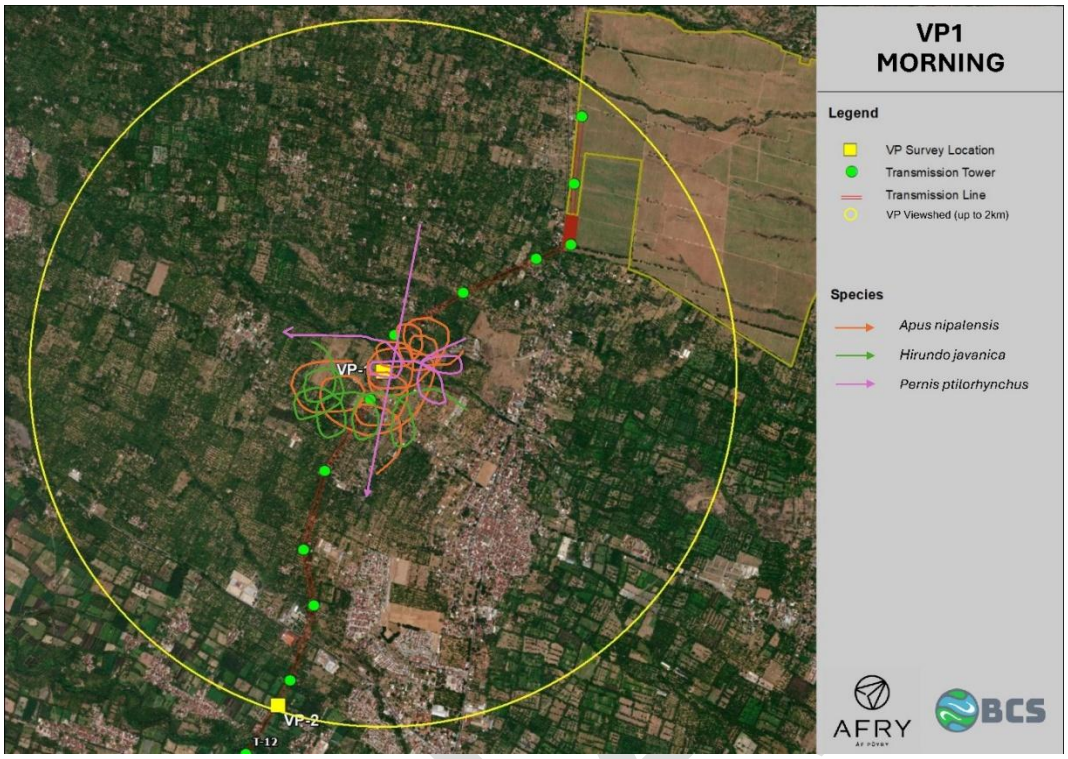


Figure 4-37 *Birds Flight Direction Illustration within VP1 during Morning Observation*

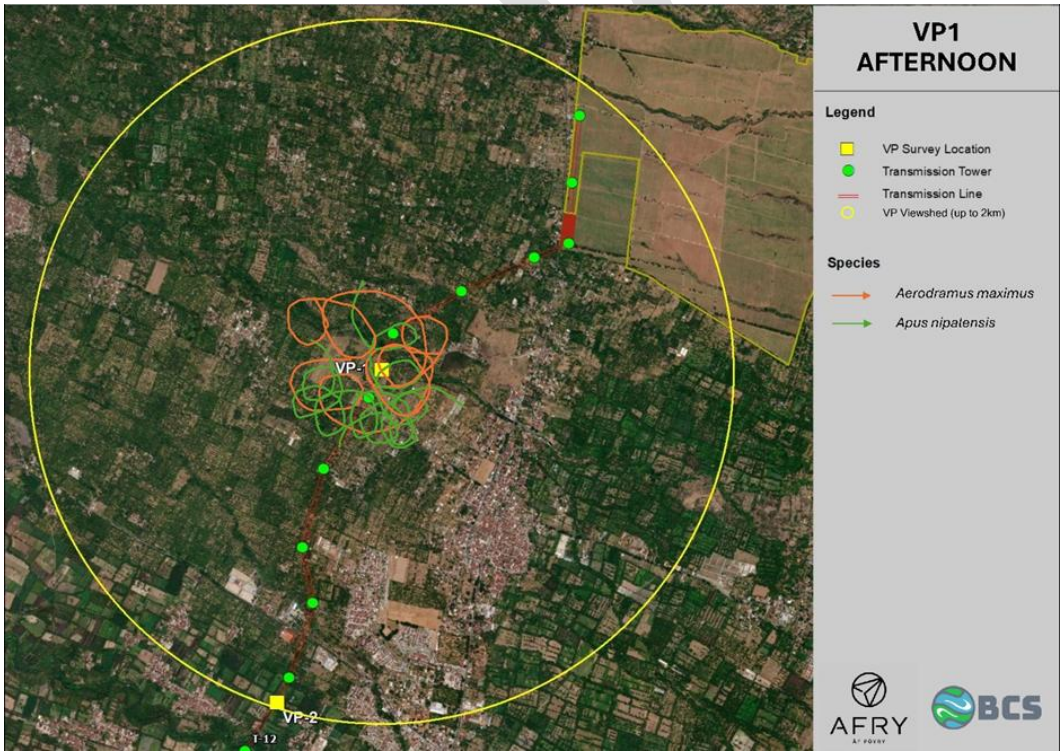


Figure 4-38 *Birds Flight Direction Illustration within VP1 Location during Afternoon Observation*

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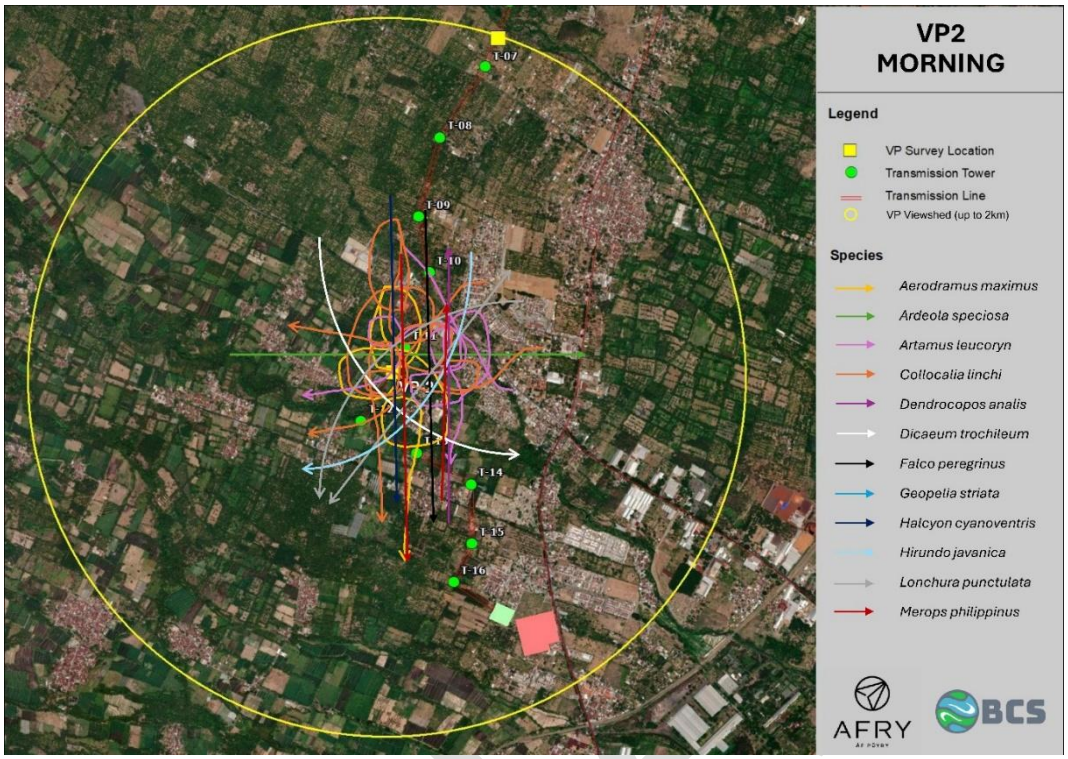


Figure 4-39 *Birds Flight Direction Illustration within VP2 during Morning Observation*

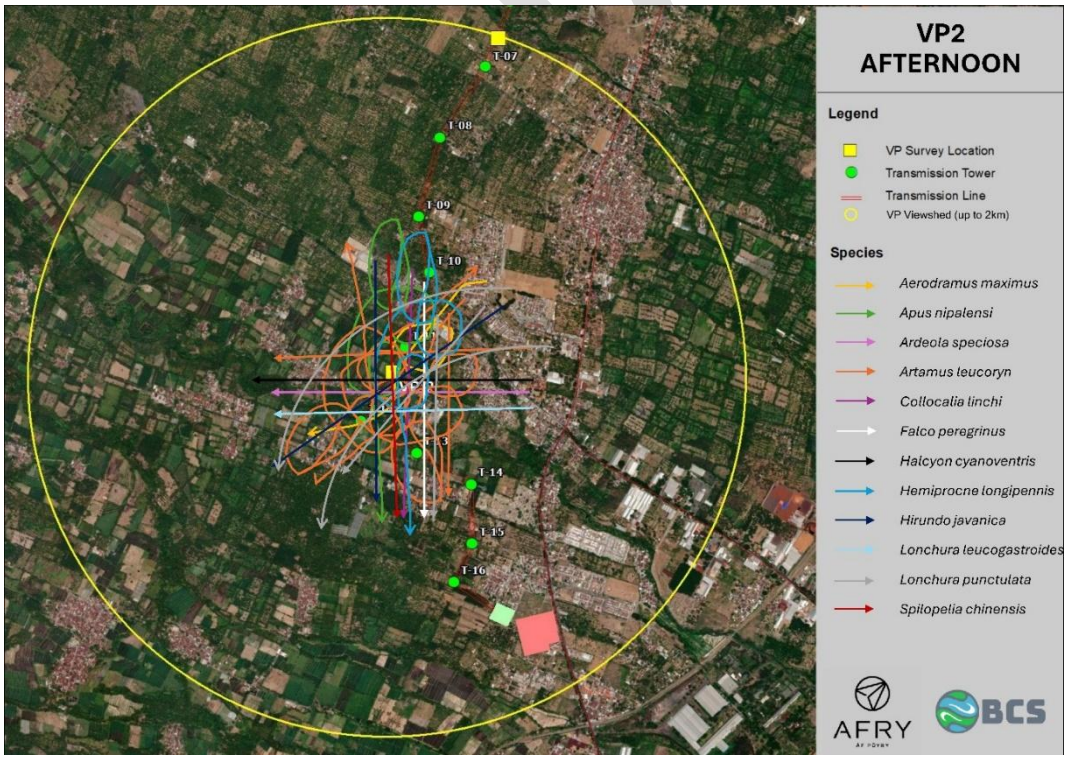


Figure 4-40 *Birds Flight Direction Illustration within VP2 Location during Afternoon Observation*

The survey results advised that those VPs are common habitats for a diverse range of bird species, particularly within Band 2, where at least 17 species have been recorded utilising this specific zone. This area, characterised by its proximity to both agricultural

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lands and plantation environments, plays a significant role in sustaining these species. The presence of birds commonly associated with these modified landscapes suggests that this region continues to fulfil essential ecological functions. These include providing food sources, shelters, and nesting sites, particularly through tree vegetation that supports both foraging and breeding activities.

In general, the species observed in this area exhibit relatively small home ranges, which is reflected in their movement patterns. Notably, birds frequently move between trees with heights exceeding 10 meters, indicating that these higher canopy layers are crucial for their daily activities. This pattern of movement further suggests that the species utilise a relatively confined spatial area, reinforcing the idea that their habitat preferences are closely linked to the structural features of the landscape, such as tree density and height.

These observations underscore the highly dynamic nature of bird presence and population dynamics in this area. The variability in species movement, particularly the limited home ranges, hints at a fluid interaction with the environment, likely influenced by seasonal changes, food availability, and other environmental factors. Moreover, these patterns align with broader ecological findings on bird migration and movement ecology, which highlight the complex and context-dependent nature of space use in avian species. The shifting patterns of bird behavior in this region suggest that habitat utilisation will continue to evolve, potentially driven by changing environmental conditions, human activities, or shifts in local biodiversity.

Mammals

Based on observations made using various methods, ten species of mammals were found, divided into seven families. Below is a complete list of all the mammal species found.

Table 4-36 *List of observed mammals in the survey location*

No	Family	Scientific Name	English Name	Transect				Habtitat		
				TB1	TB2	TB3	TB4	AF	MP	ST
1	Ceropithecidae	*Macaca fascicularis*	Long-Tailed Macaque	TB1						ST
2	Hystricidae	*Hystrix javanica*	Sunda Porcupine	TB1				AF		
3	Muridae	*Rattus sp.*	Rat				TB4			ST
4	Sciuridae	*Callosciurus notatus*	Plantain Squirrel	TB1		TB3	TB4		MP	
5	Tupaiidae	*Tupaia javanica*	Horsfield's Treeshrew			TB3			MP	
6	Viveridae	*Paradoxurus hermaphroditus*	Common Palm Civet	TB1		TB3		AF	MP	
7	Pteropodidae	*Cynopterus brachyotis*	Lesser Dog-Faced Fruit Bat	TB1			TB4	AF	MP	ST
8	Pteropodidae	*Cynopterus minutus*	Minute Fruit Bat				TB4	AF		
9	Pteropodidae	*Eonycteris spelaea*	Cave Nectar Bat	TB1						ST
10	Pteropodidae	*Rousettus amplexicaudatus*	Geoffroy's Rousette	TB1						ST

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No	Family	Scientific Name	English Name	Transect				Habtitat		
				TB1	TB2	TB3	TB4	AF	MP	ST

Notes: AF=Agricultural Field; MP=Mixed Plantation; PF=Plantation Forest; ST=Settlement

The survey for mammals in the study area resulted in eleven species from ten families. Plantain squirrel is the only mammal species found in three of four transects. Plantain squirrels are spread in the Malay Peninsula, Sumatra, Borneo, Java, Bali, and Lombok. This species is adaptable, as it is found in secondary forests, plantations, and all kinds of habitats, though not so common in pristine forests. It is widespread in towns, scrub, secondary forests, forest edges, and urban parks, sometimes even considered a pest in plantations (Duckworth 2016).

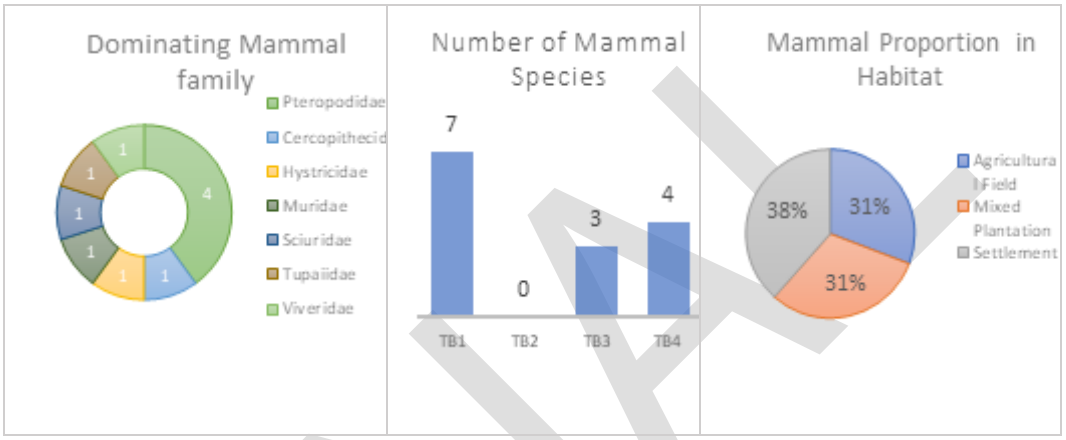


Figure 4-41 *Number of mammal families and species in different transects and habitats*

Pteropodidae has the highest number of mammal species found during this survey, with four species. While other families only have 1 species respectively. Pteropodidae, commonly known as Fruit bats, are confined to the tropics of the Old World, including Africa and Asia, and are nocturnal fruit, nectar, and leaf eaters (Phillipps and Phillipps 2016). Transect TB2 does not have sufficient canopy cover because it is dominated by sugarcane fields and cannot accommodate mammal life in it, so the number of species found on this transect is zero. Agricultural field habitats can still accommodate mammal life, as can be seen from the percentage of mammal species found in agricultural field habitats of 31%. The case in TB2 is likely due to sugar cane not yet growing and even being harvested in some areas, thus affecting encounters with mammals.

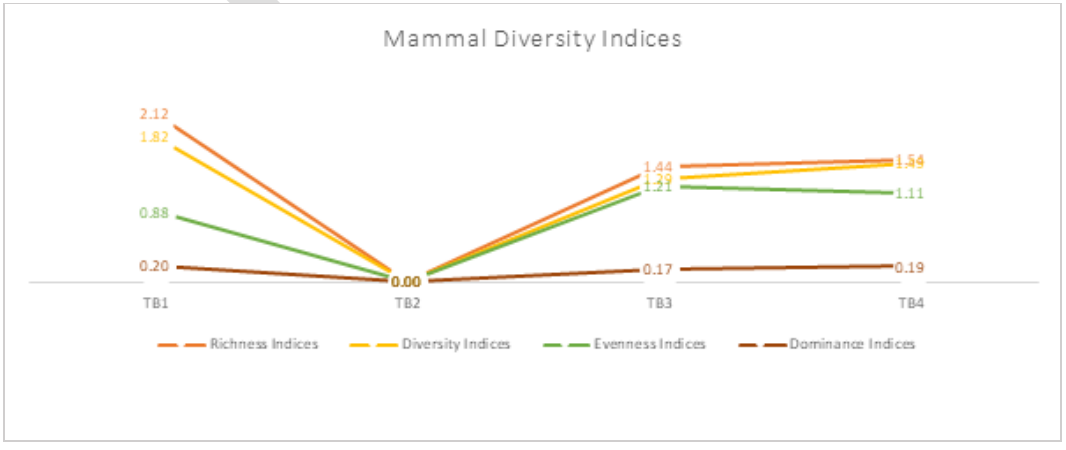


Figure 4-42 *Diversity, evenness, and richness indices of mammal species*

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Based on the calculation results above, the TB1 transect which has the most mammal species also has the highest diversity and richness values. However, the TB1 evenness value is the lowest and does not reach the value of 1, which means that the distribution of individuals of each species is not evenly distributed (Odum 1993). This can also be seen from the dominance value, which is higher than other transects, which means that there are certain species that dominate the encounters.



Long-Tailed Macaque



Horsfield's Treeshrew



Lesser Dog-Faced Fruit Bat



Geoffroy's Rousette

Figure 4-43 *Mammals observed in the study area*

Herpetofauna

The survey resulted in 12 species from 7 families: two amphibian families and five reptile families. Below is the complete list of herpetofauna observed during the survey.

Table 4-37 *List of observed herpetofauna in the survey location*

No	Family	Scientific Name	English Name	Transect				Habitat		
				TB1	TB2	TB3	TB4	AF	MP	PF
Amphibian										
1	Bufonidae	*Duttaphrynus melanostictus*	Asian Common Toad				TB4		MP	
2	Rhacophoridae	*Polypedates leucomystax*	Four-lined Tree Frog	TB1			TB4		MP	
Reptile										
3	Gekkonidae	*Cyrtodactylus marmoratus*	Marbled Bow-fingered Gecko		TB2	TB3			MP	
4	Gekkonidae	*Gekko gecko*	Tokay Gecko	TB1	TB2	TB3	TB4		MP	PF
5	Gekkonidae	*Hemidactylus frenatus*	Common house gecko				TB4		MP	

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No	Family	Scientific Name	English Name	Transect				Habitat		
				TB1	TB2	TB3	TB4	AF	MP	PF
6	Scincidae	*Eutropis multifasciata*	Common Mabuya	TB1	TB2	TB3	TB4		MP	PF
7	Agamidae	*Bronchocela cristatella*	Green Crested Lizard	TB1					MP	
8	Agamidae	*Bronchocela jubata*	Great Crested Canopy Lizard			TB3			MP	
9	Agamidae	*Calotes versicolor*	Changeable Lizard	TB1	TB2		TB4		MP	
10	Colubridae	*Ahaetulla prasina*	Oriental whip snake	TB1	TB2				MP	
11	Colubridae	*Xenochrophis trianguligerus*	Red-sided Keelback Water Snake			TB3			MP	
12	Varanidae	*Varanus salvator*	Common Water Monitor			TB3			MP	

Notes: AF=Agricultural Field; MP=Mixed Plantation; PF=Plantation Forest; ST=Settlement

The Tokay gecko and Common mabuya are the herpetofauna species found in all transects and is the most frequently encountered species. Tokay gecko is widespread in the Indo-Malayan region, throughout Western Indonesia to Sulawesi and Lesser Sunda. This large, nocturnal gecko which can be common in urban and rural areas, which thrives in artificial environment. In natural areas, this species has been observed in lowland and hill dipterocarp forest (Lwin et al. 2019). Meanwhile Common mabuya has an extensive range from India through continental Southeast Asia to Indonesia, which has been introduced to Papua. This species is very widespread and abundant throughout its range, and the global population is stable (Shea et al. 2018).

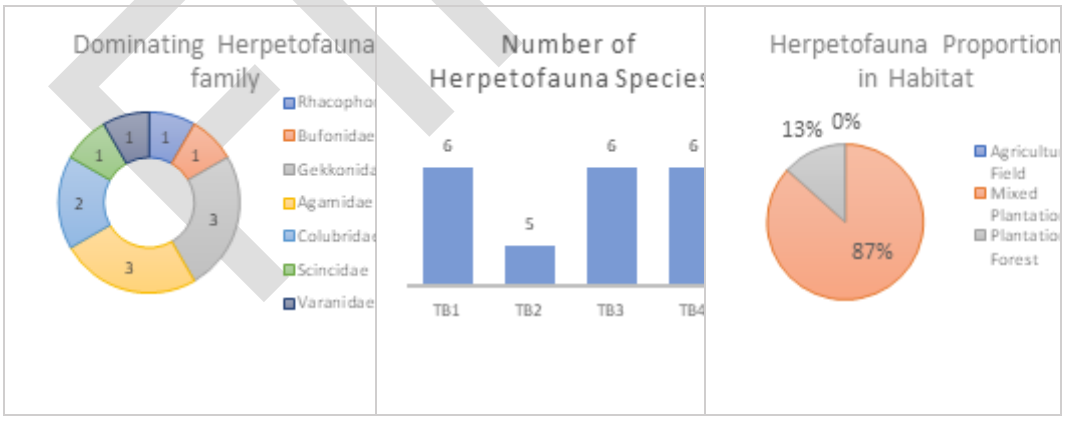


Figure 4-44 *Number of herpetofauna families and species in different transects and habitats*

Only two species of frogs were found in this survey, so no one family is considered dominant. Meanwhile, on the reptile side, there are two families that have the most species, with 3 species each, namely Gekkonidae and Agamidae. Gekkonidae is the most prominent family of geckos, which contains many of the most widespread gecko species. Many genera of this family are capable of widespread geographic habitation and can be considered invasive in some areas. Meanwhile, Agamidae is a family of over 550 species of iguanian lizards indigenous to Africa, Asia, Australia, and a few in Southern Europe. TB2 transect which has limited habitat in the form of agricultural field cannot

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accommodate many herpetofauna species, with only 5 species found. It can also be seen in the graph above that 87% of herpetofauna species are found in mixed plantation habitats.

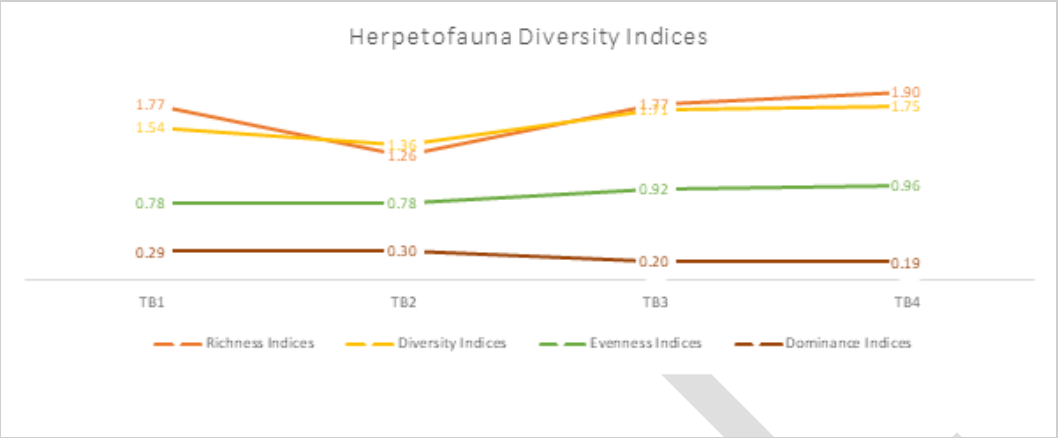


Figure 4-45 *Diversity, evenness, and richness indices of herpetofauna species*

It was previously mentioned that the three transects had an equal number of species, with 6 species each. But the results of statistical index calculations show different results, where TB1 shows the lowest value compared to the other two transects. The TB1 transect evenness value was the lowest, which means that the distribution of individuals for each type was not evenly distributed. A fairly high dominance value indicates that there is a certain species that is considered to dominate the herpetofauna community in this transect. The presence of this dominant species then influences the diversity and richness index values.



Red-sided Keelback Water Snake



Common Water Monitor

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Baram Whipping Frog



Four-lined Tree Frog

Figure 4-46 *Herpetofauna observed in the study area*

Insects

Survey activity resulted in 35 butterfly species from 10 families and 9 dragonfly species from 4 families. Below is the complete list of insects observed during the survey.

Table 4-38 *List of observed insect in the survey location*

No	Order	Family	Scientific Name	Transect				Habitat		
				TB1	TB2	TB3	TB4	AF	MP	ST
1	Lepidoptera	Lycaenidae	*Arophala sp*				TB4			ST
2	Lepidoptera	Lycaenidae	*Zizina otis*	TB1	TB2			AF	MP	
3	Lepidoptera	Pieridae	*Appias lyncida*	TB1					MP	
4	Lepidoptera	Pieridae	*Appias lybithea*				TB4			ST
5	Lepidoptera	Pieridae	*Belenois java*	TB1			TB4		MP	ST
6	Lepidoptera	Pieridae	*Catopsilia pomona*	TB1		TB3		AF	MP	
7	Lepidoptera	Pieridae	*Leptosia nina*				TB4			ST
8	Lepidoptera	Pieridae	*Eurema hecabe*	TB1					MP	
9	Lepidoptera	Papilionidae	*Papilio demoleus*	TB1		TB3	TB4	AF	MP	ST
10	Lepidoptera	Papilionidae	*Papilio polytes*				TB4			ST
11	Lepidoptera	Nymphalidae	*Acraea terpiscore*	TB1			TB4		MP	ST
12	Lepidoptera	Nymphalidae	*Danaus chrysippus*	TB1	TB2	TB3	TB4	AF		ST
13	Lepidoptera	Nymphalidae	*Elymnias hypermnestra*			TB3	TB4	AF		ST
14	Lepidoptera	Nymphalidae	*Elymnias nassae*				TB4			ST
15	Lepidoptera	Nymphalidae	*Euploeae mulciber*				TB4			ST
16	Lepidoptera	Nymphalidae	*Junonia hedonia*	TB1			TB4		MP	ST
17	Lepidoptera	Nymphalidae	*Junonia iphita*				TB4			ST
18	Lepidoptera	Nymphalidae	*Junonia orithya*			TB3		AF		
19	Lepidoptera	Nymphalidae	*Mycalesis mineus*	TB1	TB2		TB4	AF	MP	
20	Lepidoptera	Nymphalidae	*Neptis hylas*	TB1					MP	
21	Lepidoptera	Nymphalidae	*Telinga janardana*	TB1					MP	
22	Lepidoptera	Nymphalidae	*Ypthima horsfieldii*		TB2		TB4	AF		ST
23	Lepidoptera	Nymphalidae	*Ypthima baldus*	TB1					MP	
24	Lepidoptera	Erebidae	*Amata huebneri*			TB3		AF		

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No	Order	Family	Scientific Name	Transect				Habitat		
				TB1	TB2	TB3	TB4	AF	MP	ST
25	Lepidoptera	Erebidae	*Grammodes geomatridae*		TB2			AF		
26	Lepidoptera	Erebidae	*Nyctemera coleta*				TB4			ST
27	Lepidoptera	Erebidae	*Trigonodes hyppsia*			TB3		AF		
28	Lepidoptera	Erebidae	*Utetheisa pulchella*	TB1	TB2			AF	MP	
29	Lepidoptera	Hesperidae	*Potanthus omaha*	TB1					MP	
30	Lepidoptera	Hesperidae	*Tribe baorini*				TB4			ST
31	Lepidoptera	Nolidae	*Xanthodes transversa*			TB3		AF		
32	Lepidoptera	Pyralidae	*Dasypyga sp*			TB3		AF		
33	Lepidoptera	Sphingidae	*Theretra oldenlandie*		TB2			AF		
34	Lepidoptera	Sphingidae	*Theretra sp*	TB1					MP	
35	Lepidoptera	Thyrididae	*Mellea sp*	TB1					MP	
36	Odonata	Calopterygidae	*Vestalis lactuorsa*			TB3		AF		
37	Odonata	Euphaeidae	*Euphaea variegata*			TB3		AF		
38	Odonata	Libelluidae	*Diplacodes travialis*	TB1			TB4			ST
39	Odonata	Libelluidae	*Aethriamantha gracilis*				TB4			ST
40	Odonata	Libelluidae	*Pantala flavescens*			TB3	TB4	AF	MP	ST
41	Odonata	Libelluidae	*Potamarcha congener*				TB4			ST
42	Odonata	Libelluidae	*Ortethrun sabina*				TB4			ST
43	Odonata	Libelluidae	*Neurothemis terminata*			TB3	TB4	AF	MP	ST
44	Odonata	Platycnemididae	*Nososcticta insignis*			TB3		AF	MP	
Notes: AF=Agricultural Field; MP=Mixed Plantation; PF=Plantation Forest; ST=Settlement										

Among all the butterfly species found, *Danaus chrysippus* can be found at all transects. *Danaus chrysippus*, also known as the Plain tiger, is a medium-sized butterfly widespread in Asia, Australia, and Africa. The plain tiger prefers arid, open areas, and is found in a variety of habitats, including deserts, mountains, deciduous forests, and human-tended gardens in cities and parks. Among the dragonfly species found, none were found in all transects, only a few species were found in two transects, one of which was *Pantala flavescens*. *Pantala flavescens* or Globe skimmer is considered the most widespread dragonfly on the planet with good population on every continent except Antarctica although rare in Europe (Boudot et al. 2016).

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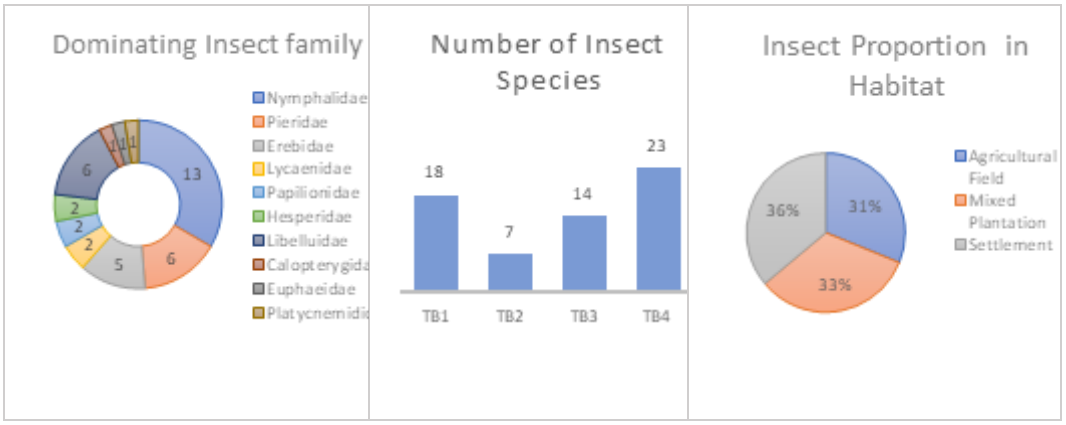


Figure 4-47 *Number of insect families and species in different transects and habitats*

Nymphalidae is the most common butterfly family with 13 species, while Libellulidae is the most common for the dragonfly group with 6 species. The Nymphalidae are the largest family of butterflies, with more than 6000 species distributed throughout most of the world. While Libellulidae is the largest dragonfly family in the world, consist of what is known as skimmers or perchers. With nearly worldwide distribution, these are almost certainly the most often seen of all dragonflies.

As observed in other taxa, the fewest insect species were found in transect TB2. Monoculture planting of sugar cane with little food and an environment that tends to be dry results in a low number of insect species in this transect. Based on the graph above, the most common insect species are found in settlement habitats with a percentage of 36%. The relatively open settlement habitat with various plant species is sufficient to support insect life. This habitat type condition supports the life of butterflies and dragonflies which need sunlight to sunbathe, making it easier to fly and forage for food (Wijayanto et al. 2016).

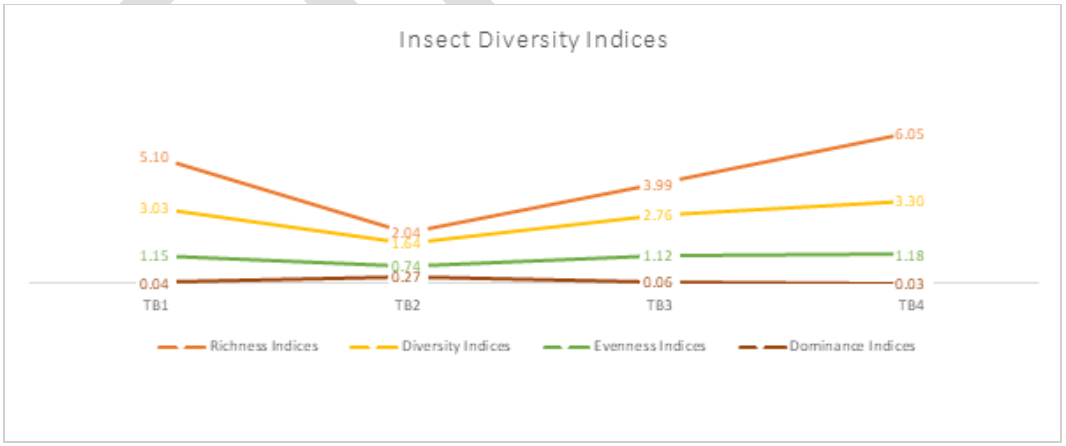


Figure 4-48 *Diversity, evenness, and richness indices of herpetofauna species*

Based on the statistical calculations above, TB6 competes closely with TB3 in obtaining values, even though TB6 has one more species than TB3. When examined between these two transects, TB3 has higher diversity and evenness values, but lower than TB6 in richness and dominance values. From these results it can be estimated that TB3 has the highest species diversity with an even distribution of individuals for each species so that there is no dominant species in it.

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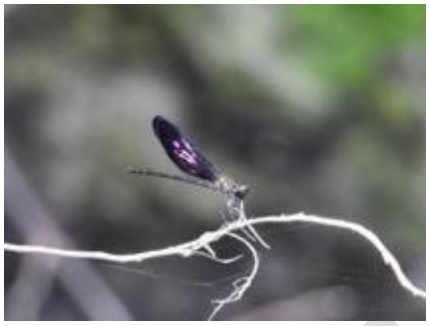
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Papilio demoleus



Junonia hedonia



Euphaea variegata



Aethriamantha gracilis

***Figure 4-49** Insect observed in the study area*

Invasive Species

In 2013, the long-tailed macaque *Macaca fascicularis* was categorized as one of the 100 worst invasive alien species (Luque et al., 2013, *Nature*, 498, 37). However, its population has declined as a result of conflicts with people, trade for pets and for the medical industry (Hansen et al., 2019, *Conservation Science and Practice*, 1, e88). In addition, the Covid-19 pandemic increased the demand for this species because of its use in vaccine development (Hansen et al., 2021, *Primate Conservation*, 35, 1–11). This macaque is considered by farmers as pest in several places. During the field observation in study area, the presence of this species occurred at TB1 only and not found at other survey locations including TB2 (proposed area for ground mounted solar PV installation).

4.1.12.8 Aquatic Biodiversity

4.1.12.8.1 Description of Aquatic Habitat

Given the field observation conducted in during the dry season, most existing riverine was dry. Location, namely FBA was selected to be aquatic fauna survey area due to the existing water (see **Figure 4-26**). It is in the downstream of project area (approximately 1.6 km from the proposed area for Project footprint) and part of Panawa River. The riverine area consists of spring water, semi-natural river, reserved river, and irrigation channel. The river is identified as lowland mountainous river with typical characteristic of short river with presence of multiple springs. The water sources of the river are mostly from springs. The springs are used for multiple purpose by local communities (clean water sources, irrigation, public bathing). Most of the riverine is modified habitat where the most of riverbanks were cemented. The water quality of the river in FBA are presented in **Table 4-39**.

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Figure 4-50 *Typical Existing Aquatic Habitats in FBA (A. Springs-functioned as traditional bathing area; B. Cemented Riverbanks; C. Remaining Uncemented River at downstream of sluice gate; D. Irrigation channel).*

The existing sluice gate divided Panawar River water flows into two distinct flow systems, irrigation and original flow of the river itself. During field observation, the water flow in the irrigation is greater than the natural river. The condition of the river is segmented by several sluice gates (located on the springs itself, PT. INKA workshop, and downstream the PT. INKA workshop). Domestic wastes such as plastic and diapers waste were also observed in the semi-natural river, especially below the bridges. The low of local communities' awareness on river water conservation has contributed to making river as waste disposal area.

Table 4-39 *Habitat Characteristic and Insitu Water Quality Parameter in each stations*

Character and Insitu Water Quality Parameters							
Research Stations	**Type and Function**	**pH**	**Substrate**	**Salinity (ppm), and temp (C)**	**Conductivity (µs/cm)**	**Depth (m), Water Body Wide (m)**	**Water Color and Clarity**
FBA (-8.14192, 114.38760)	Riverine area, Semi-artificial; Water source, irrigation.	7,74	Artificial (Cement with boulders); Mud, Sand, Organic litters, Aquatic macrophyte.	204 ppm; 23°C	418 µs/cm	0,1-0,75m (depth) 0- 4m (natural river) 0,30-0,50 irrigation channel	Transparent; 95-100%

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The recreational fishing was observed at downstream of the PT. INKA where the field survey was undertaken (**Figure 4-51**). Recreational anglers were present, and they targeted *Oreochromis niloticus.* The human activities in the springs are more intense with directly utilizing water body to become public bathing. The semi-natural rivers are observed with mud and organic litters with submerges aquatic plant (*Ceratophyllum demersum*).



Figure 4-51 *Field Survey Aquatic Fauna at FBA (A. Long-box-trap deployment. B, Electrofishing. C, Umbrella trap; D. Surber deployment in the rocky area on irrigation channels)*

4.1.12.8.2 Ichthyofauna

Species Composition

Total of nine species were collected and identified in the FBA in Panawar River. Three species are listed as non-native species, and six species are identified as native species. Majority of the species are exploited by human as consumption and ornamental. The detailed species and their information are presented in **Table 4-40**.

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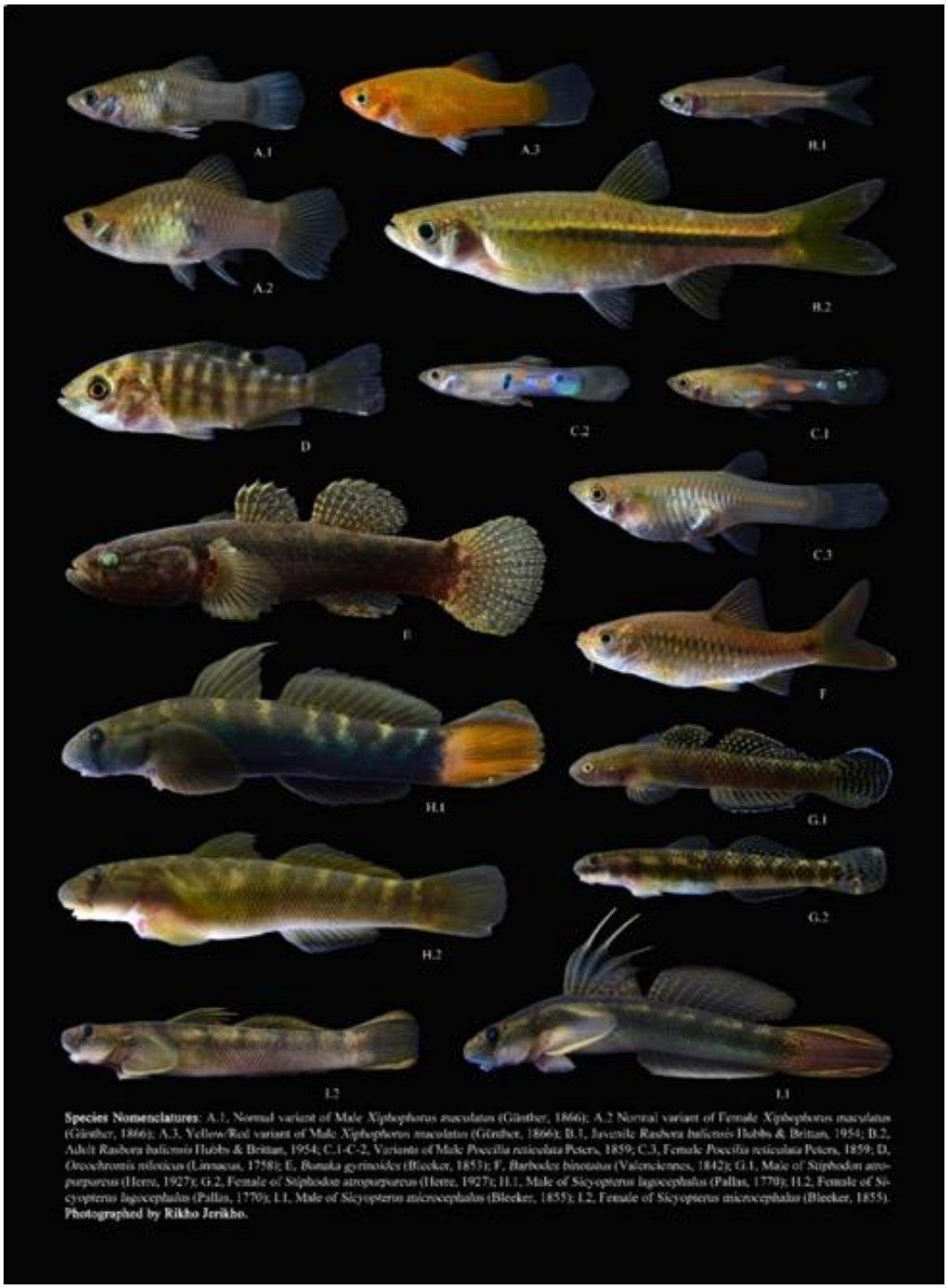


Figure 4-52 *List of Typical Freshwater Ichthyofauna in Panawar River, East Java*

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Table 4-40 *List of Freshwater Ichthyofauna in Penawar River*

No	Family	Species	Local Name	Common Name	IUCN Redlist	Human Use
1	Cichlidae	*Oreochromis niloticus* (Linnaeus, 1758)*	Nila	Nile Tilapia	Least Concern	Consumption
2	Cyprinidae	*Barbodes binotatus* (Valenciennes, 1842)	Benteur	Common spotted barb	Least Concern	Consumption
3	Danionidae	*Rasbora baliensis* Hubbs & Brittan, 1954	Wader Pari, Seluang	Bali Rasbora	Least Concern	Consumption
4	Eleotridae	*Bunaka gyrinoides* (Bleeker, 1853)	Kosar	Greenback gauvina	Least Concern	Consumption
5	Gobiidae	*Sicyopterus microcephalus* (Bleeker, 1855)	Cokot Lancip	Small Head Goby	Least Concern	Ornamental
6	Gobiidae	*Sicyopterus lagocephalus* (Pallas, 1770)	Cokot Biru	Red-tailed Goby	Least Concern	Ornamental
7	Gobiidae	*Stiphodon atropurpureus* (Herre, 1927)	Cokot kecil	Blue-neon Goby	Least Concern	Ornamental
8	Poeciliidae	*Poecilia reticulata* Peters, 1859*	Cere	Guppy	Least Concern	Ornamental
9	Poeciliidae	*Xiphophorus maculatus* (Günther, 1866)*	Guppy Merah	Southern Platyfish	Data Deficient	Ornamental
*Annotations: *indicates as non-native species*						

Members of fast current Gobiidae are present in the irrigation channel at Penawar River. Three species were observed utilizing the modified habitat (cemented riverbanks) along the irrigation channel. Adult and Juvenile of Gobiidae were observed in the irrigation channel. Male and female individuals are present in the habitats. The specific Danionidae, *Rasbora baliensis* are observed in the irrigation channels and the semi-natural river. The adult and juvenile stages of the *Rasbora baliensis* are present in schooling in the clear water. The *Barbodes binotatus* also present in the irrigation channel and semi-natural river. The non-native ichthyofauna (*O. niloticus, P. reticulate* and *Xiphophorus maculatus*) are only present in the semi natural river.

Diversity Indices

Diversity indices are presented for describing ecological conditions in Panawar River. Taxa's number (species), Simpson's Evenness Index, Dominance Index, and Shannon Diversity Index are presented. The Dominance Index are observed as low (below 0.5). Despite listed as low, the domination of non-native species based on individual relative abundance are present in FBA. This indicates the non-native species are altering the fish community and potentially causing further impact towards ecological function in Penawar River. The complete value is presented in **Figure 4-53**.

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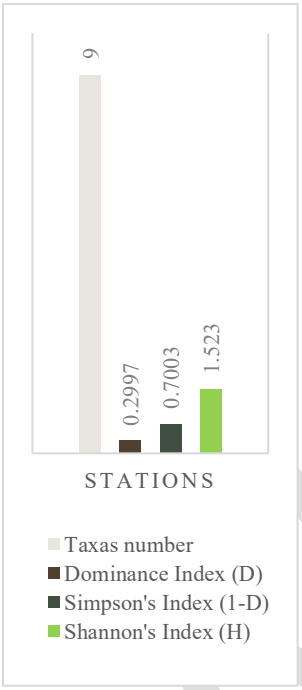


Figure 4-53 *Ichthyofauna Diversity Index, Dominance Index, Simpson's Index, and taxa's number at FBA*

Rare, Threatened, Endemic, and Protected Species

A species of ichthyofauna is listed with restricted range species due to limitation of the information and the emerging threats of the species. Here are presented the *Rasbora baliensis* species with potentially identified as RTE due its strict ranges and its vulnerability.

Rasbora baliensis is listed in the *Rasbora argyrotaenia* group with specific natural distribution in East Java to Bali. The holotypes are originally known from Lake Bratan in Bali Island. The distributions are widened (IUCN Assessment: Lumbantobing 2021) and including nearby area in the East Java. The adult specimens of *Rasbora baliensis* are visually present in the rapids and nearby submerged aquatic plant with rocky substrates. In total,68 individuals of *Rasbora baliensis* are collected in the FBA. The natural ranges of the species are still doubtful and requires updates. The species are potentially identified as RTE due to strict natural ranges, incomplete taxonomical issues, and vulnerable to habitat degradations.

Catch per unit effort

The Catch per Unit Effort of each fishing gear is calculated for ichthyofauna. Four fishing gears (*Electrofishing, Seine-netting, Umbrella trap,* and *Long-box trap*) were deployed in FBA. All fishing gears are successfully caught ichthyofauna in FBA. Most efficient based on the highest number of individual catches per unit effort are Long-box trap. Electrofishing is observed as second most efficient with the number of biomasses catch per unit effort are highest compared to other fishing methods. The umbrella trap listed with lowest value of biomass and individual catch per unit effort in FBA. The detail catch per unit effort are presented in **Figure 4-54**.

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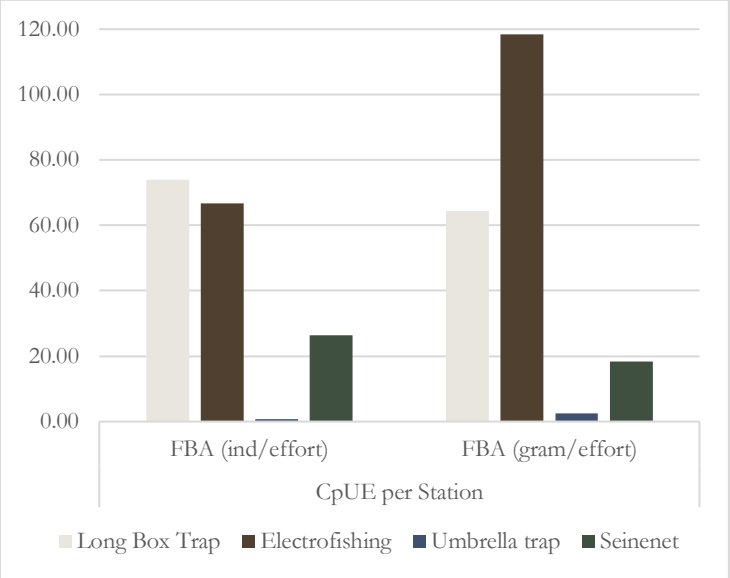


Figure 4-54 *Catch per unit effort (individual and biomass comparison) of Ichthyofauna in Panawar River*

Migration Pattern

Four species of ichtyofauna are listed with amphidromous migration pattern. The amphidromous are defines as organisms with movement from freshwater to saltwater (or vice versa) but not in purpose for breeding. The amphidromous fish are utilizing the freshwater area to live and breeding with the larvae are often drifted into the ocean and migrate into the freshwater. Four species of amphidromous ichthyofauna were identified and all the species are observed in the irrigation channel. The absence of the amphidromous species in the semi-natural river are presumably due to limited water flow with extreme isolation by dam in several area. Detailed migration pattern and its natural distribution are presented in the **Table 4-41**.

Table 4-41 *Migration pattern and occurrences of freshwater fish in Pandeglang*

No	Species	Natural Distribution	Endemic	Checklist Area	Migration Pattern
1	*Oreochromis niloticus* (Linnaeus, 1758)*	Africa	No	[FBA]	Potamodromous
2	*Barbodes binotatus* (Valenciennes, 1842)	Pan Sundaland	No	[FBA]	Uncertain
3	*Rasbora baliensis* Hubbs & Brittan, 1954	East Java-Bali	No	[FBA]	Uncertain
4	*Bunaka gyrinoides* (Bleeker, 1853)	Pan Sundaland	No	[FBA]	Amphidromous
5	*Sicyopterus microcephalus* (Bleeker, 1855)	Java-Papua	No	[FBA]	Amphidromous
6	*Sicyopterus lagocephalus* (Pallas, 1770)	Indonesia to PNG	No	[FBA]	Amphidromous
7	*Stiphodon atropurpureus* (Herre, 1927)	Java to China	No	[FBA]	Amphidromous
8	*Poecilia reticulata* Peters, 1859*	South America	No	[FBA]	non-migrant
9	*Xiphophorus maculatus* (Günther, 1866)*	North and Central America	No	[FBA]	non-migrant
Annotations: *indicates as non-native species					

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Oreochromis niloticus are the only species with potamodromous migration pattern. The potamodromous fish are utilizing the diverse habitats in freshwater area to migrate (from lake to floodplain, or to river). The *Oreochromis niloticus* are only found in the semi-natural river and have not been found in the irrigation channels.

Invasive Species

Oreochromis niloticus

This species has complex history of their introduction in Indonesia. The *O. niloticus* are listed as one of prioritized species for being used as aquaculture species. The *O. niloticus* are deliberately introduced in Indonesia for enhancing the natural protein source (Eidman 1989). The collected specimens are found in juvenile stages but report from local informing the adult phase are commonly found in the semi-natural river.

Poecilia reticulata

Poecilia reticulata are listed as non-native species in Indonesia. This species is listed as an invasive species due to its predatory habits to eggs and other microscopic aquatic organisms. This species is commonly found in Java due to their long history of introduction as bio-agent for eradicating malaria and escape from ornamental (Eidman 1989). This species is commonly observed in the shallow area and is also found in shallow ponds in the river. This species is not present in the fast-moving water in irrigation channel.

Xiphophorus maculatus

Xiphophorus maculatus are known as one of ornamental fish in the nearby area (also in Indonesia). The adult stages and juvenile stages are present in the semi natural river in FBA. In total 27 adult individuals can be collected in the semi-natural river. This species is preferred in the submerged aquatic plant such as *Ceratophyllum demersum.* The red, oranges, and normal color morphs are present in the FBA.

Individual & Biomass Relative Abundance

The highest individual relative abundance is present in the *Poecilia reticulata* with 48.21%. This value is more than twice compared to other individual relative abundances of other species. The second highest of individual relative abundances are from *Rasbora baliensis* with 22.15%. Despite having low value of individual relative abundances, the native species such as *Sicyopterus* spp; *Bunaka gyrinoides, Barbodes binotatus,* and *Rasbora baliensis* are having higher value of biomass relative abundances. Domination of non-native species are present in the number of individual relative abundance with more than 50%. The complete visual of the comparison are presented in **Figure 4-55**.

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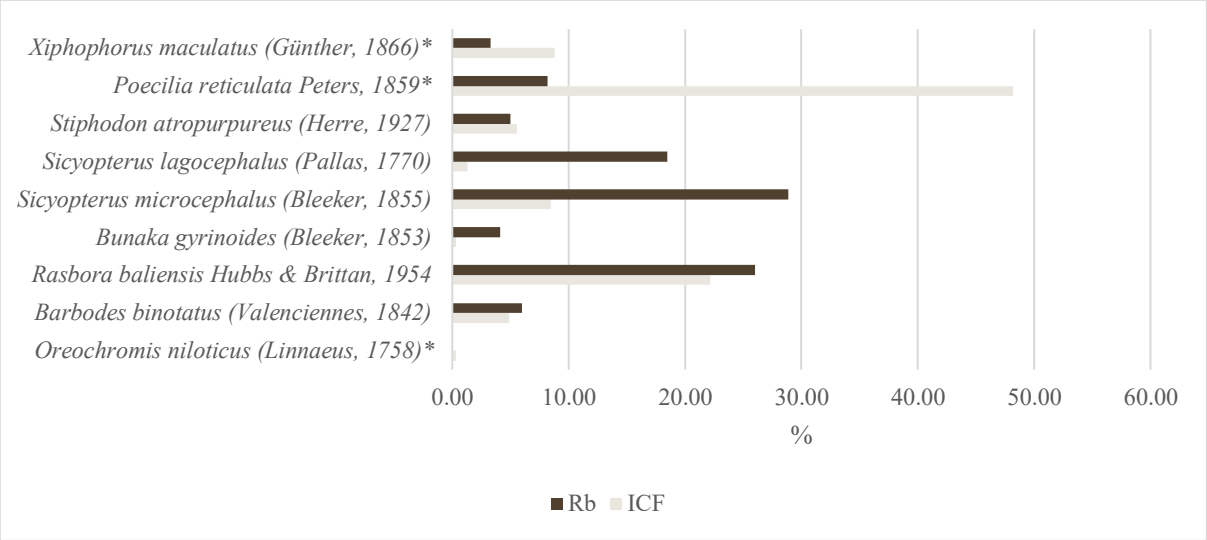


Figure 4-55 *Relative biomass (Rb) and Individual Relative Abundance (ICF) in Panawar River, East Java*

4.1.12.8.3 Macrozoobenthos

In total, five orders from six families were identified in one station based on data collection using Surber Net. In total, eleven species of macrozoobenthos are collected using Surber and by catch of fishing gears. The specimens collected as bycatch are not included in the density calculation. Most of the orders found are gastropods with *Sulcospira* cf. *sulcospira* listed as the highest density of FBA stations. The detailed list of macrozoobenthos density and list of taxa are presented in **Table 4-42**.

Table 4-42 *Density of Freshwater Macrozoobenthos in Panawar River.*

Order	Family	Species	Density (ind/m²) in Research Stations FBA
Architaenioglossa	Ampullariidae	*Pila ampullacea*	7
Architaenioglossa	Ampullariidae	*Pomacea* cf. *channeliculata**	7
Cycloneritida	Neritidae	*Neritina pulligera*	15
Hygrophila	Physidae	*Physella acuta**	22
Sorbeoconcha	Thiaridae	*Melanoides tuberculata*	26
Sorbeoconcha	Thiaridae	*Tarebia granifera*	33
Sorbeoconcha	Pachychilidae	*Sulcospira* cf. *sulcospira*	59
Trichoptera	Hydropsychidae	*Hydatomanicus sp.*	19
Total			***189***
Notes: *identified as non-native species. (Caridina typus, Parathelphusa bogorensis, and Pseudagrion cf. microcephalum are not included).			

Diversity and Dominance Index

The diversity of macrozoobenthos is presented with the approach of Diversity Indices. The detail of diversity indices and the taxa number presented in **Table 4-43**.

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Table 4-43 *Taxa's Richness, Macrozoobenthos Diversity Index, Dominance Index, and Simpson's Index in FBA*

Diversity Parameters	Value
	FBA
Taxa's Richness	11
Dominance Index	0,1268
Simpson's Index	0,8732
Shannon Diversity Index	2,2280

Eleven taxa were identified in FBA station. The dominance index value of FB3 macrozoobenthos community is nearly 0,12 indicates the FBA station is uniform and there is no dominance of a single species. The Shannon's diversity indices which have value 2,2 indicates the community is diverse. Two species of gastropods are listed as non-native species namely *Physella acuta* and *Pomacea* cf. *channeliculata*.

Physella acuta is called the North American sewage snail found is known to inhabit sewage drains and adjacent puddles (Saha 2016). .*Physella acuta* is one of the global invasive freshwater snail but the pathway is still unclear as it can be transported by birds, as well as by human activities.

Based on Global Invasive Species Database (GISD), *Pomacea* cf. *channeliculata* was originally introduced from South America to South-east Asia around 1980, as a local food resource and aquarium trade. It is a major crop pest in South-east Asia (primarily in rice fields) and poses a serious threat to many wetlands around the world through potential habitat modification and competition with native species.

Family Biotic Index

Family Biotic Index (FBI) was presented for assessing the status of the river based on the approach of tolerance value of collected macrozoobenthos. The current calculation includes specimens caught by Surber net and bycatch of fishing gears. The detail of the FBI is presented in **Figure 4-56**.

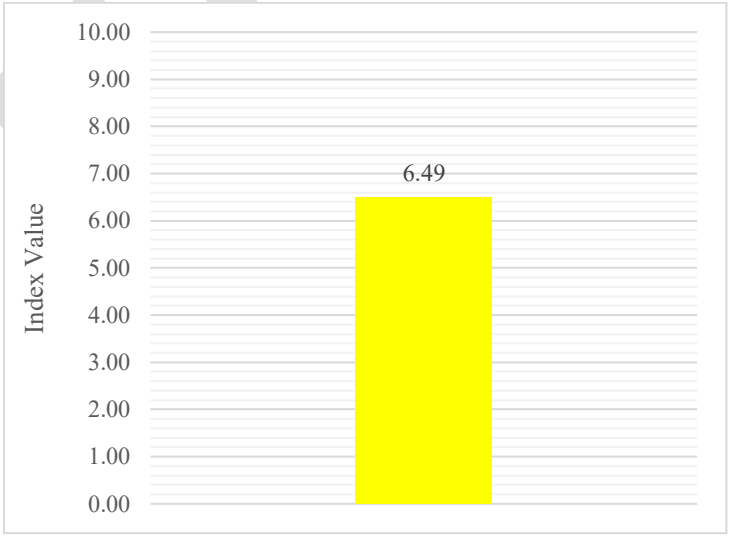


Figure 4-56 *Family Biotic Index in FBA*

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Based on the FBI standard (Mandaville 2002), The FBA index value is 6.49 and it is listed as 'fair' in terms of water quality. This standard indicates the river is 'fairly significant organic pollution'. The Family Biotic Index can be a perfect tool for long terms monitoring programs in the area or nearby ecosystem area. This tool can be useful for management practices with direct management process towards the ecosystem based on macrozoobenthos communities.

Specific Invertebrate (Decapods)

Additional 'bycatch' from ichthyofauna fishing methods (electrofishing and trapping) are presented. Specific Decapods from infra order Brachyura (Crabs) and Caridea (shrimps) are listed in **Table 4-44**.

Table 4-44 *List of Specifics Brachyura and Caridea Species Collected with Electrofishing and Trap*

Family	Species	Local name	Natural Distribution	Bio-indicator	Checklist Area	Endemic	IUCN Status
Gecarcinucidae	*Parathelphusa bogorensis* Bott, 1970	Yuyu kali	Java	[FBA, Irrigation Channel]	No	Least concern	Gecarcinucidae
Atyidae	*Caridina* aff. *typus*	Udang	Australia to Africa	[FBA]	No	Least concern	Atyidae

Rare, Threatened, Endemic, and Protected Species

Order Decapods were assessed to justify their RTE and Protected Species. The potentially novel species due its complexity of the taxonomy is presented in the discussion. The *Caridina* aff. *typus* are resembling the potentially new undescribed taxa due its complexity of the taxonomy.

Threats & Vulnerability

Habitat conversions are observed as one of major threats in Panawar River. The alteration of river morphology is visually present. The disruption of river flow and the river morphology are present from the springs into the down-streams of Panawar River. The irrigation channel is overtaking the water flow and resulting on low water level in the main body of the river. The habitat conversion from natural river into artificial habitats (or worse, dry river such as in previous FB1) are greatly affecting the aquatic organisms in Panawar River. Habitat degradations (cemented riverbanks) also generating disruption towards ecology of aquatic organisms, especially fast-flowing Gobiidae and other amphidromous organisms. The fragmentation of habitats also presents in the FBA. The check dams are present in several area and potentially altering migration of ichthyofauna.

Pollution from domestic waste, plastic, and un-recycled material such as diapers are present in the river. The accumulations of plastic waste and diapers are observed in the FBA. The public bathing area also potentially generating domestic waste and pollutions into water quality and most likely affecting the aquatic organisms. Practices of utilizing non-native ichthyofauna in the springs are also observed. This can lead to increase of invasion and generating irreversible impact towards native organisms.

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4.1.13 Ecosystem Services

The scoping exercise was conducted to refine the list of ecosystem services contained in Banyuwangi site based on scoping site visit that are taken advantage of or potentially benefit the community directly or indirectly. The identification of ecosystem services during ESIA study is presented in **Table 4-45**.

Table 4-45 *Identified ecosystem services at Banyuwangi Site*

Ecosystem Service Type	Description, Examples	Potential Ecosystem Services in the Project Area	Justification
Provisioning Services			
Food from wild-caught fish and shellfish & aquaculture	Fish caught for subsistence or commercial sale that are bred and reared in ponds, enclosures, and other forms of fresh- or salt-water confinement for harvesting	There are no fisheries activities during the site visit. And not possible to have any fisheries activities inside project area	No
Food from wild meat	Animals hunted primarily for food (recreational hunting covered under cultural services)	There is no evidence or information regarding hunting activity within project area and vicinity.	No
Food from cultivated crops	Annual and permanent crops grown for subsistence use and commercial sale	Proposed project area is included in the commercial plantation.	Yes
Livestock farming	Sedentary and nomadic livestock farming	It is noted that community are taking grass from the sugarcane plantation to feed their livestock, including goats, and cows.	No
Biomass fuel	Wood, dung, and plant matter collected for charcoal, fuel	No wood producing for fuel come from the project site.	No
Timber and wood products	Wood collected for local use or sold as timber, wood pulp, and paper	One of the products form the project site is timber (teak) and wood product.	Yes
Non-Timber Forest Products (NTFP)	Non-timber products were collected from the forest. For example, cane, palm, straw, cotton, hemp, twine and rope, natural rubber	The categorized project area is not as forest area	No
Regulating Services			
Freshwater	Freshwater for bathing, drinking, irrigation, laundry, household, and industrial use	The community uses freshwater from the river outside the project area	Yes
Biochemical, natural medicines, pharmaceuticals	Natural medicines, biocides, food additives, pharmaceuticals, and other biological materials for commercial or domestic use.	Unknown but likely to be used by local people in the Project Area and vicinity	No
Ecosystem functions	The influence ecosystems have on air quality by extracting chemicals from the	The project area is unlikely to be a significant influence on the atmosphere.	No

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Ecosystem Service Type	Description, Examples	Potential Ecosystem Services in the Project Area	Justification
	atmosphere (i.e., serving as a "sink") or emitting chemicals to the atmosphere		
	Carbon sequestration (impacts on global climate change) regulation of temperature, shade air quality by vegetated areas	The project area is not playing an essential role in carbon sequestration, temperature regulation of shade	No
	Role of vegetation in regulating erosion on slopes and riparian areas	The project area is relatively flat.	No
	Birds, insects, and some small mammals pollinate certain flora species, including some crops	Pollination of crops occurs within the project area. However, the presence of pollinators is not significant since the overall project site is dominated by sugar cane plantation.	No
Cultural Services			
Spiritual, religious, or cultural value	Natural spaces or species with spiritual, cultural, or religious importance	No information available	No
	Cultural value is placed on traditional practices such as hunting, fishing, crafts, and using natural resources.	The area has been owned by public company since long time ago	No
	Use of natural spaces and resources for tourism and recreation	No tourism activity permissible within this area	No
	The cultural value placed on the aesthetic value provided by landscapes, and natural landmarks	Unknown but unlikely to be present within proposed Project Area and vicinity	No
	Information derived from ecosystems is used for intellectual development, culture, art, design, and innovation.	No cultural services presence at the Project area	No
	Ornamental resources	N/A	No
Supporting Services			
Non-use value of biodiversity (e.g., existence, bequest value)	Species and areas valued globally as of high conservation value	Given the area within AoI and most of EAAA are highly modified habitat, the conservation value is low.	No
	The flow of nutrients (e.g., nitrogen, sulphur, phosphorus, carbon) through ecosystems.	Although the Project area and vicinity are likely to play an essential role in the flow of nutrients through ecosystems especially for carbon absorption. However,	No

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Ecosystem Service Type	Description, Examples	Potential Ecosystem Services in the Project Area	Justification
		that role is not significant since the overall project site is dominated by sugar cane plantation, while the vicinity area is mixed plantation with heterogeneous plants.	
	The flow of water through ecosystems in its solid, liquid, or gaseous forms.	The river flows through the Project area, and vicinity may contain or contribute to essential ecosystem processes especially during wet seasons.	No
	Natural soil-forming processes throughout vegetated areas.	The Project area and vicinity do not play a role in the natural formation of soil-forming processes.	No
	Natural spaces that maintain species populations and protect the capacity of ecological communities to recover from disturbances.	The project area and vicinity are potentially as a habitat of species of conservation significant but no evidence within this stage.	No

Source: AFRY, 2023

Critical habitats and ecosystem services are related in that critical habitats are designed to protect the physical and biological features that species need to survive and reproduce, and ecosystem services are the benefits that ecosystems provide to all life on earth.

The CH screening results (see Sub Section 4.1.12.6) advised that none of them (including teak, part of existing ecosystem services) is qualify for Critical Habitat Assessment based on IFC PS6.

Given the Ground-Mounted PV Module and Plant Switchyard facilities is in the plantation area (belong PTPN XII) and planted with sugar cane and some parts of the plantation is planted with hard plants such as teak and Sengon *(Paraserianthes falcataria)* wood thrive; the AoI is not considered as critical habitat where the certain species of conservation significance's habitat is required to be maintained and protected.

4.1.14 Natural Hazard

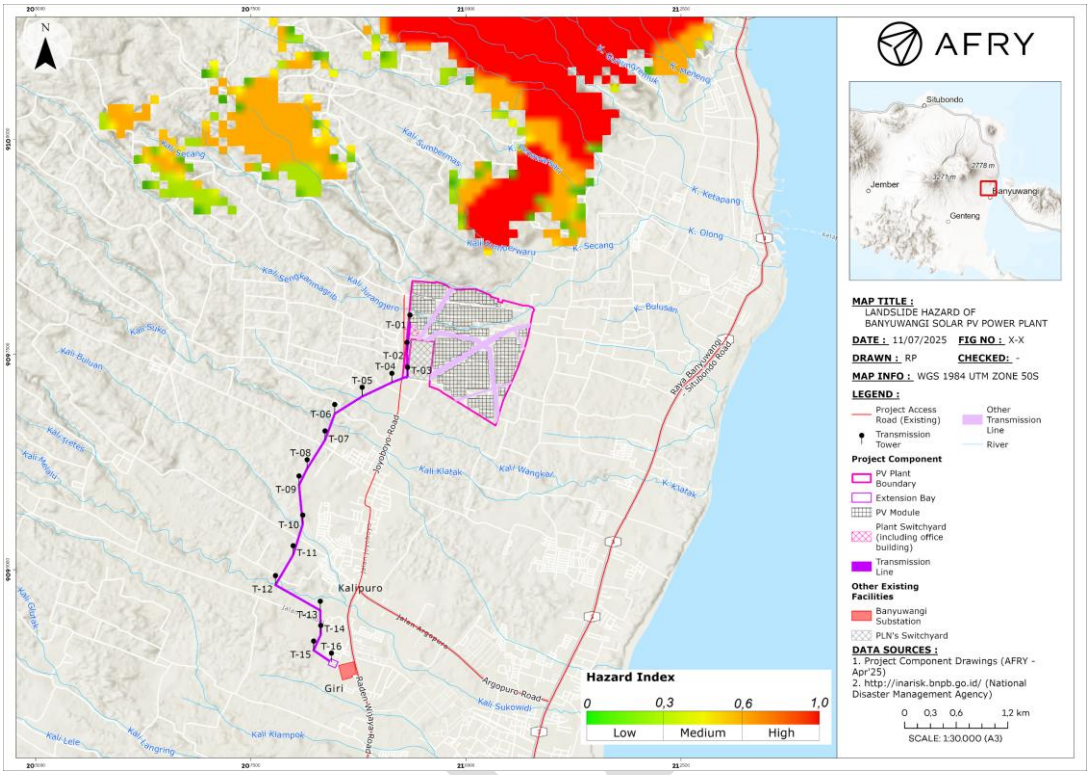
The natural hazard index was calculated based on the spatial probability, frequency, and strength (magnitude) of a natural phenomenon. Natural disasters that may occur at the transmission tower location are landslides, flash-flood, and earthquake.

4.1.14.1 Landslide Hazard

Based on the indicative hazard index map below, the locations project area and including the transmission line are located on the no landslide hazard index.

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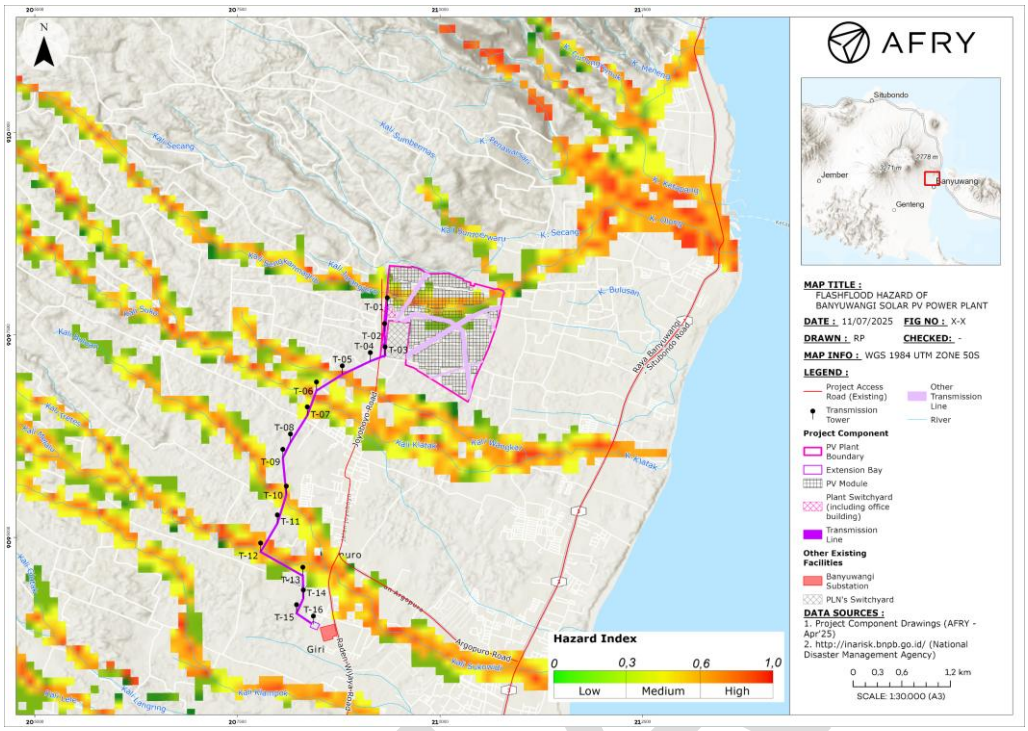
Source: [http://inarisk.bnpb.go.id/)](http://inarisk.bnpb.go.id/)

Figure 4-57 *Landslide hazard index of Banyuwangi Solar PV Power Plant*

4.1.14.2 Flash Flood Hazard

Based on the indicative hazard index map below, Banyuwangi PV plant area are prone to flash flood risk. This is due to the presence of several river that crosses through the transmission line area. The several rivers are intermittent river and flow depend on wet season.

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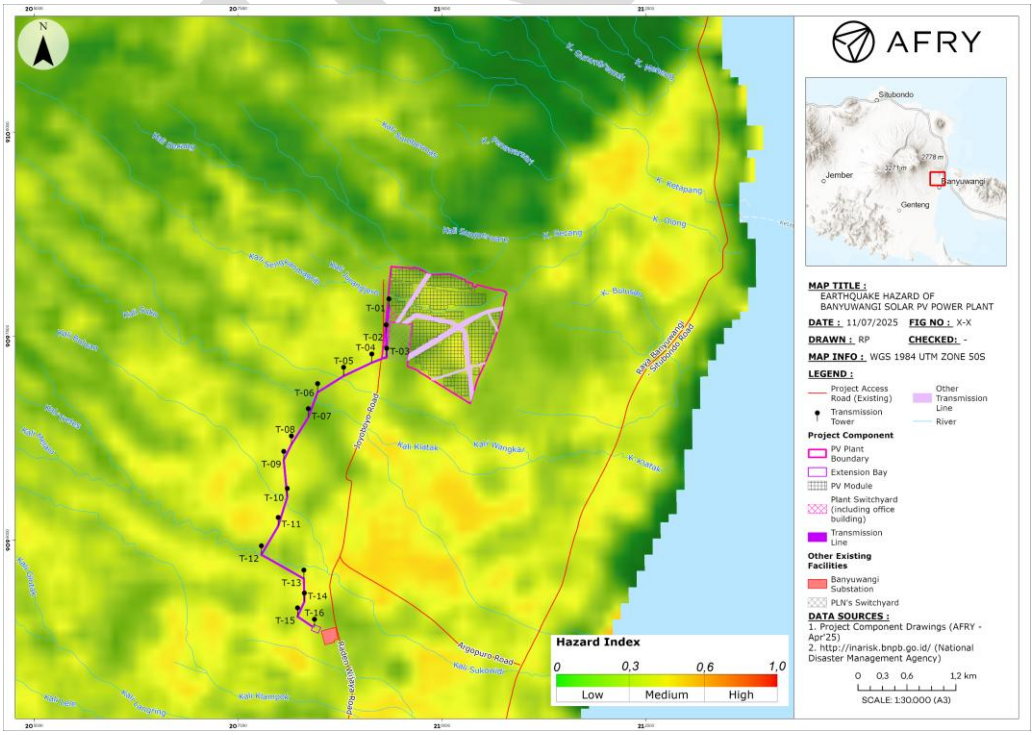


Source: http://inarisk.bnpb.go.id/

Figure 4-58 *Flash flood hazard index of Banyuwangi Solar PV Power Plant*

4.1.14.3 Earthquake

Based on the indicative hazard index map below, Banyuwangi Ground-Mounted Solar PV area and its transmission line are prone to earthquake risk.



Source: http://inarisk.bnpb.go.id/)

Figure 4-59 *Earthquake hazard index of Banyuwangi Solar PV Power Plant*

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4.2 Social Baseline Data

4.2.1 Overview

A social baseline study was conducted to complement the environmental and social impact licensing documents for the Ground-Mounted Solar Photovoltaic (PV) project. In any impact assessment, baseline study plays a crucial role in attaining a comprehensive understanding of the project. It involves clearly defining the study area, incorporating relevant standards and guidelines for conducting the assessment, and establishing a strategy for engaging stakeholders and an assessment methodology.

The social baseline study aim to:

- Collect socio-economic, socio-cultural, and public health environmental baseline data for inclusion in environmental permit documents.
- understand the current conditions related to socio-economic; socio-cultural aspects and community health around the Ground-Mounted Solar PV Banyuwangi site.
- Capture the community's perceptions and expectations regarding Ground-Mounted Solar PV Banyuwangi site activities, providing essential input to develop the project's community development and empowerment initiatives.

The Ground-Mounted Solar PV is located in Kaliselogiri Plantation in Afdeling Wangkal, a plantation land owned by Perseroan Terbatas Perkebunan Nusantara XII (PTPN XII). Administratively, Kaliselogiri is in Kalipuro Village, Kalipuro District, Banyuwangi Regency. Currently, the plantatland is planted with sugarcane varieties covering an area of 156 hectares. The following is a table of Project Component, and its location information can be seen in the **Table 4-46**.

Table 4-46 *Project Component based on Villages in Banyuwangi Regency*

Project Component	Village
Ground-Mounted PV Module	PTPN XII Kaliselogiri Afdeling Wangkal, Kalipuro Village, Kalipuro District
Plant Switchyard	PTPN XII Kaliselogiri Afdeling Wangkal, Kalipuro Village, Kalipuro District
Transmission Line	• Kalipuro Village, Kalipuro District • Kelir Village, Kalipuro District • Giri Village, Giri District
Substations	Giri Village, Giri District

Source: AFRY, 2023

Based on the locations of the project components, three villages were identified as directly impacted, thus, the social baseline surveys were conducted in these locations. First, Kalipuro village, which will be the location for the construction of Ground-Mounted PV modules and Plant Switchyard. The facility will be located on Kaliselogiri Plantation Land owned by PTPN XII. Second, the transmission line will pass through three villages, namely Kalipuro Village and Kelir Village in Kalipuro Sub-district, and Giri Village in Giri Sub-district. The Substation is located in Giri Village, Giri Sub-district.

Meanwhile, Kaliselogiri Plantation Land borders with several sub-villages, on the west side, Kaliselogiri Plantation borders with Secang Sub-village, on the north side borders with Wangkal Sub-village, on the south side borders with Secang Timur Sub-village. These three Sub-villages are in the administrative area of Kalipuro Village. On the east side, Kaliselogiri Plantation borders with Bulusan Sub-village settlement area, which is

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included in Bulusan Village, Kalipuro Sub-district. Although Bulusan Sub-village is not included in the study area, during the social baseline survey, an interview with one of the community leaders in Bulusan Sub-village was conducted. Overall, the baseline study area is in Banyuwangi Regency. The distribution of respondents in the study areas is shown in **Figure 4-60**.

In addition, the approach and methodology of the social baseline study can be found in **Appendix G**.

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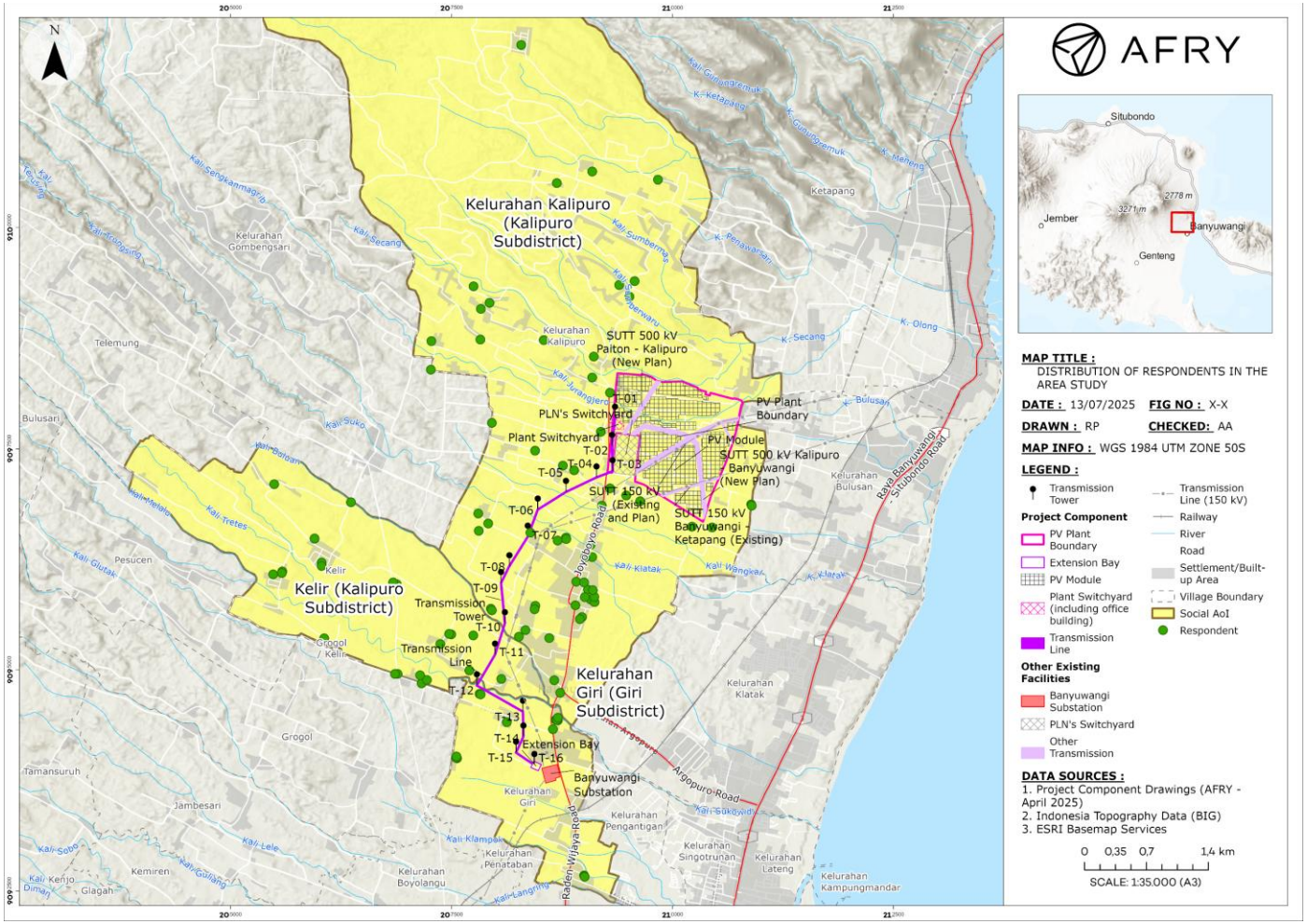


Figure 4-60 *Map of Ground-Mounted Solar PV and Distribution Map of Respondents in the Area Study*

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4.2.2 Social Baseline of the Project Area of Influence

4.2.2.1 Demography

The scope of the study covers three villages in two districts and a regency that are potentially affected by the components of the Banyuwangi Solar PV project. The potentially affected villages are Kalipuro, Kelir and Giri.

All villages within the project AoI, Kalipuro Village, Kelir Village and Giri Village have more male population than female. **Table 4-47** describes the detailed population in the Project area.

Table 4-47 *Population of Area of Influence for Ground Mounted Banyuwangi Project*

Regency	Location		Land Area (km^2)	Population (people)			Sex Ratio	Population Density (people per km^2)
	District	Village		Male	Female	Total		
Banyuwangi	Kalipuro	Kalipuro	80.41	7,563	7,537	15,100	100.34	188
		Kelir	14.35	2,989	2,976	5,654	100.44	416
	Giri	Giri	4.07	3,268	3,313	6,581	98.64	1,617

Source: Civil Registry Service Office, 2025

Based on the table above, the highest population density is in Giri village with at 1,617 people/km² as Giri District is an urban area with numerous residential clusters, trading activities and less area availability compared to both other villages, Kalipuro and Kelir. The situation in the Giri District is very different from the Kalipuro District, with a population density of 183 people/km² and mostly rural areas dominated by agricultural, plantation, and forestry activities.

However, based on project components, there is a plan to construct an extension bay within the substation, and the transmission lines will traverse the area of Giri Village. Kelir Village and Kalipuro Village will be affected by the transmission lines. Most of the sections of the transmission line will pass through agricultural land owned by residents, including the extension bay that will utilize a farmland around the substation. The Ground-Mounted Solar PV will be in Kalipuro Village, mainly on land owned by PTPN XII. Although most of the area is rural, Kalipuro Village has the highest population due to significant population movement. This is driven by the village's proximity to the harbor and many factories and warehouses located in the Ketapang Port area, as well as the large area of Kalipuro. Many of these newcomers live in the northern area of Kalipuro District, on the hills and close to PTPN plantations.

4.2.2.1.1 Migration

The migration rate affects the population size and density. Areas with high immigration levels have high population size as migrants settle and become part of the resident population.

Table 4-48 *Number of Migration in Study Area*

Villages	Migration	Migration Percentage
Kalipuro	138	48%
Kelir	63	22%
Giri	88	30%
Total	289	100%

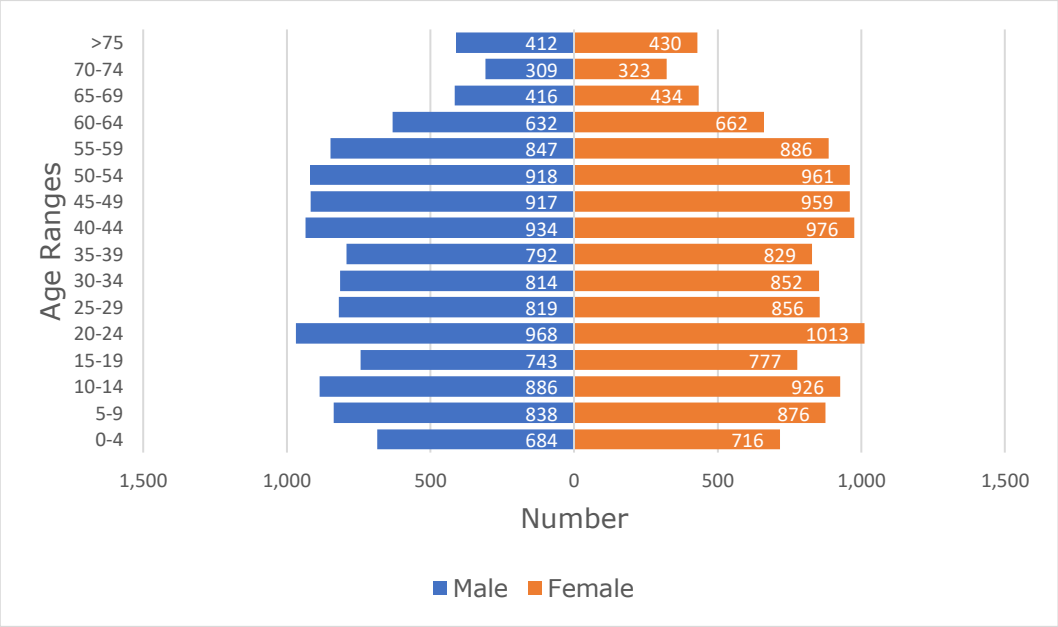
Source: Civil Registry Service Office, 2023

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Based on data on migration levels in the three villages in the Area of Influence (AoI) (see table above), Kalipuro Village is the village with the highest migration rate with 138 residents or 48% of the total population, followed by Giri Village with 88 residents or 30%, and Kelir Village with 63 residents or 22%. The existence of companies or factories is one of the factors for the high migration rate in Kalipuro Village, namely PTPN XII, PT Semen Bosowa, PT INKA[21], and other companies and warehouses are located on the Banyuwangi-Ketapang axis road. Apart from that, Kalipuro has also become a crossing center connecting the islands of Java and Bali which is connected by Ketapang and Gilimanuk Port, so many workers make Kalipuro Village their place of residence.

4.2.2.1.2 Population Composition Based on Age

The population pyramid below reflects the general distribution based on gender and age. According to the graphic below, the population distribution at the study location is quite even within the productive age range. The largest population distribution for both males and females falls within the age bracket of 20-24, with 968 males and 1,013 females.



Source: Civil Registry Service Office, 2023

Figure 4-61 *Number of Population in Study Area by Gender*

Based on the table provided below, from 2022 to 2024, each studied area experienced population growth, averaging between 3.42% to 16.85%. The most significant population growth occurred between 2022 and 2023, notably in Giri, Kalipuro, and Kelir Village, with an increase of 1,555 in Giri Village, 714 in Kalipuro Village, and 529 in Kelir Village.

Table 4-49 *Population in 2022-2024 in the Study Area*

Village	Population (people)			Average Increase (%)
	2022	2023	2024	
Kalipuro	14,122	14,836	15,100	3.42%

[21] PT INKA is an abbreviation from *PT Industri Kereta Api*, an Indonesian state-owned enterprise engaged in the production of railway facilities.

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Village	Population (people)			Average Increase (%)
	2022	2023	2024	
Kelir	5,384	5,913	5,965	5.35%
Giri	4,899	6,454	6,581	16.85%

Source: Civil Registry Service Office, 2023-2025

Population composition based on age can be described by the dependency ratio in an area. Data on the dependency ratio can be seen in the table below:

Table 4-50 *Workforce in Area of Influence Banyuwangi Ground-mounted PV Project*

District	Productive Age	Non-Productive Age	Dependency Ratio
Kalipuro	10,061	4,703	46.74
Kelir	3,099	2,426	78.28
Giri	3,568	1,841	51.59

Source: Civil Registry Service Office, 2023

Based on table dependency ratio above, the number of people of productive age (15-64 years) in the study area is higher than the number of people of non-productive age (0-14 and >65 years), with a ratio of more than 50%. The highest number of people of productive age is in Kalipuro Village with 10,061 with a 46.74 of dependency ratio. Kelir Village has 3,099 people of productive age with a 78.50 of dependency ratio. Giri Village has 3,568 people of productive age with a 51.59 of dependency ratio.

4.2.2.1.3 Education

Population composition based on education can show the human resource potential that exists in an area. The higher the number of people with a high education level, the greater the regional human resources. Residents with the lowest level of education are in the no/not yet schooled category, while residents with the highest level of education are in the S1/Master's/S3 category. Data on education levels in the study area can be seen in the table below:

Table 4-51 *Education Attainment around Banyuwangi Ground-mounted Solar PV Location*

Village	Not Schooling	Not Completed Elementary School	Elementary School	Junior High School	Senior High School	Diploma	Bachelor's Degree	Master's Degree/Higher
Kalipuro	107	3,544	4,825	1,177	2,799	79	418	15
Kelir	25	562	787	851	715	11	71	NA
Giri	NA	NA	1,507	731	1,055	116	394	40

Source: Civil Registry Service Office, 2023

All the villages within the AoI possess both skilled and unskilled labour that can participate in the construction and operation of solar PV. Giri village has the highest count of skilled workers, totaling 550 people, including 116 diploma holders, 394 graduates, and 40 individuals with master's degrees. Additionally, Kalipuro has 512 skilled workers, comprising 79 with diploma degrees, 418 with bachelor's degrees, and 15 with master's degrees. The unskilled workforce comprises individuals in their productive age with lower educational levels, mainly basic education.

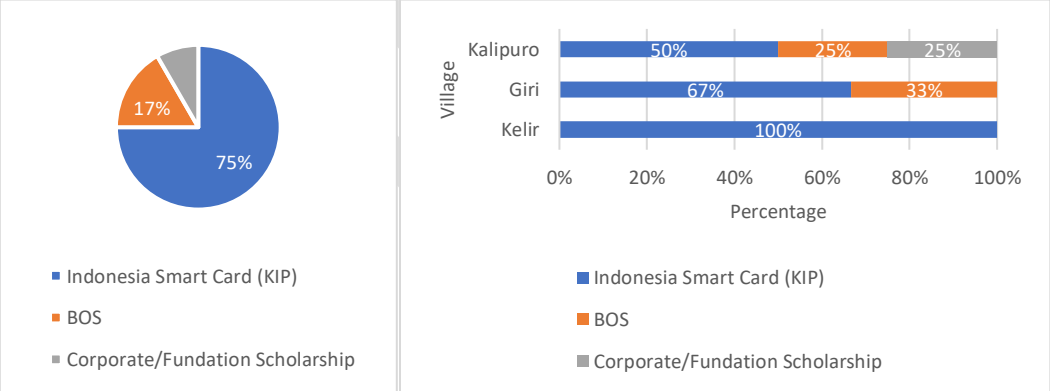
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Banyuwangi Regency area has a unique socio-cultural characteristic with the development of the Islamic religion-based organization *Nahdlatul Ulama* (NU)[22] having great influence on the society, including on education. In Banyuwangi Regency, there are many Islamic boarding schools managed by NU, some of which are in the AoI.

In Kalipuro Subdistrict, a large portion of the population receives their education through NU-affiliated Madrasah and Islamic boarding schools, which offer schooling from kindergarten to university level. While access to education is not a major issue, there is a gap between the competencies developed in Madrasah and those required by the formal job market. Based on information obtain from interview with youth representative of Kalipuro Village, it is noted that companies typically favor graduates from public schools, resulting in many Madrasah graduates facing difficulties in securing formal employment and often resorting to manual labor. Perhaps because the purpose of religious education is to spread religion, many of them become mentors in boarding school or return to their neighbourhoods again.

This mismatch between educational background and labor market demands contributes to high unemployment rates in the area. Although religious education plays an important role in preserving and spreading Islamic values, its limited alignment with broader professional and academic standards restricts career opportunities for many youth.

Based on the survey, most respondents do not receive education aid (93%), while the remaining 7% received education aid. An aspect that can enhance the local economy and the quality of the local workforce is the opportunity to obtain education and scholarships. According to the graph above, only 7% of respondents receive educational scholarships, with the highest percentage found in Kelir Village at 14%, while Kalipuro Village has the lowest percentage of scholarship recipients at 4%.



Source: Primary Data, 2023

Figure 4-62 *Percentage of Type of Education Aid Recipients (left) and by Villages (right) in the Study Area*

Data on the education level of the community in the study location also shows the low level of junior high school graduates, this is due to the high number of children of compulsory school age who drop out of school, one of the causes of the high dropout rate is household economic factors whose economic level is mostly middle to lower, as revealed by one of the teachers at State Elementary School 02 Kalipuro.

[22] is an Indonesian Islamic religious organization founded by Hasyim Asy'ari, the head of Tebuireng Islamic Boarding School from Jombang, East Java. NU has members ranging from 40 million (2013) to more than 95 million in 2021, making it the largest Islamic organization in the world. NU is also a charity that manages Islamic boarding schools, schools, colleges, and hospitals and organizes communities to help improve the quality of life of Muslims.

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One of the efforts of the Banyuwangi Regency government to overcome the problem of the high number of school-age children dropping out of school is the GARDA AMPUH program (*Gerakan Daerah Angkatan Anak Muda Putus Sekolah - Regional Movement of Out-of-School Youth Force)*. This program is in accordance with Banyuwangi Regency Government Regulation No. 4 of 2014 concerning the Community Movement Program for the Eradication of Tributa and the Upgrading of Out-of-School Students (*Gempita-Perpus*) Banyuwangi District. In Giri Village itself, to support the GARDA AMPUH program by holding a PKBM[23] (Community Learning Activity Center) Anggrek Bulan with 15-20 students assisted. While in Kalipuro Village there are 1 SKB[24] and 2 PKBM to support this dropout completion program.

The most significant education aid received by the community is the Education Smart Card (KIP) at 75%, followed by the School Operational Assistance (BOS) at 17%. Respondents receiving BOS were found in Kalipuro Village and Giri Village, at 25% and 33%, respectively. Meanwhile, in Kelir Village, 100% of the respondents receive KIP scholarship. With the presence of educational scholarships, both females and males have equal opportunities to access higher education.

4.2.2.2 Socio-Economic and Livelihood

This section addresses the socio-economic status of the community in the research area. A vital aspect of understanding the socio-economic requirements of the community involves investigating the livelihoods of the people in that specific location. The examination of livelihoods encompasses the various occupations present within the community, emphasizing the utilization of natural resources in agriculture, trade, and other service-oriented enterprises. The selection of livelihood strategies depends on assets, access, and activities influenced by the capacity of human resources. Consequently, livelihood strategies are dynamic and susceptible to alterations (Baiquni., 2007). In addition, according to the Banyuwangi Statistics Data 2026, the community occupant status divided into several types consisting of 1. Entrepreneur, 2. Entrepreneur with other temporary occupants, 3. Entrepreneur with other permanent occupants, 4. Employee, 5. Freelancer worker, 6. Family occupants or not paid. The details of social baseline survey result can be seen as below.

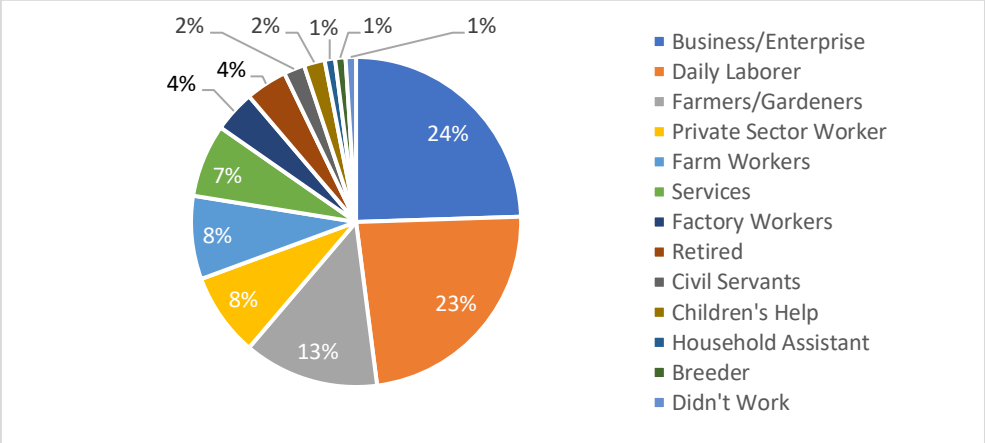
4.2.2.2.1 Main Occupations

Individuals in the research area are involved in various professions, and a broad range of income streams. These professions function as both primary and secondary income sources, with primary sources generally yielding greater and more stable economic value. Secondary sources serve as additional income to meet household requirements. In each village within the study location, a diverse set of occupations or livelihoods is classified into types as shown in **Figure 4-63**.

[23] PKBM is an institution formed by the community for the community that is engaged in non-formal education. PKBM is still under the supervision and guidance of the National Education Office. As one of the non-formal education units, PKBM is expected to be a forum for community activities to further improve their potential and skills. PKBM was formed with the aim of opening the widest possible opportunity for underprivileged communities to improve knowledge, mental attitudes, and skills. These three elements will form a community that is able to compete and earn a living independently.

[24] education unit that provides services and organizes PNF/PAUD Dikmas programs. Structurally, SKB is under the Department of Education and Culture.

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Source: Primary Data, 2023

Figure 4-63 *Percentage of Main Source of Income in the Study Area*

The primary income sources in the study area are business/entrepreneurship 24%, daily labour 23%, farming/gardening 13%, farm work and private sector work 8%, services 7%, factory work and retirement 4% and others.

Entrepreneurs mostly from respondents in Giri and Kalipuro Villages, while daily labourers are mostly from among respondents in Kelir Village. Kelir Village also has a dominant agricultural and plantation land area, so agriculture is a sector that provides income and absorbs labour in Kelir Village. On the other hand, the strategic location of Giri and Kalipuro Villages along the main road makes both villages conducive to business/enterprise activities.

Kelir Village has many coconut plantations, while Kalipuro Village and Giri Village only has a few. With so many coconut plantations in this area, the number of people working as casual labourers is also high because coconut cultivation absorbs labour and coconut has many product outputs.



Source: Primary Data, 2023

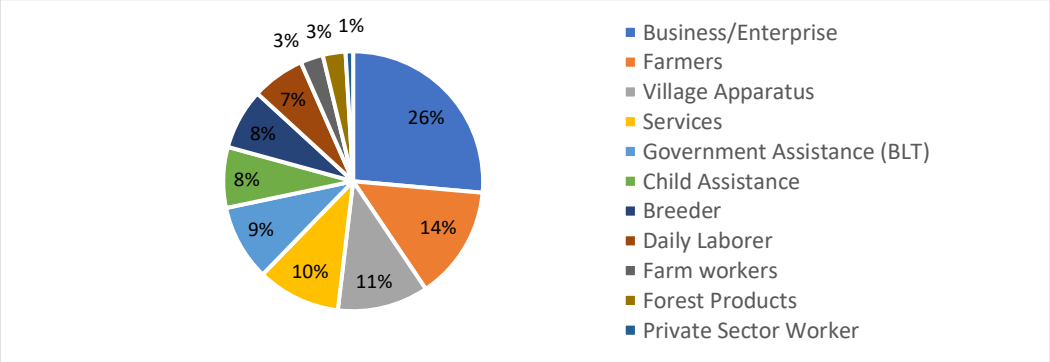
Figure 4-64 *Existing Coconut Plantation Land in the Study Area*

4.2.2.2.2 Secondary Occupation

In the study area, respondents are involved in various secondary occupations, with specific types of jobs dominating in each village. The most common source of secondary income in the study area, include business/entrepreneurship 26%, farming 14%, village

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official 11%, services 10%, Direct Cash Assistance (*Bantuan Langsung Tunai* - BLT)[25] 9%, and childcare/child Assistance and livestock breeder 8%, Daily Labourer 7% and others. The increased prevalence of business/entrepreneurship as a secondary occupation can be attributed to its flexibility and strategic location of the village. A detailed overview of the types of secondary occupations of respondents in the study area can be seen in **Figure 4-65**.

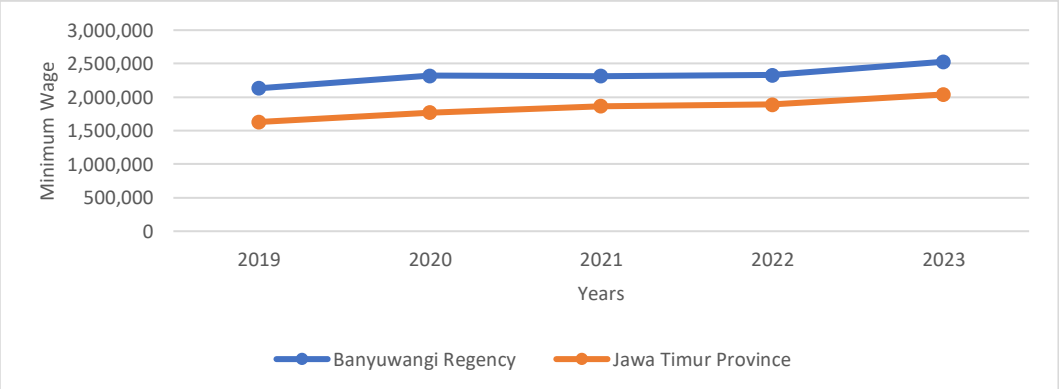


Source: Primary Data, 2023

Figure 4-65 *Percentage of Source of Secondary Income in the Study Area*

4.2.2.2.3 Household Income

The income of the community are indicators of the economic sector's growth in a region. In addition to the level of expenditure and income, which represent the actual consumption by the community, administratively, the Regional Government is also obligated to establish the provincial and regency/city minimum wage as one of the indicators of economic development. The regulations pertaining to the Minimum Wage is governed by Government law No 51 of 2023. According to regulations, the governor determines the minimum wage at the provincial and regency/city levels, who establishes the Provincial Minimum Wage (UMP) or Regency/City Minimum Wage (UMK). A detailed overview of the amounts for UMK in Banyuwangi Regency and UMP in East Java is provided in **Figure 4-66**.



Source: BPS Data series Minimum Wage of Banyuwangi Regency and Jawa Timur Province (2019-2023)

Figure 4-66 *Minimum Wage of Banyuwangi Regency and East Java Province (2019-2023)*

[25] Direct Cash Assistance (*Bantuan Uang Tunai – BLT)* is a Government of Indonesia program giving for poor community. The program aims to reduce the economic burden of community. Retrieve from https://ppid-desa.jemberkab.go.id/ on 14 July 2025

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Table 4-52 *Minimum Wage list from 2019-2023 Banyuwangi Regency and East Java Province*

No	Year	Banyuwangi Regency	Increase	East Java Province	Increase
1	2019	IDR 2,132,779	0%	IDR 1,630,059	0%
2	2020	IDR 2,319,796	0.3%	IDR 1,768,777	8%
3	2021	IDR 2,314,278	-2 %	IDR 1,868,777	5,6%
4	2022	IDR 2,328,899	0.,6%	IDR 1,891,567	1,2%
5	2023	IDR 2,528,899	8.5%	IDR 2,040,244	7,8%

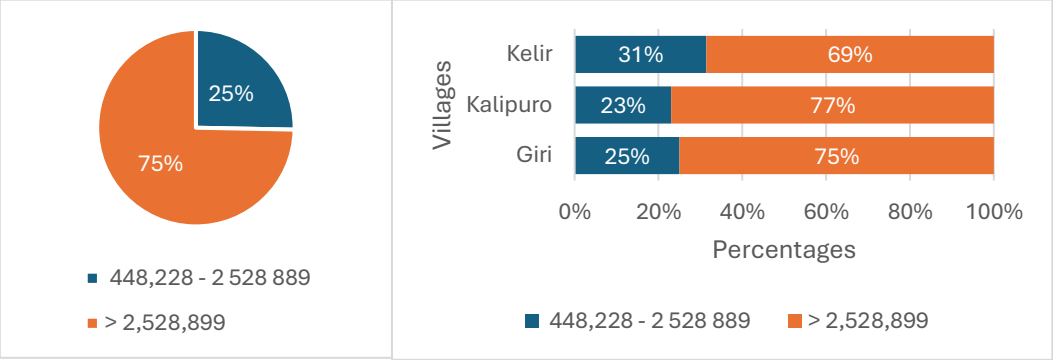
Source: BPS Data series Minimum Wage of Banyuwangi Regency and Jawa Timur Province 2019-2023

Based on the table above, the Regency Minimum Wage (UMK) of Banyuwangi and the Provincial Minimum Wage (UMP) of East Java from 2019 to 2023 increased. The UMK of Banyuwangi in 2019 was IDR 2,132,779 and rose to IDR 2,528,889 in 2023. Meanwhile, the UMP of East Java in 2019 was IDR 1,630,059 and increased to IDR 2,040,244 in 2023. The increase in both UMK in Banyuwangi and UMP in East Java indicates economic growth, however, the inflation rates in both regions also increased. This growth is particularly evident in Banyuwangi, which has become a hub for trade and a popular tourist destination in the eastern part of Java and Bali.

Information regarding respondents' actual income is obtained from the survey conducted. Respondent's actual income is classified into three classes:

1. Income class less than IDR 448,928: Income below the poverty line, according to BPS.
2. Income class IDR 448,928 – IDR 2,528,899: The income range is above the poverty line and same or below the regency/city minimum wage (UMK) of Banyuwangi Regency
3. Income class more than IDR 2,528,899: Income above the UMK of Banyuwangi Regency.

Referring to the income classification above, **Figure 4-67** illustrates that the percentage of household income in the study locations is mostly in the range above the poverty line and below or equal to the minimum wage of Banyuwangi Regency at 25%. The rest 75% of household income is above the minimum wage of Banyuwangi Regency. This data shows that most of community members in the study locations whose main income and livelihood are above the poverty line.



Source: Primary Data, 2023

Figure 4-67 *Range of Household Income (left) and by Villages in the Study Area (right)*

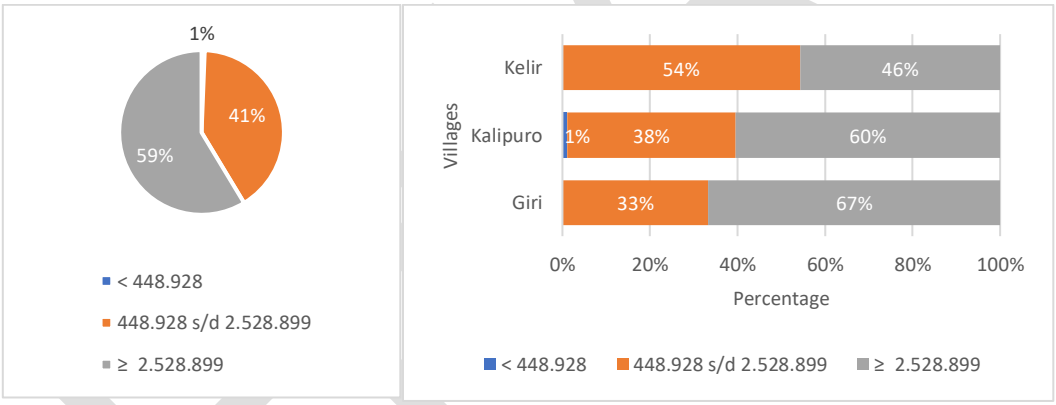
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75% of respondents from Giri, Kalipuro, and Kelir villages have incomes of more than 2,528,899, indicating that most respondents are in the higher income group. Kalipuro village has the highest proportion of respondents with incomes of more than 2,528,899 (77%), while Kelir village has the lowest proportion in this category (69%). Compared to other villages, Kelir village has the highest proportion of respondents (31%) with incomes between 448,228 and 2,528,889.

4.2.2.2.4 Household Expenditure

Monthly expenditures are divided into three categories: i) below poverty line, ii) poverty line – regency minimum wage, and iii) above the minimum wage. Based on the survey shown below, most of the respondents have monthly expenditure above the minimum wage with 59%, followed by poverty line – regency minimum wage with 41%.

One percent of the respondents' whose monthly expenditures are below poverty line are located in Kalipuro Village. Most of Kelir Village respondents have monthly expenditures within the range of poverty line – regency minimum wage, furthermore most of Giri Village respondents have monthly expenditures above the minimum wage. Giri represents the urban area of Banyuwangi, housing both the local government and the primary economic centre of the region. Consequently, the living expenses in this locality are elevated compared with other areas like Kalipuro and Kelir (see **Figure 4-68**).



Source: Primary Data, 2023

***Figure 4-68** Range of Household Expenditure (left) and by Villages (right) in the Study Area*

Detailed expenditure distribution data is needed to understand where the allocation of respondents' expenditures in the study area. The expenditures are divided into 12 categories, namely: (1) Food, (2) Debt, (3) Education, (4) Lottery Club or a rotating savings and credit association (Arisan), (5) Cigarettes, (6) Transportation, (7) Electricity, (8) Communication, (9) Clothing, (10) Social Donation, (11) Residence, and (12) Health. See graphic below for the detail respondent's average monthly expenditure by the type of expenditures.

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Source: Primary Data, 2023

Figure 4-69 *Respondents Average Monthly Expenditures in the Study Area*

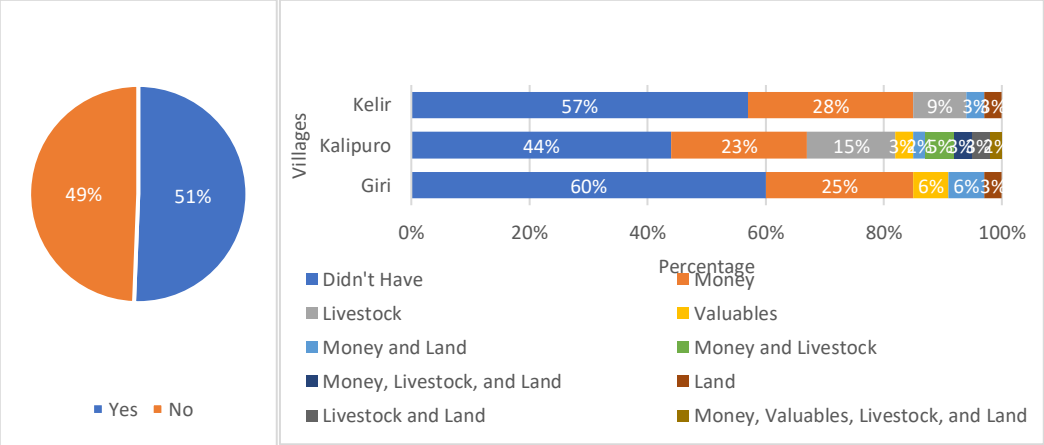
Based on the survey, the most significant expenditure is food. Expenditure on food is allocated the highest amount with an average of IDR 1,385,988 per month. Expenditure on debt or borrowed fund is also high amount at IDR 767,371 per month. This result indicates that consumption in the study area is quite high, either for daily needs or tertiary needs. The average expenditures on education and lottery club (*arisan*) are almost the same at IDR 434,723 and IDR 432,202, respectively. The lowest average expenditure is health at IDR 32,146.

4.2.2.2.5 Saving Ownership

Having savings is linked to a surplus in household income, enabling it to meet its financial requirements over a specific period. According to the survey in the graphic below, the percentage of respondents with savings is nearly equivalent to the percentage of the community without savings with percentages of 51% and 49%.

The types of savings isare (1) Money, (2) Livestock, (3) Valuables, (4) Money and Land, (5) Money and Livestock, (6) Money, Livestock, and Land, (7) Land, (8) Livestock and Land, and (9) Money, Valuables, livestock, and Land. Based on Figure 4-60 above, the community prefers to save in the form of money through banks or savings and loan institutions. Furthermore, the community also prefers to save in the form of livestock such as cow or goat. While this practice is commonly observed among individuals who still have available land, it is different in Giri village, which has already transitioned into a suburban area. Other than money and livestock, the community also prefers to save in the form of money and land, with the highest percentage is in Giri Village with 6%, which in Kelir Village is only at 3% and Kalipuro at 2%.

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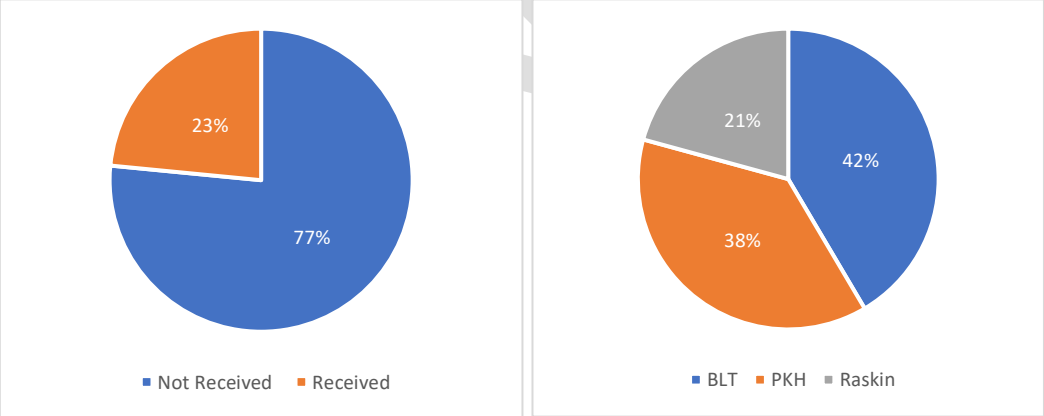
Source: Primary Data, 2023

Figure 4-70 *Percentage of Savings Ownership in the Study Area (left) and by Villages (right)*

4.2.2.2.6 Social Assistance

Referring to the Regulation of the Minister of Social Affairs of the Republic of Indonesia Number 1 of 2019, this study looks into social assistance[26] as one of the indicators of the socioeconomic condition of the community in the study area. This indicator aids in analysing the economic capability and household welfare level of the study area.

Based on the survey and as shown in the **Figure 4-71**, only 23% of respondents in study area received social assistance from the government.



Source: Primary Data, 2023

Figure 4-71 *Percentage of Social Assistance Recipients in the Study Area (left) and Percentage of Social Assistance Type Recipients in the Study Area (right)*

There are three types of social assistance received by respondents: 1) PKH[27], 2) *Raskin*[28], and 3) Direct Cash Assistance/BLT[29] (*Bantuan Langsung Tunai*). Respondents in study area received social assistance from government program as presented in **Figure 4-71**. 42% of the respondents received direct cash assistance/BLT, 38% received PKH and 21% received Raskin.

[26] social assistance is defined as financial, material, or service assistance provided to individuals, families, groups, or communities that are poor, unable, and vulnerable to social risks, aiming to enhance economic capability and community welfare

[27] Program Keluarga Harapan (PKH) is a conditional cash transfer program for impoverished families identified as beneficiaries. PKH is a program initiated by the Ministry of Social Affairs of the Republic of Indonesia.

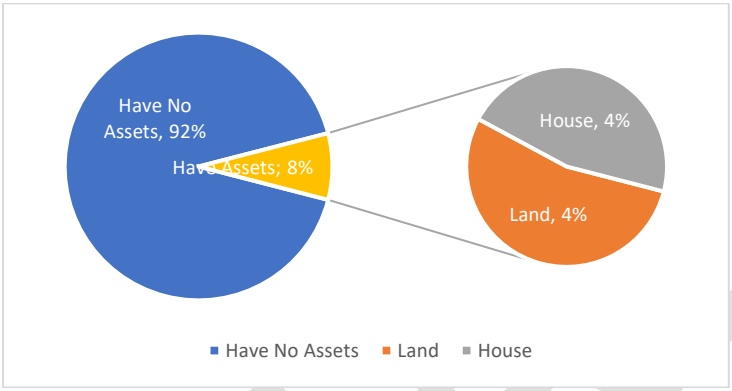
[28] Raskin is a subsidized rice program for low-income households. Beneficiaries of Raskin purchase rice at a price below the market rate.

[29] A government assistance programs that provides cash or other forms of assistance for poor household.

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4.2.2.2.7 Ownership of Assets

Ownership of assets in the form of land and buildings is a crucial factor supporting the community's production processes and economic activities. The survey shows that most of the respondents do not own assets other than the house and land on which they live, (92%). Ownership of assets elsewhere indicates a stable economic capacity and a form of investment. Meanwhile, respondents in the study area who own assets elsewhere account for only 8%, with half in the form of houses the other half in the form of land. Detailed data on asset ownership elsewhere by village in the study area can be seen in **Figure 4-72**.

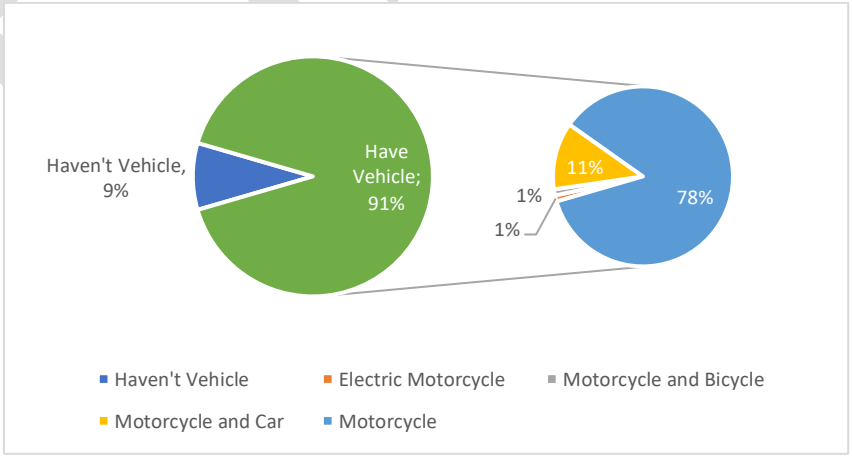


Source: Primary Data, 2023

***Figure 4-72** Percentage of Ownership of Assets Elsewhere in the Study Area*

4.2.2.2.8 Transportation

The ownership of transportation assets is important for mobility and productivity. Based on the study, most of the respondents in the study area own transportation for household and economic activities, (91%). Only nine percent of respondents need vehicle (see **Figure 4-73**).



Source: Primary Data, 2023

***Figure 4-73** Percentage of Respondent's Vehicle Ownership in the Study Area*

Based on the **Figure 4-73** above, vehicle ownership in the study area comprises mainly of motorcycles (78%), motorcycles and cars (11%) and some ownership of bicycles. The results indirectly indicates that the economic capacity is at middle to lower economic level. Motorcycles are affordable for most of the population, meeting their mobility needs

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and enhances the local population's access to distant public facilities and services. It is also used regularly to reach agricultural and plantation areas.



Source: Primary Data, 2023

Figure 4-74 *Ownership of Transportation Facilities at the Study Site Motorbikes (left) and Pick-up Trucks (right)*

4.2.2.2.9 Agriculture, Plantation, and Livestocks

Agriculture, horticulture, and plantation were identified as the main sources of livelihood for the respondents in the study location. There are 20 types of agricultural and plantation crops being propagated by the respondents. For the detailed information on the main types of agricultural crops, please refer to the **Table 4-53**.

Among these, coconut (*Cocos nucifera*) is the most productive with a total production of 212,350 nuts per year, accounting for 66%. It is followed by corn (*Zea mays*) with a production of 54,642 kg per year, or 17%, and rice (*Oryza sativa*) with a production of 25,200 kg per year, making up 8%. Banana (*Musa paradisiaca*) makes up to 4%. Additionally, avocado (*Persea americana*), coffee (*Coffea spp*) production are also prevalent crops in the study area, each contributing below 2% of total production.

Table 4-53 *The Number of Commodity in Study Area*

No	Commodity	Kalipuro	Kelir	Giri	Total	%
1	Avocado / *Persea americana*	5,000	0	0	5,000	2%
2	Chili / *Capsicum sp.*	500	88	0	588	0%
3	Durian / *Durio zibethinus*	195	0	0	195	0%
4	Corn / *Zea mays*	47,342	3,300	4,000	54,642	17%
5	Coconut leaves	0	210	0	210	0%
6	Bean / *Phaseolus spp.*	1,500	0	0	1,500	1%
7	Long bean / *Vigna unguiculata subsp. sesquipedalis*	100	0	0	100	0%
8	Peanut / *Arachis hypogaea*	70	0	0	70	0%
9	Coconut / *Cocos nucifera*	209,650		2,700	212,350	66%
10	Coffee / *Coffea spp.*	3,853	0	0	3,853	1%
11	Sword bean / *Canavalia ensiformis*	200	0	0	200	0%
12	Mango / *Mangifera indica*	620	0	0	620	0%
13	Mangosteen / *Garcinia mangostana*	0	100	0	100	0%
14	Paddy / *Oryza sativa*	14,000	10,000	1,200	25,200	8%
15	Various crops	1,000	0	0	1,000	0%
16	Stink bean / *Parkia speciosa*	1,225	0	0	1,225	1%
17	Banana / *Musa paradisiaca*	14,492	0	0	14,492	4%
18	*Sengon* / *Paraserianthes falcataria*	40	0	0	40	0%

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No	Commodity	Kalipuro	Kelir	Giri	Total	%
19	Cassava / *Manihot esculenta*	950	0	0	950	0%
20	Eggplant / *Solanum melongena*	200	0	0	200	0%
	Grand Total	**300,937**	**13,698**	**7,900**	**322,535**	**100%**

Source: Primary Data, 2023

A detailed overview of the production results of agricultural and plantation crops at the study location is presented in **Figure 4-75**.



Source: Primary Data, 2023

Figure 4-75 *Coconut Harvest (left) and Rice Ready for Harvest (right)*

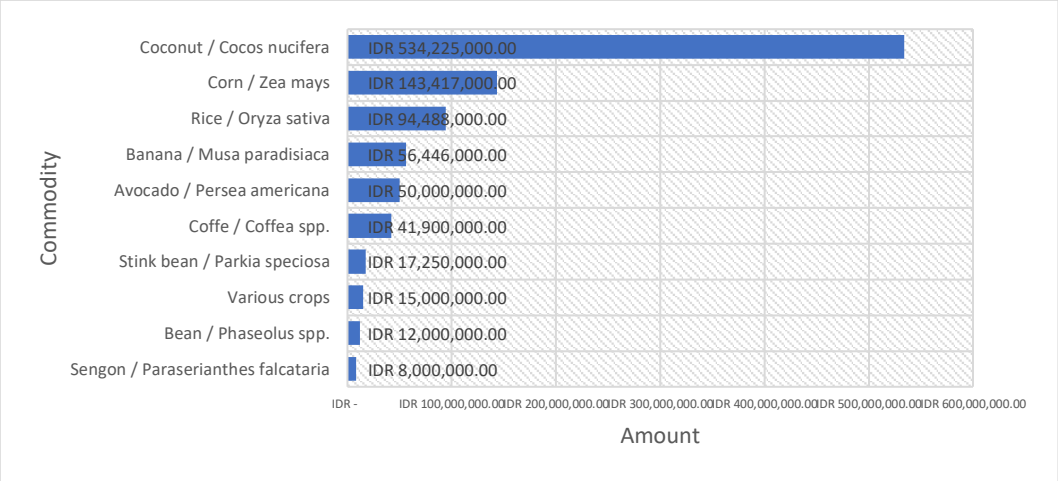
Kalipuro Village produces most of the agricultural crops, while in Giri Village and Kelir Village, the variety of crops produced are limited, including mainly corn, rice, and coconut. Coconut production is most prevalent in Kalipuro Village, followed by Giri Village. Corn is mostly produced in Giri Village and least produced in Kalipuro Village while rice is mostly produced in Kelir Village and least produced in Kalipuro Village.

The types of crops planted by respondents are highly influenced by the geographical conditions and the availability of water sources for irrigation. Based on field observations, most of the communities in Kalipuro Village plant coconut, coffee, and bananas as Kalipuro Village relies on rainwater as water source. In Giri Village, especially in the northern part (Karangrente, Kluncing, and Kopenbayan Hamlet), a highland area with water sources coming from rivers and rain, majority of the crops are corn and rice on rain-fed rice field (*tadah hujan*)[30]. Meanwhile, Kelir Village is a hilly highland area with water sources from rivers and springs. The relatively stable water supply for agriculture in Kelir Village allows the community to plant rice, corn, and other essential crops.

Most agricultural products of the respondents are sold, with only a small portion consumed for personal use. The most sold agricultural commodities include avocado, coconut leaves, beans, peanuts, mangosteen, stink beans, sengon (Paraserianthes falcataria) wood, cassava, and eggplant, all 100% sold. Coconut, corn, and rice are also frequently sold commodities. The high percentage of agricultural commodities sold indicates that agricultural products are a significant source of household income. The agricultural commodity most consumed by respondents is peanuts, followed by chili and durian.

[30] is a rice field whose irrigation system relies heavily on rainfall. This type of rice field only produces in the rainy season. In the dry season this rice field is left uncultivated because water is difficult to obtain or does not exist at all. Rain-fed rice fields are generally only harvested once a year. The intensity of labour use in rainfed rice fields is higher because farmers have to embroider (replant) more often than irrigated rice fields, due to unstable water supply.

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Source: Primary Data, 2023

Figure 4-76 *Respondent's 10 Largest Annual Agricultural and Plantation Commodity Sales Values in the Study Area*

Figure 4-76 presents the total sales value of 10 agricultural and plantation commodities in the study area. Coconut has the highest sales value at IDR 534,225,000 per year, followed by corn at IDR 143,417,000 per year, and rice at IDR 94,488,000 per year. These three commodities are the main crops found in the study area. Sengon (Paraserianthes falcataria) and bean are the commodities with the lowest annual sales values, amounting to IDR 8,000,000, and IDR 12,000,000, respectively. These two commodities are only intercropped plants and are not the main commodities for the community.

As mentioned, water sources in the communities come from groundwater, rivers, or rainwater. Based on the survey results, most respondents who own agricultural land rely on rain for irrigation of rice fields with a percentage of 74%, followed by rivers at 23%, and groundwater/wells at 3%.

Of the villages, Kalipuro Village rely on rain for irrigation due to its hilly topography. Many rivers dry up during the dry season, thus, few respondents utilize groundwater/well for irrigation. In Kelir Village, irrigation channels funneling water from rivers are the main source. Field observations found that the rivers in Kelir Village still have water during the dry season. There are also springs that feed into agricultural irrigation channels.



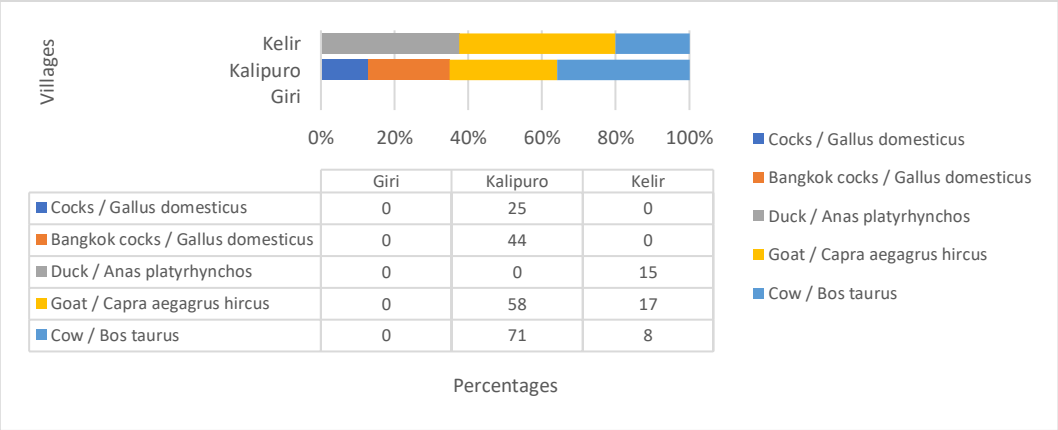
Source: Primary Data, 2023

Figure 4-77 *Clean Water Source and Irrigation in Kelir Village*

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In addition to crop agriculture, respondents also own livestocks. The ownership of livestock contributes to the household income. The main livestock in the study area are cattle, goats, rooster[31], and ducks. Details of livestock ownership can be seen in **Figure 4-78**.

Livestock ownership is most prevalent in Kalipuro and Kelir Villages, while in Giri Village, no respondents own livestock. Ownership of cattle, goats, rooster, and hen is most widespread in Kalipuro Village, with a total of 71 cattle, 58 goats, 44 roosters[32], and 25 hens[33]. Meanwhile, the ownership of ducks is most prevalent in Kelir Village, with a total of 15 ducks.



	Giri	Kalipuro	Kelir
Cocks / Gallus domesticus	0	25	0
Bangkok cocks / Gallus domesticus	0	44	0
Duck / Anas platyrhynchos	0	0	15
Goat / Capra aegagrus hircus	0	58	17
Cow / Bos taurus	0	71	8

Source: Primary Data, 2023

Figure 4-78 *Percentage of Ownership of Respondent's Livestock by Villages in Study Location*

Respondents utilize livestock for personal consumption, and, for sale to meet daily needs. Based on the study, most respondents sell most of the livestock products, with very few being consumed for personal use. The livestock product most sold by respondents is roosters[34], followed by cattle, and goats. In the cattle farming sector, the proceeds from cattle sales were divided equally between the cattle caretaker and the cattle owner. Livestock products consumed by respondents were limited to chickens.



Source: Primary Data, 2023

Figure 4-79 *Sales Value of Respondents Livestock Commodities in the Study Area*

The graph above indicates that the sales value of cattle is the highest among livestock in the study area, totalling IDR 241,000,000 per year followed by goats, with a total sales value of IDR 31,800,000 per year, and cocks with a sales value of IDR 14,500,000

[31] Rooster used for cockfighting (***sabung ayam***) in communities.
[32] Rooster variety from Thailand (they called **ayam Bangkok**)

[34] Roosters for cockfight (***sabung ayam)*** activities.

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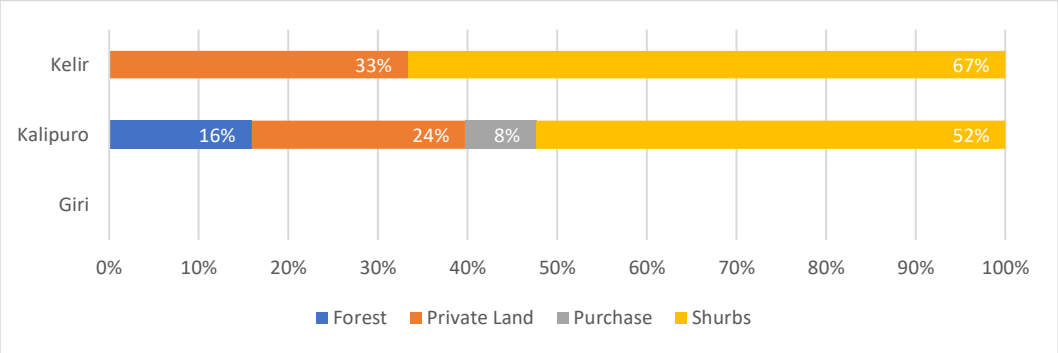
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per year. The community considers cattle as a form of savings that can be sold in times of urgent need. Examples of cowsheds and goat sheds located in the study area can be seen in the **Figure 4-80**.



Source: Primary Data, 2023

Figure 4-80 *Cowshed (left) and goatshed (right)*



Source: Primary Data, 2023

Figure 4-81 *Percentages of Source of Livestock Feeds by Villages in the Study Area*

The ownership of cattle or goats by respondents is linked to the availability of feed sources. The primary source of livestock feed is predominantly from shrubland (67%) most prevalent in Kelir Village. Own land places second at 33%. Livestock feed sourced from the forest is most found in Kalipuro Village, constituting 16%, and purchasing feed such as corn leaves and straw, which is 8%, is also observed in Kalipuro Village. Respondents purchase livestock feed due to the extended dry season, making it challenging for some farmers to collect livestock feed.



Source: Primary Data, 2023

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Figure 4-82 *One of the Sellers of Corn Leaf Fodder (left) and a Farmer Bringing Jermai for Animal Feed (right)*

Based on an interview conducted with one of the cattle caretakers in Secang Sub-village and in Wangkal, cattle feed is collected from PT PN and other areas farther. Those who collect grass from PTPN area are residents of Bulusan and Wangkal. The remaining grass are taken from other areas even to the west of Banyuwangi and Pertuhani's land.

The same was explained by several residents carrying grass when passing on the road met by researchers. Animal feeds are gathered from many places, such as private land, land owned by others who had finished harvesting corn or paddy, forest land, and some bought animal feed. During sugarcane harvest season, residents come to PTPN's land to collect sugarcane tops as animal feed. PTPN does not charge gatherers for collecting the waste products from the harvest, but the source of animal feed from PTPN is only allowed to be taken during harvest season.

4.2.2.3 Local Economy and Employment

4.2.2.3.1 Workforce

The workforce consists of individuals within the working-age range, covering those who are employed, unemployed, or actively seeking employment. According to the definition outlined in Minister of Manpower Regulation No. 10 of 2021, this encompasses individuals aged from at least 15 to 64 years old. There is a direct correlation between the size of the population and the probability of having a larger workforce.

Table 4-54 *Number of Productive Age by Villages in Study Area*

No	Village	Productive Age	Percentage
1	Kalipuro	**10,061**	68%
2	Kelir	**3,099**	56%
3	Giri	**3,568**	66%

Source: Village Profile 2022

Based on the table above, Kalipuro has the greatest working age population at 68% of its population, followed by Giri Village with a working age percentage of 66%. The lowest percentage of productive age population is found in Kelir Village at 56%. The high number of labour force members in Kalipuro Village is due to the large population compared to Giri and Kelir Villages.

4.2.2.3.2 The Absorption of the Workforce in Each Village

The absorption of employment can be assessed by examining the extent to which the population occupies job opportunities. According to the survey, nearly all individuals of working age (refer to the labour force table) are engaged in diverse job roles within the study area and its vicinity (refer to **Table 4-55** below).

Table 4-55 *Number of Type Livelihood by Villages in Study Area*

No	Livelihoods	Kalipuro	Kelir	Giri	Total
1	Farmers	1,661	663	125	2,449
2	Farm Labourer	159	1,310	750	2,219
3	Daily Labourer	2,124	0	0	2,124
4	Honorary Labourer	37	0	0	37
5	Civil Servant (PNS)	108	66	110	284

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No	Livelihoods	Kalipuro	Kelir	Giri	Total
6	Indonesian Armed/Police Force (TNI/Polri)	32	2	20	54
7	Doctor Private	3	0	2	5
8	Midwife Private	5	2	3	10
9	Nurse	8	0	0	8
10	Mechanic	28	2	0	30
11	Driver	137	0	0	137
12	Merchant	256	26	50	332
13	Breeder	3	42	2	47
14	Fisherman	13	0	0	13
15	Private Sector employee	1,033	260	1,110	2,403
16	Self-Employed	10	12	10	32
17	Businessman	617	2	0	619
18	Entrepreneur of small food stalls, eateries, restaurants	0	65	0	65
19	Village Officials	10	10	0	20
20	Religious Leader	7	0	0	7
21	Lecturer	200	0	1	201
22	Lawyer	1	1	1	3
23	Notary Public	0	0	1	1
24	Pensioner	62	10	75	147
25	BUMN	43	0	30	73
26	Woodworker	5	75	0	80
27	Tailor	5	11	0	16
28	Welder	4	2	0	6
Total		**6,571**	**2,561**	**2,290**	**11,422**

Source: Village Profile 2022

Based on village demographic data, the total population in the project area is 27,037. From this population, around 16,728 individuals are part of the workforce or 62%. These individuals in the workforce are typically engaged in occupations such as daily labourers, farmers, private sectors employees, farm labourers, businessman, and service providers.

Most of the labour force in the study locations are in the agricultural sector, such as farmers and farm labourers, and the service sector and industry, such as daily labourers and private or company workers. Absorption of the labour force is strongly influenced by the level of education and skills possessed by the labour force. Data on the education level of the population shows that most of the community's education level is primary school graduates, non-primary school graduates and senior high school graduates. People with basic or low levels of education mostly work as day labourers and people with a secondary level of education are mostly absorbed as private sector employees. This was expressed by one of the youths from the Secang Sub-village in Kalipuro Village, that generally, teenagers who just graduated from senior high school look for jobs outside the village, such as in Ketapang or Banyuwangi, where they work in factories or become employees in private companies.

The same thing was also conveyed by a cattle farmer and construction worker, who explained that many residents are unemployed because they have low education, and most residents work in factories on the axis road, where there are shrimp factories and cement warehouses.

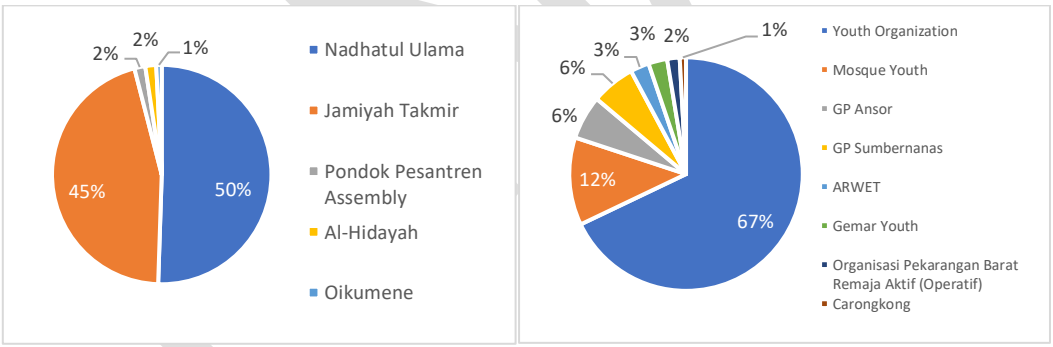
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The Giri Village government during 2023 has provided training to the workforce and the community in its area, this aims to reduce unemployment and increase the capacity of the workforce in Giri Village, this is in accordance with the statement of the Head of Giri Village, that in addition to the program to solve the dropout rate in Giri Village, during 2023 the local government also conducted car paint training, culinary training and pastry making, all in collaboration with the Banyuwangi Manpower Office, this is aimed at reducing unemployment and they can develop and be competitive in their business.

4.2.2.4 Socio-Culture

Banyuwangi is homeland for several ethnicities, including the Osing, Javanese, Balinese, Madurese, and Mandar ethnic groups, which have a long history in the region's development. Each ethnic group brings tradition, language, art, and customs diversity. This diversity creates an atmosphere of Banyuwangi society rich in culture, making it a heterogeneous city. In the context of diversity, community meetings become community forums to build understanding and get to know each other to strengthen group ties in the Banyuwangi community.

Most of respondents in the project area, as many as 77%, actively attended meetings held by the village government. High attendance at village government meetings can be interpreted as active community participation in decision-making activities and communication with local government. It reflects the positive level of involvement of most of respondents in the management and development process in their region. Meanwhile, 23% of respondents do not actively attend village government meetings. Even though this proportion is smaller, it may be caused by several factors, for example, the respondents' busy schedule or distance from the meeting place.



Source: Primary Data, 2023

Figure 4-83 *Percentage of Religious Group (left) and Percentage of Youth Groups (right)*

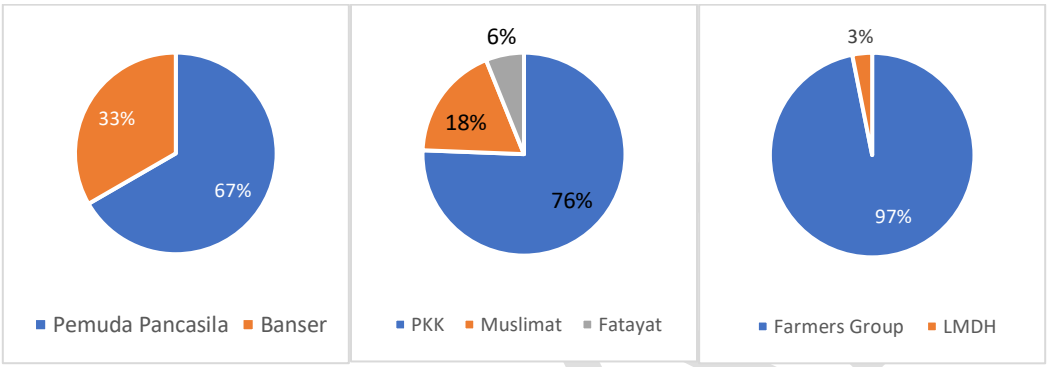
Organizational affiliations

Respondents follow five religious' groups in the project area (see **Figure 4-83**). Of the five groups, four of them are related to Islamic religious activities, while one other group is related to Protestant Christianity. The *Nahdhatul Ulama*[35] group is the largest religious group followed by 50% of the respondents followed by *Jamiyah Takmir*[36], at 45%. Meanwhile, the religious group with the least participation was *Oikumene*[37], only attended by 1% of respondents. *Oikumene* is a Protestant Christian religious organization.

[35] Islamic organization concern about of the concept of Islam Nusantara, a distinctive feature of Islam that has undergone interaction, contextualization in accordance with the socio-cultural conditions in Indonesia.
[36] a group of people organising a mosque
[37] A cross-denominational gathering of Christians to achieve inter-church unity. Activities involve meetings, prayers, worship, and theological discussions to strengthen relationships between Christians.

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In addition, as seen in **Figure 4-83**, the youth organization (*Karang Taruna*[38]) is the organization with most membership from the respondents, at 67%. Giri Village respondents have the highest participation in youth activities, at 94%. Activities carried out by Karang Taruna act as a forum for developing management and leadership skills among the youths in the community. Some of the activities generally carried out by the youth organization (*Karang Taruna*) in the three villages include sports such as organizing volleyball tournaments, building street lighting, *rewang*[39], and other social activities. This shows the active role and contribution of *Karang Taruna* in strengthening social networks and advancing youth activities in the project area.



Source: Primary Data, 2023

Figure 4-84 *Percentage of Community Organizations (left), Percentage of Women Groups (center), and Percentage of Profession Group in Study Area (right)*

Figure 4-84 above shows that two large community organizations, Pemuda Pancasila[40] and Banser[41], have different levels of participation in the project area. Pemuda Pancasila has the highest participation rate, 68% of respondents. In addition, Banser had a participation rate of 33% of respondents.

Women's participation in organizations at the village level has an important role in building an inclusive and sustainable society. Based on survey results, most female respondents in the project area participated in Family welfare Empowerment (PKK[42] – Pemberdayaan Kesejahteraan Keluarga) activities, at 76%. PKK is a women's organization under village institutions that focuses on efforts to improve family welfare. Other organizations followed by women are *Muslimat*[43], with 18% of respondents, and *Fatayat*[44], with 6% of respondents. These two organizations are organizations under *Nadhatul Ulama*. *Fatayat* consists of young people aged up to 40 years, while *Muslimat* consists of adult women aged over 40 years.

In addition, there are two professional organizations respondents participate: the farmer groups, with 97% participation and Forest Village Community Institution (*LMDH-Lembaga Masyarakat Desa Hutan*[45]) with 3% participation. Farmer groups are usually

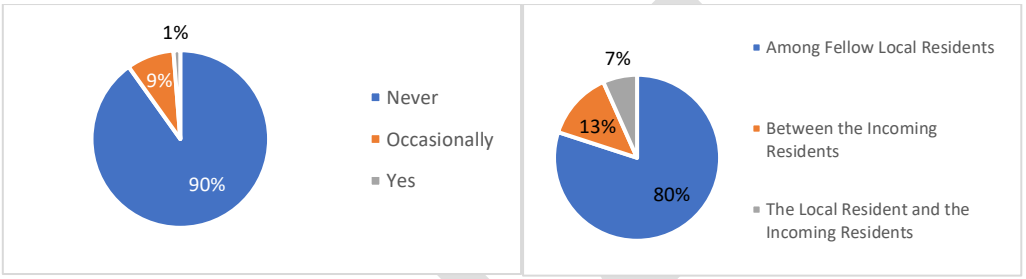
[38] Karang Taruna is a youth organization in Indonesia formed by the community as a forum for the younger generation to develop themselves, grow, and develop based on awareness and social responsibility of, by, and for the younger generation, which is oriented towards achieving social welfare for the community.
[39] Rewang is a tradition carried out by neighbours, both women and men will come together to help people who are celebrating.
[40] Pemuda Pancasila is is an Indonesian paramilitary organization formed to support the New Order government, which has principles referring to the constitution of the Republic of Indonesia.
[41] Banser, short for Barisan Ansor Serbaguna, better known as Banser, is an Islamic militia organization based in Indonesia. It is part of the military wing of the Ansor Youth Movement (GP Ansor), affiliated with Nahdlatul Ulama (NU), the world's largest Islamic mass organization. Banser operates as a semi-autonomous body of GP Ansor and functions primarily for security and humanitarian operations.
[42] PKK is a community organization to empower women and participate in the development of Indonesia's prosperity
[43] Muslimat is a women's organisation of Nadhatul Ulama that is concerned with social and religious issues.
[44] Fatayat is a Nahdlatul Ulama young women's organization focusing on youth, social, and religious affairs.
[45] LMDH- Lembaga Masyarakat Desa Hutan. Forest Village Community Institution (LMDH) is an institution formed by village communities located in or around forests to manage and fulfil their needs through interactions with forests in the social, economic, political and cultural

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linked to access to agricultural assistance programs from the government, such as subsidies for fertilizer, seeds, or agricultural equipment. As for LMDH, although its participation is lower, it still plays an important role in environmental conservation and utilization of forest resources.

Social institutions have been considered beneficial for society, both in relation to improving welfare and social and religious matters. In Giri village, there is a *SEGO LANSIA*[46] community that provides basic food assistance to older people, lends wheelchairs to disabled residents, and provides additional food to babies who are suspected of being stunted. Farmer groups in Kelir village are considered a platform to facilitate access to information and various agricultural assistance from the government. *Nahdhatul Ulama* in Kalipuro village holds religious activities and often distributes zakat aid (Lazis NU)[47] to the community.

Social conflicts



Source: Primary Data, 2023

Figure 4-85 *Percentage of Perception About Conflict in Study Area (left) and Percentage of the Conflicting Communities in the Study Area (right)*

The graph above shows that 9% of all respondents think that social conflicts occasionally occur, and 1% of respondents stated that conflicts have occurred. Most of the Kelir village respondents stated that there had never been any conflict in their village. However, Kalipuro village respondents sometimes experience conflict in the village. Based on interviews, the conflicts experienced are usually related to internal family problems. According to respondents, as many as 80% of conflicts occurred between fellow residents, 13% between the incoming residents, and 8% between residents and the incoming resident.

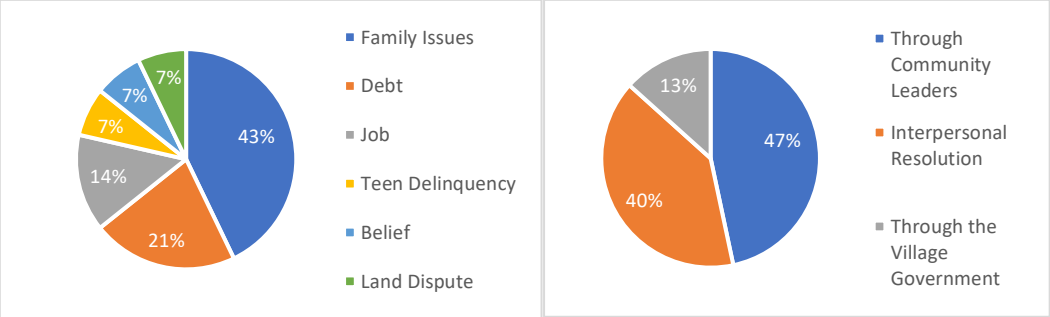
In the village context, the perception of minimal conflict is related to relatively strong social ties even though they consist of various ethnic groups. Family members are often involved in various monthly activities in various groups mentioned above.

contexts. The purpose of forest village community organizations is to improve the quality of life of communities around the forest, manage human resources and forest resources and fight (advocacy) for the rights of communities around the forest to work, access information and access to existing natural resource policies.

[46] Sego Lansia is Abbreviation from *Bantuan Sembako untuk Lansia sebatangkara*. This community provides staple food assistance for older people who live alone.

[47] Is a non-profit organization owned by the Nahdlatul Ulama (NU) association which aims to serve in order to help the welfare and independence of the people, lifting social dignity by utilizing Zakat, Infaq, Sadaqah (ZIS) funds and other social-religious funds.

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Source: Primary Data, 2023

***Figure 4-86** Percentage of the Main Issues Causing Conflicts in the Study Area (left) and Percentage of the Conflict Resolution in the Study Area (right)*

Family issues are the most dominant cause of conflict, at 43%. The second most common cause of conflict is debt, at 21%. Meanwhile, as many as 14% of conflicts originate from work-related problems.

Based on various conflicts involving residents in the project area, some conflicts are usually resolved through intervention carried out by community leaders, at 47%. However, some are resolved directly between individuals (40%). The other conflicts such as land disputes between families, labour issues or debts are resolved through village government at 13%.

4.2.2.4.1 Land use

Based on in-depth interview with respondent, ownership of agricultural land and land for buildings are the assets that is a basic need for community. The ownership of land and land for buildings correlates with livelihood sustainability of the people and has the potential to support increased community income and the effectiveness of community spending for livelihood needs.

The Plantation Area (PTPN XII), planned to be used as the main project area for the Ground-Mounted PV Module and Plant Switchyard facilities, is owned and managed by PTPN XII and planted with sugar cane. Some parts of the plantation is not planted with sugar cane because the surface is filled with stones where hard plants such as teak and Sengon *(Paraserianthes falcataria)* wood thrive. A memorandum of understanding (MoU) has been established between the Client and PTPN XII to utilize the land which will be followed by cooperation mechanism. Meanwhile, for the transmission line routes, the lands belongs to residents of the local communities.

According to spatial planning of Banyuwangi Regency or Regency Regulation Number.8 of 2012, the Banyuwangi Solar PV site, switchyard site, and transmission line route area are within plantation area. Parts of the transmission line route are located within irrigated agriculture land, see **Figure 4-87**.

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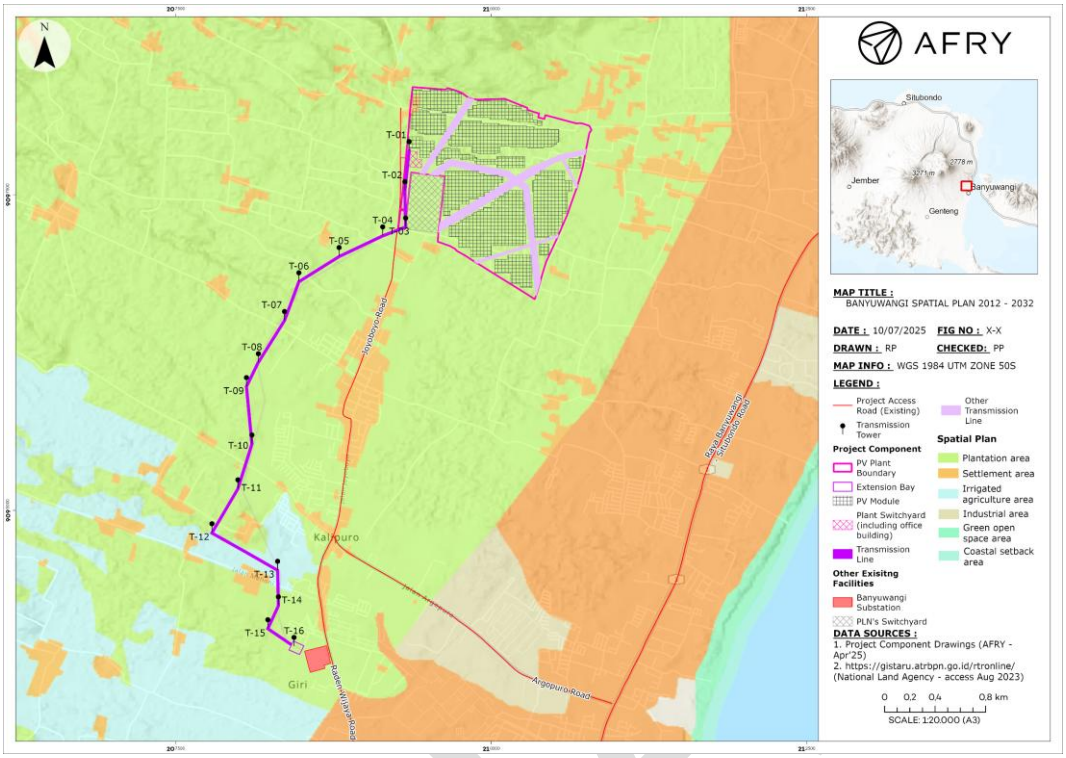


Figure 4-87 *Spatial Planning of Banyuwangi Solar PV*

The spatial planning also mentions that Banyuwangi Regency is designed for development of renewable energy which includes solar power plant specifically Kalipuro District and Wongsorejo District. It is reflected in the space utilization conformity approval (*Persetujuan Kesesuaian Kegiatan Pemanfaatan Ruang* – PKKPR) which has been issued by Indonesia Government on 24th January 2023.[48]

Based on Ministry of Agrarian Affairs and Spatial Planning/Head of the National Land Agency No. 1589/SK-HK.02.01/XII/2021 on protected rice fields[49] in regencies/cities in several provinces including East Java Province, Banyuwangi Solar PV PP including switchyard and transmission line routes are located outside the protected rice field. (**Figure 4-88**).

[48] Approval for the conformity of space utilization for business activities No. 25012310413510086. Issued by Minister of Agrarian Affairs and Spatial Planning/Head National Land Agency Minister of Investment/Head of Investment Coordinating Board on 24th January, 2023.
[49] The purpose of the establishment of the regulation is to control the conversion of rice fields into other functions such as housing, shops, offices, and other investment functions.

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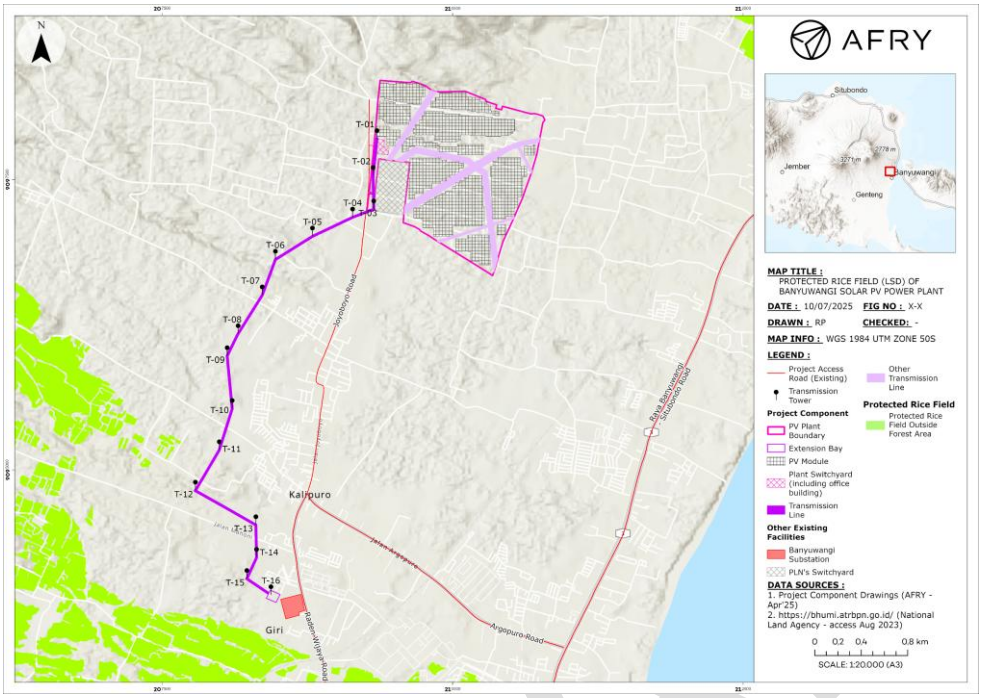


Figure 4-88 *Protected Rice Field (LSD) locations near Banyuwangi Solar PV PP*

While according to forest classification, the locations the Banyuwangi Solar PV PP including its components and the transmission line route are located within non forest areas also known as an area for other land uses (*Area Penggunaan Lain* – APL) see **Figure 4-89**.

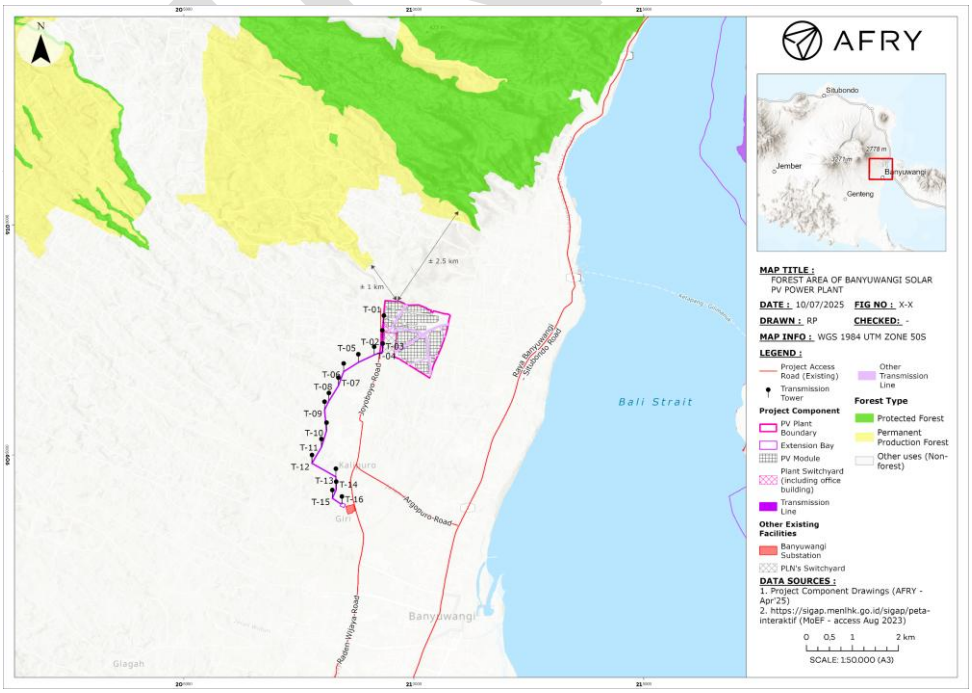


Figure 4-89 *Forest area of Banyuwangi Solar PV PP*

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To determine the land use by the communities around the project area, the researcher categorizes four types of land utilized by the community. The types of land are shown in **Table 4-56**.

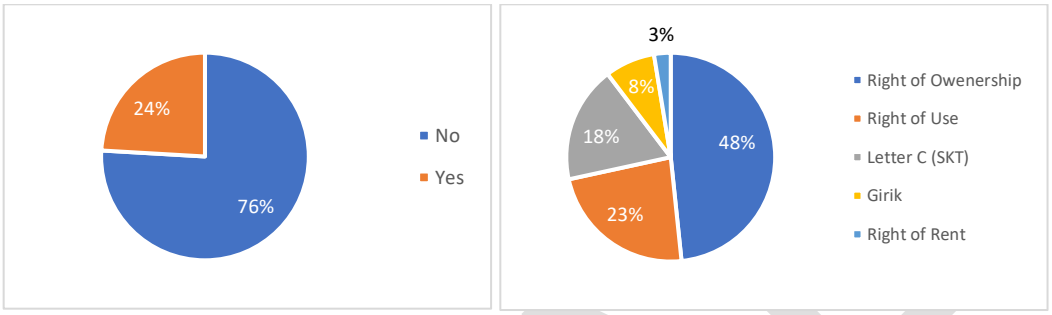
Table 4-56 *Type of Land Use*

Type of Land	Land Use by Community	Issue on the Project Area
Plantation PTPN	This land is owned by PTPN XII and is used as a sugarcane plantation. The local community uses this land primarily for access to a through road to Ketapang, as this road can cut travel time by more than 15 minutes. By using this road, the local community can get to their destination faster. Local communities, especially children and teenagers, also use this land for entertainment activities, such as kite flying. During the harvest season, local communities are allowed to utilize sugarcane tops, which are waste from sugarcane harvesting activities, to be used as animal feed. By utilizing sugarcane tops from harvesting activities, local communities can save on animal feed. It is also a source of livelihood for some local people, especially during the harvest period, because the harvest period for sugarcane plantations can reach 4 months.	The agricultural access road in this plantation is also used by the local community as an alternative road that is closer and faster to get to the Ketapang area, but the condition is quite bad and there is no improvement because this road is a plantation road. the surrounding community hopes that if it will be used as a project site, it is necessary to continue to provide access roads for use by the community as it already exists at PT INKA.
Perhutani	Forest land in Kalipuro Village is used as a source of livelihood for pine resin tapping labourers and is used by local communities to collect bamboo for sale. Some local communities that have joined the LMDH (*Lembaga Masyarakat Desa Hutan*) can utilize the land with a *Tumpangsari* system. In Sumbernanas and Papring Hamlets, there are several local communities who live and build houses on forest land with a Decree of the Minister of Forestry.	People who live on land owned by Perhutani are casual daily labourers tapping pine trees owned by Perhutani. However, forestry land on which there are settlements will be released for Agrarian Reform Object Land (TORA - *Tanah Obyek Reformasi Agraria*)
Private Land	Privately-owned land in the study area is used as a residence, place of business - business activities, as well as agricultural activities, livestock, or rented to other parties.	Land with letter C status or a Land Certificate (*Surat Keterangan Tanah*-SKT) issued by the village government as proof of ownership. Have proof of land ownership through a Girik, proof of Land, and Building Tax (Pajak Bumi dan Bangunan -PBB) payment from the village.
Community Land	Land owned by the village or commonly referred to as tanah kas desa or tanah bengkok. Each village in the study area owns this land and it is usually leased to tenant farmers or utilized as public facilities managed by the village, such as in Kelir Village, where village treasury land is used as village-owned agricultural and plantation land managed by farmer groups in the village.	Based on the results of the field visit, there are several points where the transmission line tower plan is located on village treasury land.

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4.2.2.4.2 Land Ownership

Most respondents, 76%, do not have agricultural land because they live in sub-urban regions with limited agricultural land. Meanwhile, 24% of respondents own agricultural land in the area (see **Figure 4-90**). Most respondents who do not own agricultural land are in the Giri Village, a sub-urban area where the main income does not come from the agriculture. The largest land ownership is in the Kalipuro Village, which is also a sub-urban area, but the community still works on agriculture, especially in areas close to PTPN's sugar plantations.



Source: Primary Data, 2023

Figure 4-90 *Percentage of Respondents Agricultural Land Ownership in Study Area (left) and Percentage of Agricultural Land Ownership Status in Study Area (right)*

Figure 4-90 illustrates the status of agricultural land ownership in the project area. As many as 48% of respondents own agricultural Land with rights ownership *(Hak milik*). Meanwhile, 23% of respondents cultivate agricultural Land with right-of-use status. Rights of use status refer to *Perhutani* land used by people who work as *Perhutani* pine tapper workers. Some of the land is planted with coffee, cocoa, and fruit crops, with the harvests consumed by the cultivator. As many as 18% of respondents have Land with letter C status or a Land Certificate (*Surat Keterangan Tanah-SKT*) issued by the village government as proof of ownership. Meanwhile, 8% of respondents have proof of land ownership through a *Girik*[50], proof of Land, and Building Tax (*Pajak Bumi dan Bangunan -PBB)* payment from the village. Only 3% of respondents rent agricultural Land in the area.

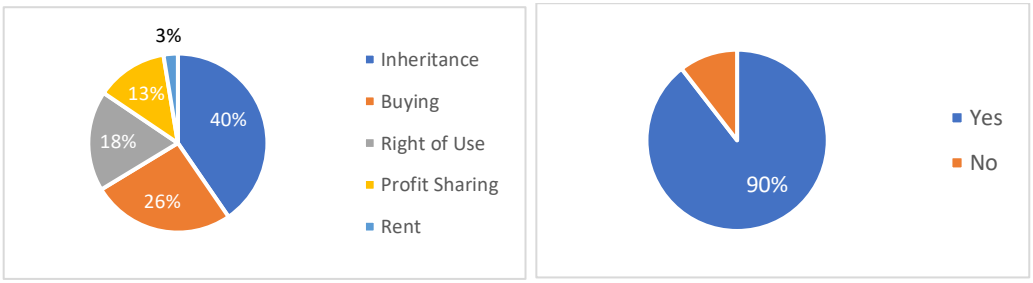
Figure 4-91 shows some respondents obtained land in various ways, including inheritance from previous generations, as was the case for 40% of respondents. 18% of respondents acquired agricultural land by buying it from residents. There are also 18% of respondents who own agricultural land in the form of use rights, where the farmer can only manage the agricultural land but does not have ownership rights. The land being worked on is government-owned land, and several respondents in the project area cultivate land owned by *Perhutani.*[51]

13% of respondents obtained land through profit sharing. In Indonesia's agricultural realm, including in Banyuwangi, a profit-sharing system has also been implemented, different from the rental system. The landowner hands over the land to the farmer, who is then responsible for all agricultural capital to manage and cultivate the land. When harvest time arrives, agricultural products are divided between the cultivator and the

[50] Girik is not a landowner's rights, but evidence that the girik owner controls customary land and is a taxpayer of the land parcel along with the buildings on it (if any). Thus, girik cannot be equated with a certificate of land rights.
[51] Perhutani is a State-Owned Enterprise in the form of a Public Company (Perum) that has the duty and authority to manage state forest resources on the islands of Java and Madura. Perhutani's strategic role is to support environmental sustainability in forestry communities' socio-cultural and economic systems.

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landowner according to the previously agreed agreement. 3% of respondents obtained agricultural land by renting land.

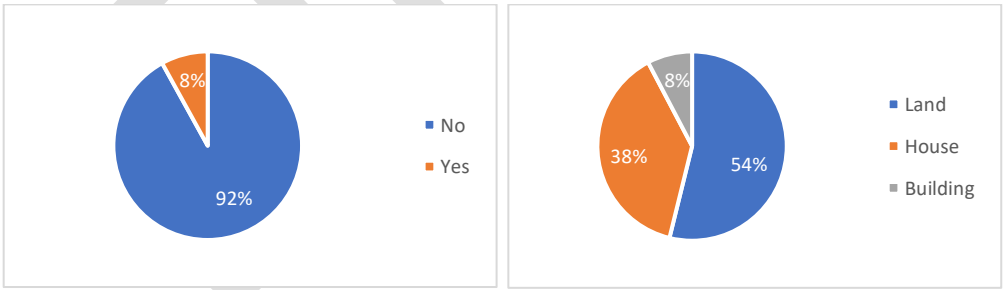


Source: Primary Data, 2023

***Figure 4-91** Percentages of How to Obtain Land in Study Area (left) and Percentage of Ownership of a Building or Residential House in Area Study (right)*

Ownership of assets in the form of land and buildings is a crucial factor in supporting the production process and the ongoing economic activities of the community in the Project area. The survey results show that most respondents in the project area already have land for residence, at 90%, while 10% of respondents do not own land for residential buildings. Details regarding land ownership for housing can be seen in the **Figure 4-91**. Based on the survey results, almost all land ownership for housing is owned by the respondents, which is spread evenly throughout the project area. The respondents with the most land for residence is in Kalipuro Village. Meanwhile, Giri Village has the greatest number of respondents who did not have land for settlement.

Based on the study, it was also found that some community members have assets elsewhere. To determine the percentage of asset ownership in another location, refer to **Figure 4-92** below. Based on survey results, 8% of respondent have land assets in other locations.



Source: Primary Data, 2023

***Figure 4-92** Percentage of Ownership of asset in other Location (left) and asset Categories in other Location (right)*

Figure 4-92 (right) above explains the distribution of assets owned by respondents in the Project area. Respondents from Giri village comprise the majority of those who own land in other locations, at 67%. Meanwhile, respondents from Kalipuro village comprise the majority of those who have assets in the form of houses in other locations, at 43%. Only respondents from Kalipuro village have ownership of assets in the form of other buildings located outside the village, at 14%.

Based on data from the National Land Agency (BPN) in the study area, especially the area adjacent to the project component, there are parcels of community-owned land that can be categorized into two, namely registered land and unregistered land. More

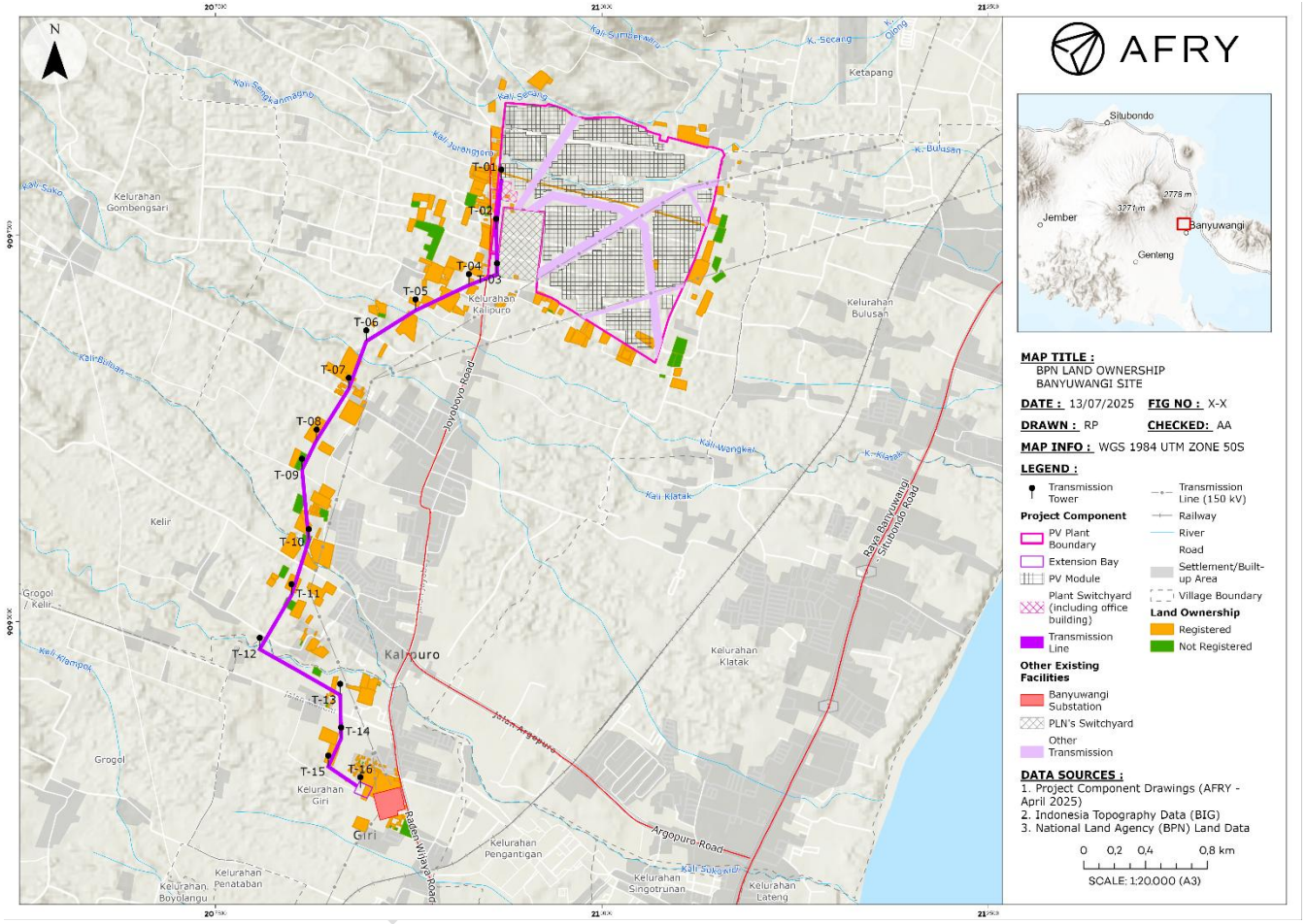
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detailed information regarding the distribution of registered and unregistered community land can be seen in the **Figure 4-93**.

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Source: Primary Data, 2023

Figure 4-93 *Map of Land Ownership by National Land Agency (BPN) in Ground-Mounted Solar PV Plant Banyuwangi Site*

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Based on the map above, there are several issues related to landownership as follows:

- There are six (6) land parcels that have been certified by BPN (SHM) within the plantation area (Solar PV area) and there is a land parcel that has not been registered. Meanwhile, as explained above, the ownership of the plantation land belongs to PTPN XII. However, there is no information regarding the landownership of the parcels. Thus, for the project, it is necessary to validate these parcels through DPPT.
- Based on field surveys, a facility building from the Regional Drinking Water Company, seven residential buildings, and one factory are permanent structures located within the designated transmission line RoW. However, there is no risk of physical displacement or involuntary resettlement, as all buildings remain within safe height limits (i.e., below 5 meters). Temporary impacts may occur during the construction phase, particularly related to access disruptions to settlement areas. These will be managed through appropriate mitigations measures, including the implementation of a Traffic Management Plan.
- Based on the map, the study area, especially land surrounding the area of transmission line (ROW) is a densely populated residential area and agricultural land as indicated by the large number of registered parcels. The project is likely to have an impact on the number of affected people around the transmission line area. Specifically, the impacts may include potential physical displacement (relocation of homes or structures, however, the ongoing LALRP study has confirmed that there is no physical displacement), loss of access to or damage to agricultural land which may affect livelihoods, possible restrictions on land use within the right-of-way (ROW) and potential for a reduction in land prices/values.

Based on the issues described above, it can be concluded that the project needs to validate the existence of parcels in the area around the project components which have been carried out during the LALRP study.

4.2.2.5 Community Amenities and Public Facilities

The public and community facilities examined in this study represent the socio-economic conditions of the community. These facilities include economic, worship, education, sports, clean water, and health facilities.

Table 4-57 *Number of Public Facilities in Study Area*

No	Public Facilities	Kalipuro	Kelir	Giri	Total
Economic Facilities					
1	Credit Union	1	0	1	2
2	Permanent Building Market	1	0	0	1
3	Semi-Permanent Building Market	0	0	0	0
4	Market without Building	0	1	0	1
5	Mini-Market	3	0	1	4
6	*Bumdes*	0	0	0	0
7	Bank	0	0	0	0
8	BPR	1	0	0	1
9	KUD	1	1	0	2

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No	Public Facilities	Kalipuro	Kelir	Giri	Total
10	Other Unions	9	1	0	10
11	Shopping Area	2	0	0	2
12	Grocery store	161	34	50	245
13	Food Stalls	43	9	33	85
14	Food Drinks Industries	12	18	2	32
15	Other woods and Forest Product industries	93	0	1	94
16	Materials Excavation Industries	6	1	0	7
Worship Facilities					
17	Mosque	12	10	6	38
18	Musholla	17	6	24	47
19	Church	1	0	0	1
20	Temple	0	0	1	1
Educational facilities					
21	Preschool	0	0	0	0
22	Kindergarten	2	2	5	9
23	Elementary School	9	4	3	16
24	Junior High School	5	2	1	8
25	High School	3	1	2	6
Sport Facilities					
26	Volleyball Court	3	5	3	11
27	Soccer Field	2	1	0	3
28	Table Tennis	0	1	2	3
Clean Water Facilities					
29	Clean Water Management (PAB)	N/A	2045	1131	
30	Pump Well	N/A	0	0	
31	Well	N/A	0	50	
Health Facilities					
32	Integrated Healthcare Center (*Posyandu*)	16	8	10	34
33	Puskesmas Pembantu	1	0	1	2
34	Public Health Center (*Puskesmas*)	0	1	0	1
35	Clinic Health	1	0	2	3

Source: BPS, 2021

Based on the data from BPS in the table above, almost all economic, worship, education, sports, clean water, and health facilities already exist in the study area. In terms of economic facilities, each village lacks a bank and a village-owned enterprise (*Bumdes*[52]), making it challenging for the community to access capital. Regarding educational infrastructure, the absence of preschools in all three villages makes it difficult for the community to prepare children for elementary school.

4.2.2.5.1 Economic Facilities

The existence of economic facilities plays a crucial role in providing essential support for the primary needs of the community. Examples of vital economic necessities for the

[52] "BUMDes" is a legal entity established by a village and/or in collabouration with other villages to manage businesses, utilize assets, develop investments and productivity, provide services, and/or engage in other types of businesses for the greatest possible welfare of the rural community.

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community include markets, savings and loan cooperatives, banks, shops, and minimarkets.

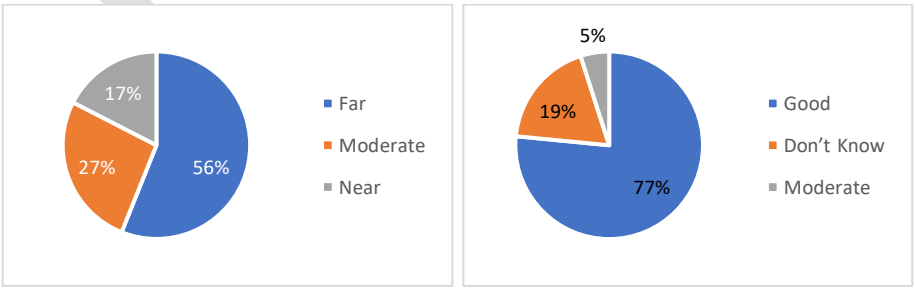
Table 4-58 *Number of Economic Facility by Villages in the Study Area*

No	Economic Facilities	Kalipuro	Kelir	Giri	Total
1	Credit Union	1	0	1	2
2	Permanent Building Market	1	0	0	1
3	Semi-Permanent Building Market	0	0	0	0
4	Market without Building	0	1	0	1
5	Mini-Market	3	0	1	4
6	Bumdes[53]	0	0	0	0
7	Bank	0	0	0	0
8	BPR	1	0	0	1
9	KUD	1	1	0	2
10	Others Union	9	1	0	10
11	Shopping Area	2	0	0	2
12	Grocery store	161	34	50	245
13	Food Stalls	43	9	33	85
14	Food Drinks Industries	12	18	2	32
15	Other woods and Forest Product industries	93	0	1	94
16	Materials Excavation Industries	6	1	0	7

Source: BPS 2021

Based on the table above, it is noted that the highest number of economic facilities is represented by grocery store, totalling 245 units. The largest number of grocery store is in Kalipuro Village, with 161 units, while the lowest count is in Kelir Village, with 34 units. Referring to the survey data on public facilities, Banks are among the facilities that are difficult for the community to access due to their distant locations.

The presence of a bank facility in the study area serves as a support for economic activities. In the survey, 56% of respondents perceived that the bank facility is at a distant location, while 27% responded to a moderate distance, and 17% indicated a proximity. The detailed perception regarding the distance to the bank facility can be seen through the **Figure 4-94**.



Source: Primary Data, 2023

Figure 4-94 *Percentage of Distance to Bank/Savings and Loan Institutions in Study Area (left) and Conditions of Bank/Savings and Loan Institutions in Study Area (right)*

[53] Bumdes, abbreviation from *Badan Usaha milik Desa*, is a business entity managed by the community, and the village government works Village-Owned Enterprises (BUMDes) to strengthen the village economy and is formed based on the needs and potential of the village.

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For the survey, the focus was not only on the perception of distance but also on the condition of the bank facility. This perception indirectly indicates whether respondents have accessed the bank facility, thus forming opinions about the facility's condition. As shown in **Figure 4-94** it can be observed that 77% of respondents have positive perceptions of the bank facility, while 19% don't have an opinion, and 5% of respondents have a moderate perception. From these percentages, it can be inferred that 19% of respondents have never accessed the bank facility because they do not understand its condition. Meanwhile, 82% of respondents have accessed the bank facility.

Through observations and interviews conducted, it was found that many respondents have savings accounts in banks. However, in two sub-villages within the Giri area, namely Kalangrente and Kopenbayan, which are quite far from the district center, residents have not accessed the bank facility, and they still use conventional storage systems.



Figure 4-95 *Bank Condition in Kalipuro Village*

4.2.2.5.2 Public Transportation Facilities (Village Roads)

The Banyuwangi PV PP site can be accessed from the nearest city via a two lane 3-meterwide asphalt road. This road is mainly for public use and trucks rarely pass this route. Access along the perimeter of the site and within the site itself are via a 3-meterwide local road made of soil. This access road is wavy and might turn into muddy during rainy season. At the PTPN XII Afdeeling Wangkal plantation site there is a plantation access road which is also used as an alternative road (shortcut) for the local community to go to Kalipuro village. The plantation road is still mainly dirt, but at some points there are concrete pavers that have been damaged. The width of this plantation road is 4-6 meters. This road is mainly used by the plantation worker to mobilize crops and for their daily commuting. See **Figure 4-96**.

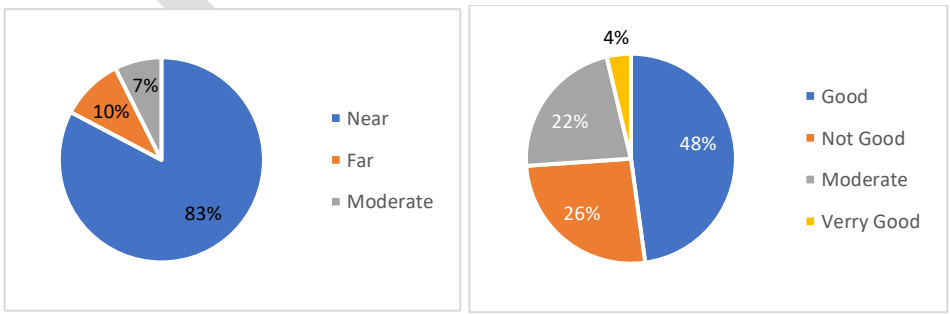
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Village Road at Wangkal Sub-village

Kalipuro Village

Figure 4-96 *The condition of access road to and within proposed Banyuwangi site*



Source: Primary Data, 2023

Figure 4-97 *Percentages of Distance Villages Road by Respondent in Area Study (left) and Village Roads Condition According to Respondents in Area Study (right)*

Based on the survey results in **Figure 4-97** (left), respondents in the study location evaluated rural/district roads as close and easily accessible, with a percentage of 83%.

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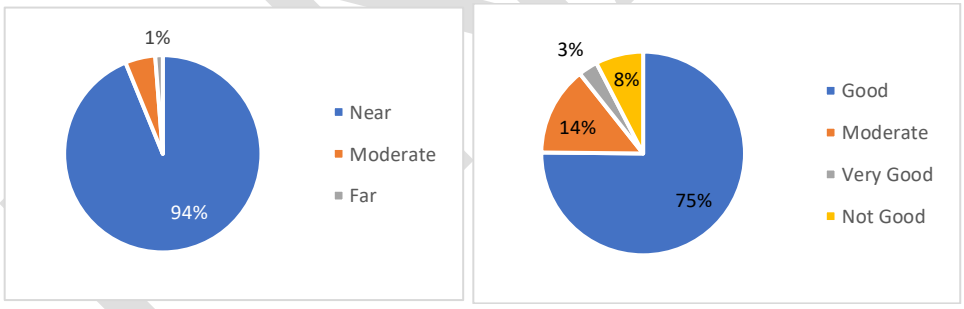
Only 10% of the respondents faced difficulties in accessing rural/district roads, while the remaining 7% considered it easy to access these roads. According to observational findings, all environments and sub-villages in the study location can be accessed via rural roads. Based on the distribution of respondents who assessed rural/district road accessibility, the highest is found in the Giri Village, followed by the Kelir Village.

Respondents view that they have easy road access in the Giri Village is attributed to the fact that the village is crossed by district/provincial roads serving as the main route from Banyuwangi Regency to the port and Ketapang railway station. Conversely, respondents in the Kalipuro Village found it difficult and distant to access rural/district roads because the residences of the respondents are far from rural/district roads, especially for those in the neighbourhoods of Sumber Nanas, Papring, Secang Manggir, and Secang.

The survey results regarding the condition of rural/provincial road access in the study location (see **Figure 4-97**, right) indicate that 48% of respondents rated the road condition as good, 26% rated it as poor, 22% rated it as good, and 4% rated it as very good. Observational findings indicate that the road condition on the northern side of the Kalipuro Village is poor, with many potholes and some sections still being dirt roads with uneven terrain.

4.2.2.5.3 Worship/Religious Facilities

The survey results found that most respondents in the study location rated religious facilities as very accessible or close, with a percentage of 94%. 5% of respondents considered access to religious facilities to be easy, and 1% of respondents perceived it as distant. Detailed information on respondents' access to religious facilities can be seen in **Figure 4-98**.



Source: Primary Data, 2023

***Figure 4-98** Percentages of Distance Places of Worship in Study Area (left) and Condition of Places of Worship Based on Respondents in Study Area (right)*

The presence of religious facilities is inseparable from their maintenance and cleanliness. Based on the survey results, most respondents in the study location assessed the condition of religious facilities as good, with a percentage of 75%. 14% of respondents considered the condition of religious facilities to be good, while 8% of respondents rated it as not good, and only 3% of respondents considered it very good. Observational findings indicated that the condition of religious facilities in Kalipuro Village, especially for ablution facilities, bathrooms, and some places of worship, is not well-maintained. Additionally, there are religious facilities undergoing construction or rehabilitation.

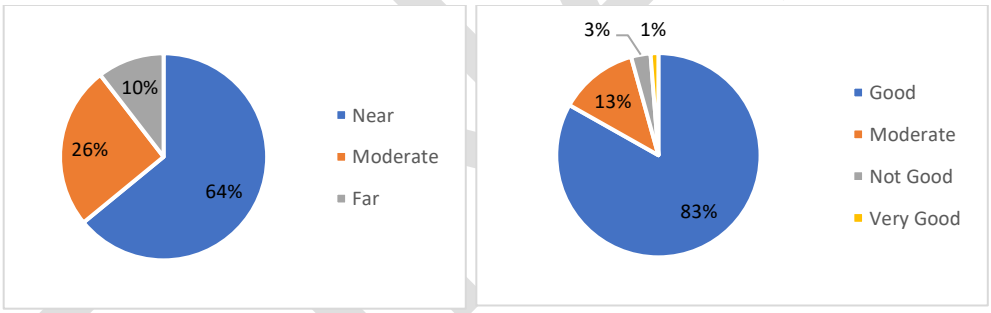
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Table 4-59 *Condition Places of Worship in the Kalipuro*

4.2.2.5.4 Public Education Facilities

The presence and condition of school facilities in the study location were also assessed by respondents, and the results show that 83% of respondents considered the condition of school facilities to be good. Additionally, 13% of respondents rated the condition as moderate, 3% of respondents perceived the condition as not good, and only 1% of respondents considered the condition of school facilities to be very good. An overview of respondent's assessments of school facility conditions can be seen in **Figure 4-99**.



Source: Primary Data, 2023

Figure 4-99 *Percentage of Distance to Schools in Area Study (left) and Schools Conditions in Study Area (right)*



Figure 4-100 *Public Education Facility in the area study, Vocational School in the Kalipuro Village and Islamic Boarding School in the Kelir Village*

4.2.2.5.5 Public Health Facilities

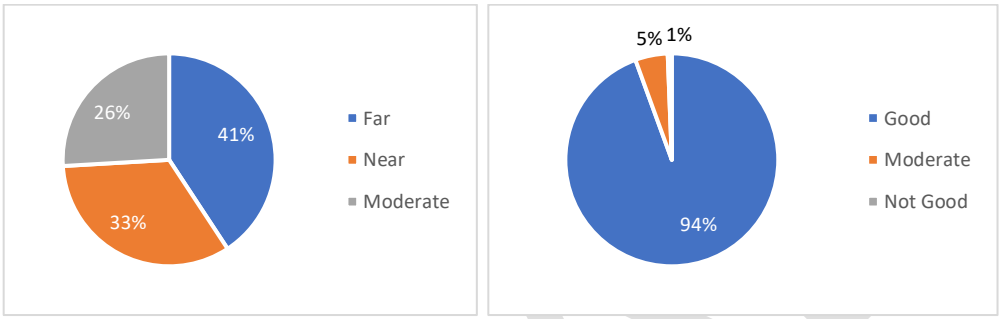
Health facilities in the studied area encompass clinics and medical centres, serving as vital resources for community healthcare. According to the survey results, 41% of

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respondents in the study area perceive the distance to health facilities as far from their residences. On the other hand, 33% consider it near, and 26% describe it as moderate. This variation indicates an uneven distribution of health facilities in the study area.

Regarding the condition, **Figure 4-101** (right) present 94% of respondents in the study area stated that the health facilities' conditions are already good. Only 5% of respondents rated the health facility conditions as moderate, and 1% described them as not good. Respondents in the study location perceive the health facilities as good, with services available every working day and with sufficient and complete of equipment and medications.



Source: Primary Data, 2023

Figure 4-101 *Percentage of Distance to Health Facilities in Study Area (left) and Condition of Health Facilities in Study Area (right)*

Respondents in Kelir Village assessed the health facilities' condition as good, attributed to the presence of a Community Health Centre (*Puskesmas)* in Kelir Village. This Community Health Center is well-equipped with complete infrastructure, including healthcare professionals such as doctors, providing health services every working day.

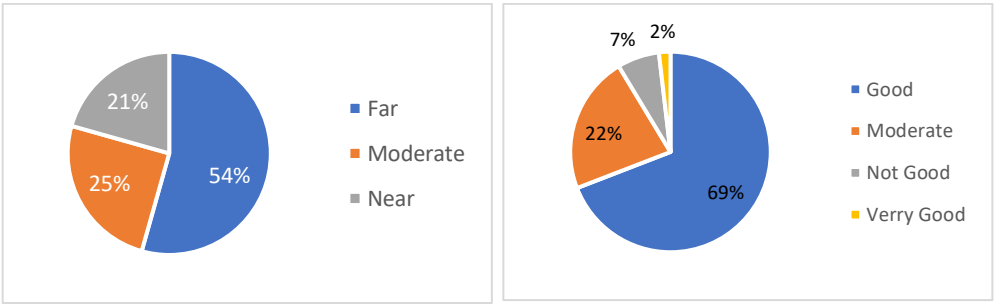


Figure 4-102 *Health facilities in the Area Study, Community Health Center in the Kelir (Left) and Auxiliary Community Health Center in the Kalipuro Village (right)*

4.2.2.5.6 Traditional Market Facilities

Traditional markets are essential access points for communities to fulfil their basic needs. According to the survey depicted in the graph below, 54% of respondents face difficulties accessing traditional markets due to their distant location from the villages, while only 21% find it easy to access these facilities. Respondents in all three villages uniformly experience challenges in accessing markets due to the long distance, with percentages reaching 61% in Kelir Village, 50% in Kalipuro Village, and 58% in Giri Village.

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Source: Primary Data, 2023

Figure 4-103 *Percentage of Market Distance in the Area Study (left) and Market Conditions Based on Respondents in Study Area (right)*

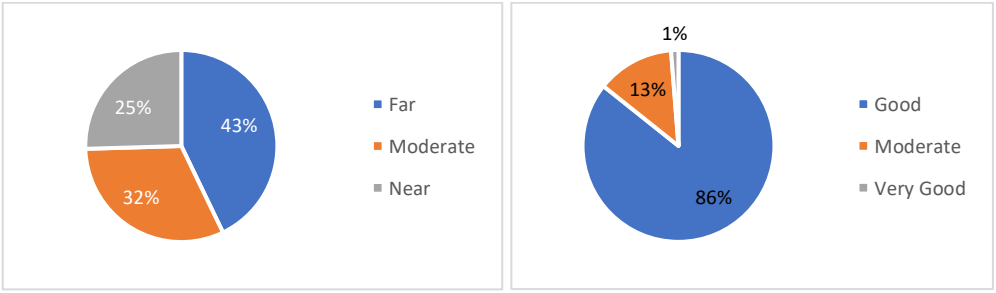
In addition to accessibility, the condition of traditional markets is also an aspect worth considering. Based on the survey results, 69% of respondents perceive the condition of traditional markets as good, while only 7% consider it not good. Despite the market's considerable distance, most residents find the market conditions satisfactory and suitable for commercial transactions.



Figure 4-104 *Market Condition of Kalipuro village (left) and Shops Group in the Kalipuro Village (right)*

4.2.2.5.7 Village Office Facility

Based on the study's findings, 43% of respondents perceive the distance as far, 32% perceive it as moderate, and 25% perceive it as near. In addition to distance, this study also captures respondent's perceptions regarding the condition of the village government office. Although most respondents in the study area perceive the distance to the village government office as far, 86% of respondents in the study area assess that the condition of the village government office is already good, with 1% even rating it as very good. No respondents consider the village government office to have bad conditions. Only 13% of respondents perceive its condition as moderate.



Source: Primary Data, 2023

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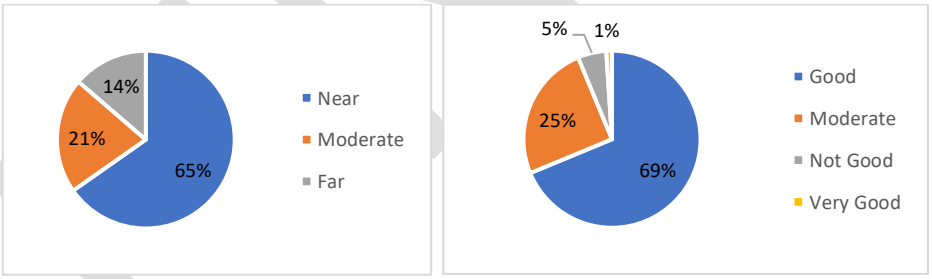
Figure 4-105 *Percentage of Distance to Village Government Offices in Study Area (left) and Conditions of Village Government Offices in Study Area (right)*



Figure 4-106 *Village Government Offices in Giri Village (left) and Kalipuro Village (right)*

4.2.2.5.8 Sport Facility

Most respondents perceive the distance to access sports facilities as near, with a percentage of 65%. Those who consider the distance as moderate account for 21%, while those who perceive it as far constitute 14%. The distribution in all three villages is equally dominated by the perception that the distance to sports facilities is near. As for the condition of sports facilities, most respondents in the study area perceive it as good, accounting for 69%. Only 5% of respondents perceive the condition of sports facilities as not good. Meanwhile, 25% perceive the facilities as having a moderate condition, and 5% perceive them as being in very good condition.



Source: Primary Data, 2023

Figure 4-107 *Percentage of Distance to Sports Facilities in Study Area (left) and Conditions of Sports Facilities in Study Area (right)*



Figure 4-108 *Volleyball Field (left) and Football (right) as Sports Facilities in Kalipuro Village*

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4.2.2.5.9 Clean Water Facility

Apart from using PDAM for daily needs (drinking, cooking, bathing), the people of Kalipuro also use clean water source come from river to the irrigation channels as presented in **Figure 4-110**. The availability of clean water management facilities is crucial to facilitate access to clean water, supporting community daily activities such as bathing, washing, and using toilets (MCK). Based on the survey depicted in the **Figure 4-109**, most respondents can easily access clean water management facilities, accounting for 58%. Meanwhile, 32% of respondents face challenges in accessing clean water due to distance, and another 10% find the access distance moderate.

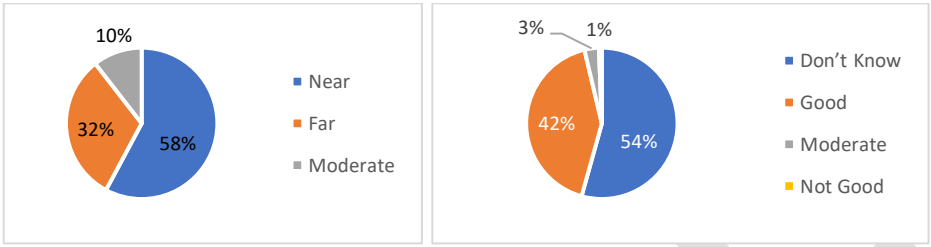


Figure 4-109 *Percentage of Distance to Clean Water Management Facilities in Study Area (left) and Condition of Clean Water Management Facilities in Study Area (right)*

Additionally, respondents also have perceptions regarding the condition of clean water management facilities. Based on **Figure 4-107**, 54% of respondents don't know about the condition of clean water management facilities, and 42% of respondents consider the condition to be good. These percentages indicate that many respondents in the study area are unaware of the existence of clean water management facilities in their village.



Figure 4-110 *Clean water source facilities in Kelir Village (left) and clean water facilities in Giri Village (right)*

4.2.2.5.10 Waste Disposal Facility

Waste disposal sites such as Waste Collection Points (*Tempat Pengumpulan Sampah or TPS*) or 3R (*Reduce, Reuse, Recycle*) initiatives can assist communities in managing their waste, and this has been implemented in several region. The survey reveals that many respondents don't know about the existence of waste disposal sites, accounting for 70%. The remaining respondents, 15%, state that the distance is far, 9% find it near, and 6% consider it moderate.

Additionally, the community also holds perceptions regarding the condition of waste disposal sites in the study area. The survey reveals that 71% of respondents are unaware of the existence of waste disposal sites, while 25% perceive that the conditions are favourable. Further figures can be observed in **Figure 4-111**.

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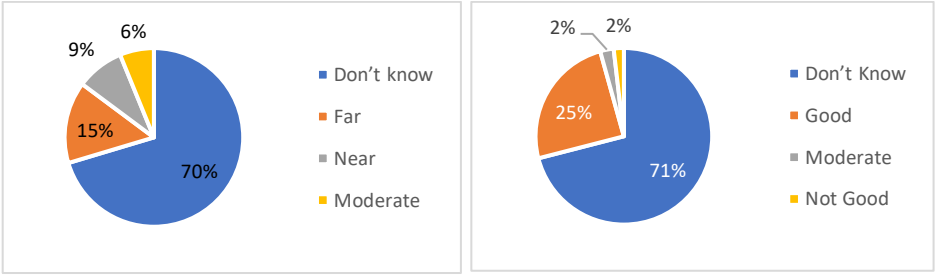


Figure 4-111 *Percentage Distance of Waste Disposal Sites in Study Area (left) and Condition of Waste Disposal Sites in Study Area (right)*

4.2.2.6 Community Use of Natural Resources (Ecosystem Services)

The utilization and management of forests plays a pivotal role in shaping the local community's way of life. Forested areas are often utilized for various purposes, including timber extraction, non-timber forest products, and ecosystem services. These activities contribute significantly to the livelihoods of the village residents. The utilization of natural resources by the respondents in the study area includes the utilization of forest resources and river resources.

4.2.2.6.1 Forest Use

The three villages in the study area constitute built-up urban areas with limited forested areas. Utilization of forest resources is only found in Kalipuro village. The forested area is located on the northern side of Kalipuro village, spreading across the Papring and Sumbernanas Hamlets and outside the project affected area. This is attributed to the presence of a forest area managed by Perhutani in Kalipuro village, falling under the jurisdiction of the North Banyuwangi Forest Management Unit (*KPH Banyuwangi Utara*).

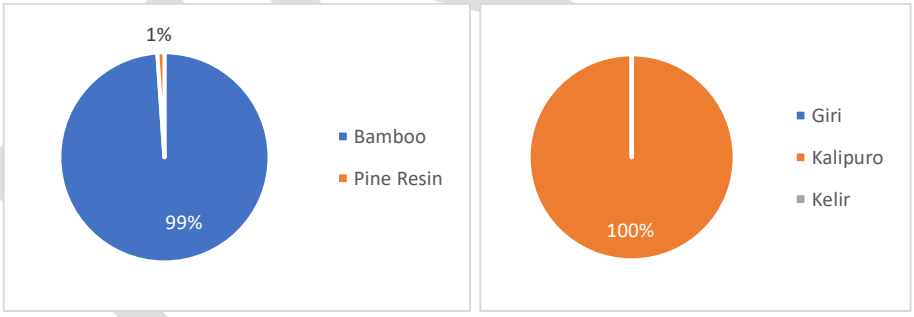


Figure 4-112 *Percentage Forest Utilization (left) and by Villages (right) in the Study Area*

The above figure (4-103) explains the community utilization of forest in the study area. The forest product most used by the community is bamboo, accounting for 99%, while pine resin constitutes 1%. The high percentage of bamboo utilization is due to easy access and availability of bamboo trees supported by the many bamboo handicraft productions marketed in *Kampoeng Batara* (Baca Taman Rimba), is a non-formal conservation-based school which is fostered by PT PLN (Persero) located in Dusun Papring, Kelurahan Kalipuro. As for the utilization of pine resin, Perhutani employs the community around the Papring and Sumbernanas hamlets, Kalipuro Village. Indeed, these two hamlets are not within the project's impact area, but Perhutani's approach to community through the programs can serve as a reference for this Solar PV project.

The forest products utilized by the community for their livelihoods are diverse and are either sold or for self-consumption, however, forest products are mainly sold. Bamboo

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is a versatile raw material, which undergoes various forms of craftsmanship, becoming different productsd such as traditional woven bamboo containers (*besek*), woven items, diverse types of bags, and *gedhek* (bamboo-woven wall mat). The entrepreneurial vitality within *Kampoeng Batara* in Papring plays a crucial role in nurturing and advancing the bamboo crafting industry in Kalipuro. Beyond offering guidance and mentorship to bamboo craftsmen, the Batara village community actively engages in marketing the crafted products from local artisans. This collaborative effort not only sustains and promotes the bamboo crafting industry but also empowers the residents economically, enriching the variety of forest-derived products and strengthening the socio-economic fabric of Kalipuro.

Based on interview with Bamboo collector, the forest is still in very good condition and there are many wild animals found in the area. In the Wangkal and Papring areas, many people work as bamboo collectors for *Perhutani*, they collect bamboo in the Papringan area because there are so many bamboo trees there. The selling value of bamboo for *bongkok* or the bottom is IDR 5000 per 4-meter-long stem and for shoots the price is IDR 4000 per 4-meter length of bamboo. There are still many wild animals living in the *Perhutani* area which, according to bamboo hunters, include sightings of panthers, leopards, very large flowers, sanca snakes, and rare birds no longer easy to see in the wild.



Figure 4-113 *The Process of Making (left) and Raw Material (right) for Bamboo Woven*

In addition, based on survey, all respondents in the study locations did not experience obstacles in utilizing the forest.

4.2.2.6.2 River Utilization Activities

The study site also found respondents who use the river for daily activities, such as washing, bathing, and for sanitation (toilet). The survey results show that 69% of respondents do not use the river and 31% of respondents use the river for daily activities. Respondents who utilize the river is mostly found in Kelir Village for agricultural irrigation, bathing and washing. An overview of river utilization by respondents can be seen in the **Figure 4-114**.

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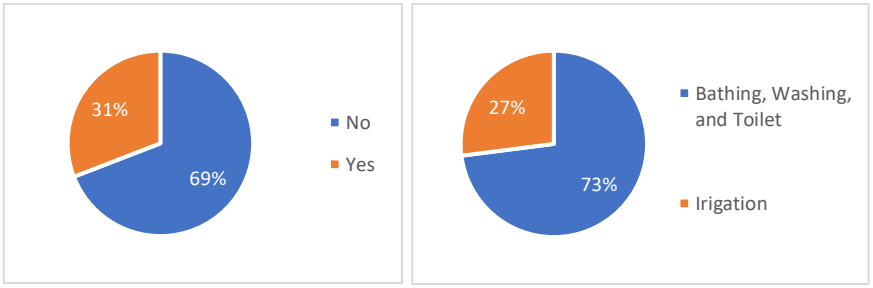


Figure 4-114 *Percentage of River Utilization Activities (left) and Activities in the River (right)*



Figure 4-115 *Community use of rivers, Bathing, washing, and Toilet (left), Irigation (right)*

4.2.2.7 Community Use of the Plantation

The location of Ground Mounted Solar PV Banyuwangi is in the plantation area of PTPN XII Kaliselogiri Afdeling Wangkal. The total area of sugarcane plantation Afdeling Wangkal Kaliselogiri Garden is 181.89 Ha. Of this total area 150.2 ha is planted with sugar cane, and the rest is for offices, employee housing, production roads and land that cannot be planted. While the land area used for main solar PV PP is 156.26 Ha, meaning that most of the Afdeling Wangkal plantation land is affected by the Ground-Mounted PV project, especially for the main solar PV PP component.

The main commodity of the Afdeling Wangkal plantation is sugar cane, this commodity is harvested once a year with a harvest time of 120 days. The utilization of the Afdeling Wangkal sugar cane plantation land by the surrounding community is more for the location of finding grass for animal feed, a place to see the view of Ketapang and the strait of Bali, road access from Kalipuro to Ketapang and vice versa. An explanation of the utilization of the Afdeling Wangkal sugarcane plantation land by the surrounding community can be seen below:

1. Locations for finding grass for animal feed.

   PTPN XII Kaliselogiri Afdeling Wangkal gives permission to the surrounding community to utilize plantation land as a place to look for fodder grass in the plantation concession area. In addition to grass, the plantation also provides opportunities for the surrounding community to take sugar cane leaves during the harvest season. Generally, people who take grass for animal feed generally come from the Wangkal, Secang, East Secang, Secang Mangir and Papring Hamlets of Kalipuro Village and the Pancoran Hamlet of Ketapang Village.

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The intensity of the community to collect grass in the plantation area increases during the rainy season and during the sugarcane harvest season. Estimates of people who routinely take grass and sugarcane leaves at the plantation site are around 300 people.

This is because most people around the plantation area are farmers and day labourers who own cattle and goats. The existence of this plantation land is very helpful for farmers in finding grass feed, this was conveyed by Lasmono, one of the farmers and breeders in the Wangkal Hamlet:

> *"The existence of plantations is very helpful for farmers here, during the rainy season many people come and gang up on the location of the plantation to look for grass, there can be hundreds of people, especially during the sugar cane harvest season, it is even more crowded." (Interview Lasmono December 31, 2023).*

The results of observations and interviews with farmers around the location of the Afdeling Wangkal sugar cane plantation in the summer are that many farmers buy grass or animal feed to meet their animal feed needs. The price of animal feed found in the study location is as follows: one bundle of straw Rp 35,000/bundle, corn stalks Rp 10,000/bundle and ordinary grass Rp 12,500/bundle. The feed requirements for livestock for 1 cow are: 1 bundle of straw feed, 3 bundles of corn stalk feed and 2 bundles of ordinary grass. From this data, it can be concluded that the existence of sugarcane plantations in Afdeling Wangkal is very helpful for farmers in providing animal feed and reducing household expenses in buying animal feed.

2. Tourism Spot.

   Near the sugar cane plantation area there is a homestay and caffe Omah telu tourism business which only started operating in mid-December 2023. The results of interviews and observations are one of the reasons business owners build homestays and caffe is that there are good views or views around the plantation, one of the views sold is the view towards Ketapang harbor which can be seen from caffe and homestay. In addition, in Kalipuro Village there is also a Batara tourism village which is also a support for homestay owners to open businesses near sugar cane plantations. Homestay and cafe operations are still newly opened so that they have not yet received a complete picture of visitor perceptions regarding the view in the Omah Telu Homestay. However, the owner and developer of Omah Telu Homestay, explained in the interview that the choice of this location is because the view is good, and they received information from the owner that the land is a plantation green belt so there is no development of any kind. She refuses the Project of solar power plant to be built.

3. Users Access the Kalipuro-Ketapang Road via the Wangkal Plantation Afdeling Road

   In the plantation area of PTPN XII Kaliselogiri Afdeling Wangkal there are access roads used by the public to facilitate daily activities. Access roads used by the community are generally by residents who live in the Hamlets of Wangkal, Papring and Secang. This access road is used to go to and from work to Ketapang Port or to Ketapang. The area around Ketapang Port is an industrial area with many factories and industrial warehouses that absorb local labour, including labour from Kalipuro Village and its surroundings.

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The access road to Ketapang Port, which passes through the road in the Afdeling Wangkal sugar cane plantation, is an alternative for workers or factory labourers who work in Ketapang. The existence of this access road facilitates and shortens the time for workers or factory labourers to go to Ketapang. If there is no access road in this plantation area, workers or factory workers must first rotate through the Kalipuro provincial road to Ketapang, this condition clearly requires more time and additional fuel costs for workers or workers who live around the sugar cane plantation area of Afdeling Wangkal. According to one of the security guards in Afdeling Wangkal, this road is always crowded both morning and night, usually used by the surrounding community, on average those who use this road work in factories in Ketapang.



Figure 4-116 *Access Road in the plantation area utilized by the surrounding community*

4.2.2.8 Tourism

The Banyuwangi Regency is one of the regions in Indonesia with enormous potential for natural tourism. The local government consistently makes efforts to enhance the development of tourism facilities and increase tourism interest from both domestic and international travelers to visit and explore Banyuwangi Regency. Some well-known tourism destinations include Tabuhan Island, Ijen Crater, De Djawatan, Bangsring Underwater, Green Bay, Alas Purwo National Park, Red Island Beach, Banyuwangi Park, Telunjuk Raung Waterfall, Baluran National Park, Plengkung Beach.

In the study area covering Kalipuro, Giri, and Kelir Villages, there are no prioritized tourism destination developed by Banyuwangi Regency Government. Generally, the study area serves as a transit zone for travelers heading to Bali or for local and international tourists who have planned tourism activities within Banyuwangi Regency.

There is one well-known natural tourist attraction in Banyuwangi in the study area, namely Sewu Sambang Hill, a place to do camping activities in nature. The location of Sewu Sambang Hill is in Papring Hamlet, Kalipuro Village, Kalipuro District, Banyuwangi Regency. Sewu Sambang Camping Ground is located at an altitude of 200 meters above sea level. From the center of Banyuwangi City, the distance is about 15 kilometers (km) with a travel time of approximately 30 minutes. This tourist spot is a hill located in the Forest Management Unit (KPH) Banyuwangi Utara. Sewu Sambang Hill Managed by the Jajang Arum Tourism Awareness Group (*Pokdarwis*), Sewu Sambang Hill Tourism offers a beautiful natural panorama with the Bali Strait in the background on the east side. However, the Sewu Sambang Hill location is not affected by the Project Component because its location is quite far from the Kaliselogiri Afdeling Wangkal Plantation and its main tourist attraction which offers a natural panorama of the Bali Strait on the east side is not affected by the project plan.

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In the study area there is also one tourism support facility that may be affected, namely the Omah Telu Homestay/Villa and Cafe located in the Secang Hamlet, Kalipuro Village, which is located adjacent to the location of the Kaliselogiri Afdeling Wangkal Plantation. This homestay offers views of sugar cane fields and the Bali Strait which are clearly visible from the location of this accommodation. Omah Telu Homestay is marketed through the Airbnb application with a facility price of IDR 400,000-IDR 600,000. The Omah Telu building, and land were leased from the owner with an initial two-year contract and began operating on December 15, 2023, after almost a year of renovations, and in the future, it will be extended longer (5-10 years). The owner of Omah Telu regrets and expresses her rejection of the project development plan because of the significant impact on her homestay business. There was resistance from owners of Omah Telu Homestay which is a tourism support facility with the possibility of the project having a direct impact on their business.



Figure 4-117 *Homestay and Cafe Omah Telu in Secang Hamlet, Kalipuro Village*



Figure 4-118 *View of the Bali Strait seen from the sugar cane plantation Afdeling Wangkal*

Data from the identification of existing tourism activities in the study area can be seen in the **Table 4-60** Based on the table above, it can be concluded that Omah Telu Homestay and Coffee Shop and Kepompong Sea View are tourism support facilities managed and owned by individuals, while there is only one tourist attraction in the study area, namely Sewu Sambang Hill. It should be noted that the ownership of Sewu Sambang Hill belongs to the community, which is managed and built communally, so it is necessary to know the beginning of the development and development plan of this tourist attraction.

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Figure 4-119 *Sewu Sambang Hill (left) and View of The Bali Strait (right)*

Table 4-60 *Potential Affected Person refer to Tourism Livelihood in Area Study*

Tourist Destinations	Description	Potential Affected Person by Livelihood
Homestay and Coffee Shop Omah Telu	It is a tourism support facility in the form of a Homestay and Cafe marketed through *Airbnb*. Omah Telu's location intersects with the Switchyard location plan. Omah Telu is owned by Halida and employs 5 local workers to help her manage the homestay. Omah Telu homestay runs its business with a land and building rental system then renovated into lodging facilities, the initial contract runs for 2 years and is planned to be extended for the next 10 years. Omah Telu opened in mid-December 2023 and is not yet aware of the Solar PV construction plan.	Its business is potentially affected by the construction of Plant Switchyard and PV Panel. Even if not physically displaced, the construction activities could cause disruptions such as noise, dust, and reduced accessibility, diminishing the appeal of the homestay to potential guests and resulting in income loss.
Sewu Sambang Hill	Sewu Sambang Hill is a nature tourism developed and managed by the Jajang Arum Tourism Awareness Group (*Pokdarwis*). Located in Papring Hamlet, Kalipuro Village, Kalipuro District, Banyuwangi Regency. The land status belongs to the Forest Management Unit (KPH) Banyuwangi Utara.	There is no potential impact because the location is quite far, around 4 kilometers from the project location, and the view offered by this tourist attraction is towards the Bali Strait (east) so there is no impact on the panorama offered by this tourist attraction.
Kepompong Sea View	It is an individually owned cafe and restaurant, located in Pancuran Hamlet, Ketapang Village, Kalipuro District, Banyuwangi Regency. It is a development of Kepompong Corner Cafe located in Djati Khayangan Housing in Banyuwangi. Kepompong Sea View offers a cafe concept with a panoramic view of the height leading to the Bali Strait Sea. This location opened at the end of December 2023.	There is no potential impact because the location is quite far, around 3 kilometers from the project location, and the view offered by this tourist attraction is towards the Bali Strait (east) so there is no impact on the panorama offered by this tourist attraction.

Source: Primary Data, 2023

Based on information from Member of Tourism Awareness Group (Pokdarwis) Jajang Arum, in Sewu Sambang Hill Kalipuro, Sewu Sambang Hill is a tourist attraction that offers a view of natural beauty and is managed by local youth, Sewu Sambang used to be a hill that was only planted with grass for animal feed for residents. The road was still difficult to access. In 2016, many local youths realized the potential for natural

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beauty from the top of Sewu Sambang Hill so they decided to make this place a nature tourism spot. They worked together to clean the path to the hill and the upper area of the hill by trimming the dense grass in just over a year. Gazebos and seating were also built at the top of the hill. In 2019, this nature tourism was officially opened to the public.

In the future, this tour will be developed by providing glamorous camping (glamping). The plan is to build permanent tents for lodgings with various tour packages. Educational tourism collabouration will also be carried out with *Taman Rimba (Batara) Reading or Kampong Batara*. Visitors will be invited to see and be involved in learning in *Kampong Batara*. *Kampong Batara* is a place for children to learn, read, and play based on the environment, customs, and culture in Papring Hamlet.

Before the pandemic, the average tourist visiting this place could reach 200 people per week. But after the pandemic, the number dropped by almost half. The entrance ticket price for Sewu Sambang Hill and motorcycle parking is IDR 5,000. As for camping, the rate is IDR 10,000. The tent rental rate is IDR 25,000-Rp 35,000.

Road access to Sewu Sambang Hill is easy, but it can only be passed by motorized vehicles. Because the road to the parking area is not too wide, only part of the road is plastered. In some locations it is still dirty, and rocks.

It can be concluded that there are no major tourism spots affected by the project, but one tourism support facility, namely Omah Telu Homestay and Coffee Shop, which has the potential to be affected by development because of its location which borders with the project plan.

4.2.2.9 Indigenous People and Cultural Heritage

4.2.2.9.1 Indigenous People

In accordance with the AIIB ESF adopted by the Project, projects are required to screen the indigenous people presence and potential associated impacts in the project area. Additionally, the project must categorize these impacts in line with the required compliance measures. As outlined in the standards adopted by the project, activities classified as Category A can have a significant impact on indigenous communities, especially if the program involves (i) the acquisition of large areas of land or forest that disrupts the community's traditional livelihoods; (ii) transformation of indigenous peoples from independent farmers and forest product collectors into industrial workers; (iii) physically displacing sub-communities far from their wider community of origin; and (iv) limiting access to forest products for forest-dependent communities. Therefore, this research includes a checklist to assess the presence of Indigenous Peoples (IP) and their potential impact on the project.

According to the AIIB ESF, this policy applies to projects that directly or indirectly affect the dignity, human rights, livelihood systems, or culture of Indigenous Peoples, or impact the natural or cultural territories/resources owned, used, occupied, or recognized as an asset of Indigenous Peoples. This policy mandates consultation with affected groups, government authorities, and non-governmental organizations.

The screening of Indigenous Peoples involves verification through the Indigenous Peoples database obtained from the Ministry of Social Affairs via Remote Indigenous People (KAT), the Indigenous Peoples Alliance of The Archipelago through the Restoration Customary Territory Agency (BRWA), and the Ministry of Environment and Forestry through Customary Law Community (MHA). Additionally, the screening is supplemented by anthropological studies related to the project location. Based on the

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screening using the registered Indigenous People list and anthropological research gathered from various sources, there is no presence of Indigenous Peoples in the vicinity of the project area.

The project visited Kalipuro and Kelir Villages in Kalipuro Sub-district, as well as Giri Village in Giri Sub-district. During these visits, the project conducted interviews with affected communities around the project area. In addition, consultations have been carried out with the Department of Culture in the study area (Banyuwangi Regency Culture and Tourism Office) and representatives from AMAN (Indigenous Community Alliance of the Archipelago). Based on screening and site visits and consultation with entities, there are no Indigenous Peoples identified in the project area.

The project is in Banyuwangi Regency, which there is a registered customary community, namely the Osing community. The Osing Community has customary territory in Kemiren Village covering an area of 180 hectares and in Bakungan Village covering an area of 201 hectares. Kemiren Village is in Glagah Sub-district at approximately 6.5 kilometers from the project area. Meanwhile, Bakungan Village is in Glagah Sub-district with distance of approximately 6.5 kilometers from the project area. Study concluded that the Oseng Kemiren community meets the criteria for Indigenous Peoples as outlined by the AIIB, IFC, and WB. However, there will be no direct impact on this community due to the project development. Nonetheless, Indonesia Power is considering involving this community in the project's social investment program, which may be structured as part of the Corporate Social Responsibility (CSR) initiative. Kalipuro and Giri Sub-districts are sub-urban areas, which have been inhabited by immigrants including Javanese and Madurese ethnicities for a long time. Meanwhile, the Osing Community in the project area is a diaspora that has blended with other ethnicities. An overview of the Osing community customary area and project area can be seen from the map in **Figure 4-120**.

Based on map above, there is no overlap between the project area of influence and the customary area. The project has also determined that there is no activity from the Osing community from Kemiren and Bakungan Villages in the project area. Therefore, there is no potential impact of the project on Indigenous People. However, as is the project's compliance with national and international regulations. The project will continue to carry out further consultations involving various stakeholders related to customary issues. Thus, due to Indigenous Peoples presence in the project area, the project is not required to comply with the FPIC (Free Prior Informed Consent) protocol and has not implemented the IPP (Indigenous Peoples Plan).

4.2.2.9.2 Cultural Heritage

As required by AIIB ESF, the project must carry out screening of impacts on cultural heritage presence in the project area. The screening must include identifying sites located in the project area, assessment of potential impacts that will occur, the attachment of the site to the community, physical cultural resource impacts and intangible (non-physical) cultural impacts. Based on the AIIB ESF, the policy applies to projects in or near recognized cultural heritage sites (archaeological, paleontological, historical, and sacred) and projects designed to support the management or conservation of physical cultural resources. It requires consultations with affected groups, government authorities, and non-government groups.

The screening of cultural heritage is conducted through the verification of the list of cultural heritage that has been registered according to national regulations. This data was obtained from the Banyuwangi Regency Culture and Tourism Office and Culture

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Preservation Center Region XI (East Java). Based on the screening and confirmation from these offices, there are no registered cultural heritage sites at the county or national level. Apart from that, there are sites owned by communities that have not been registered by national regulations.

This study verified the list of cultural heritage from the Ministry of Education, Culture, Research and Technology. Based on this database, it is identified one cultural heritage site in Banyuwangi Regency. The site registered as "*Inggrisan*" with determination number CB.6060.19700101.01738. It is in Kepatihan Village, Banyuwangi District, which has a radius of approximately 5.3 km from the project location.

The screening process also includes a field survey to understand the heritage sites owned by communities around Kalipuro, Giri, and Kelir Village. This survey identifies potential impacts of the project plan on sites in the influence area and confirms that mitigation activities should be carried out through consultations with the community. The distribution of cultural heritage in the project area can be seen on the following **Figure 4-121**.

Based on the map depicting the distribution of cultural heritage above, four sites were identified in the vicinity of the project area. Two of them are located near the transmission line, one is adjacent to the project access road, and one is associated with the ground-mounted solar PV area. The forms include tomb, cemetery, and old burial. For more detailed information regarding the findings of cultural heritage, please refer to the **Table 4-61**.

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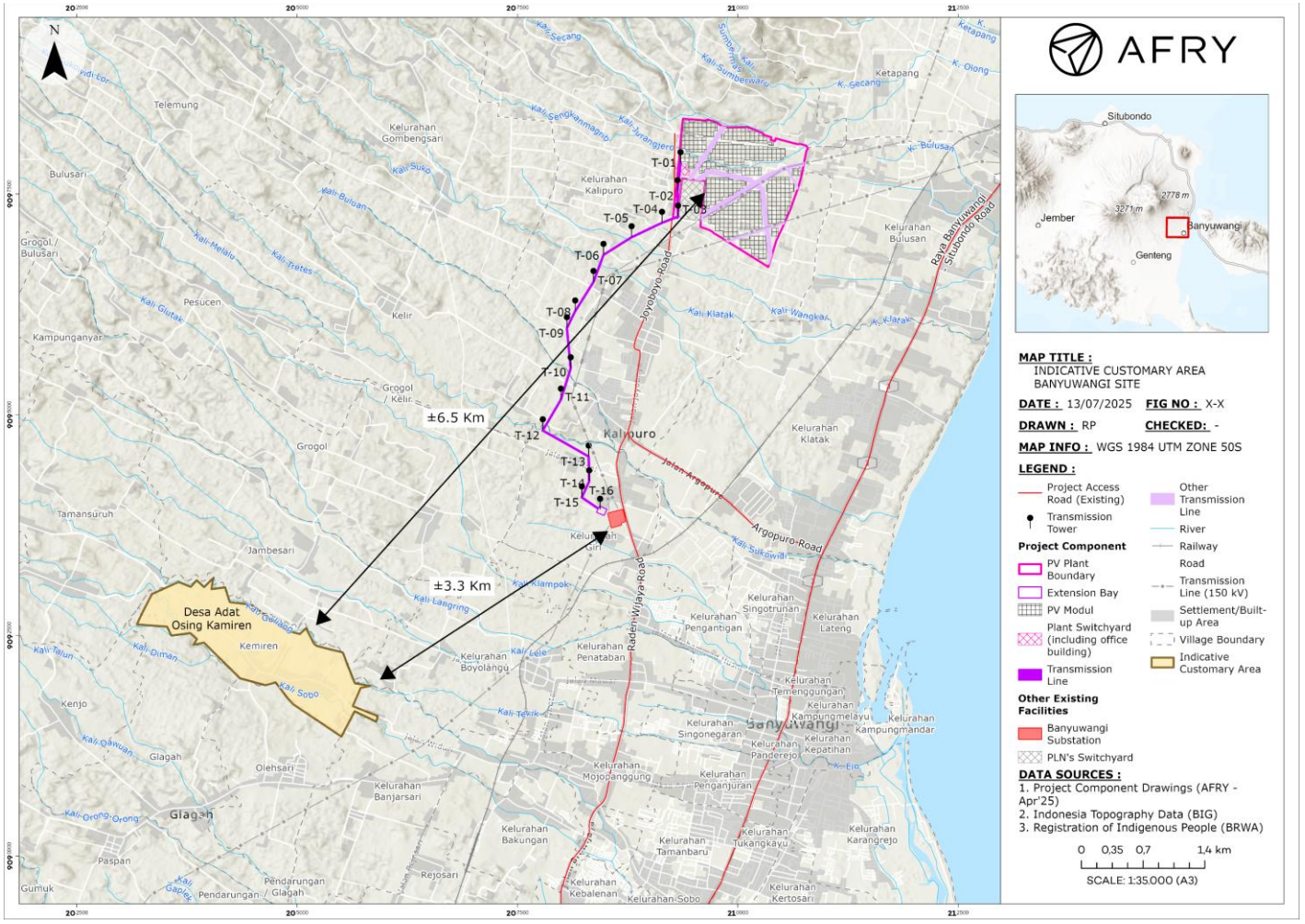


Figure 4-120 *Customary Territory Map Surrounding the Project Area*

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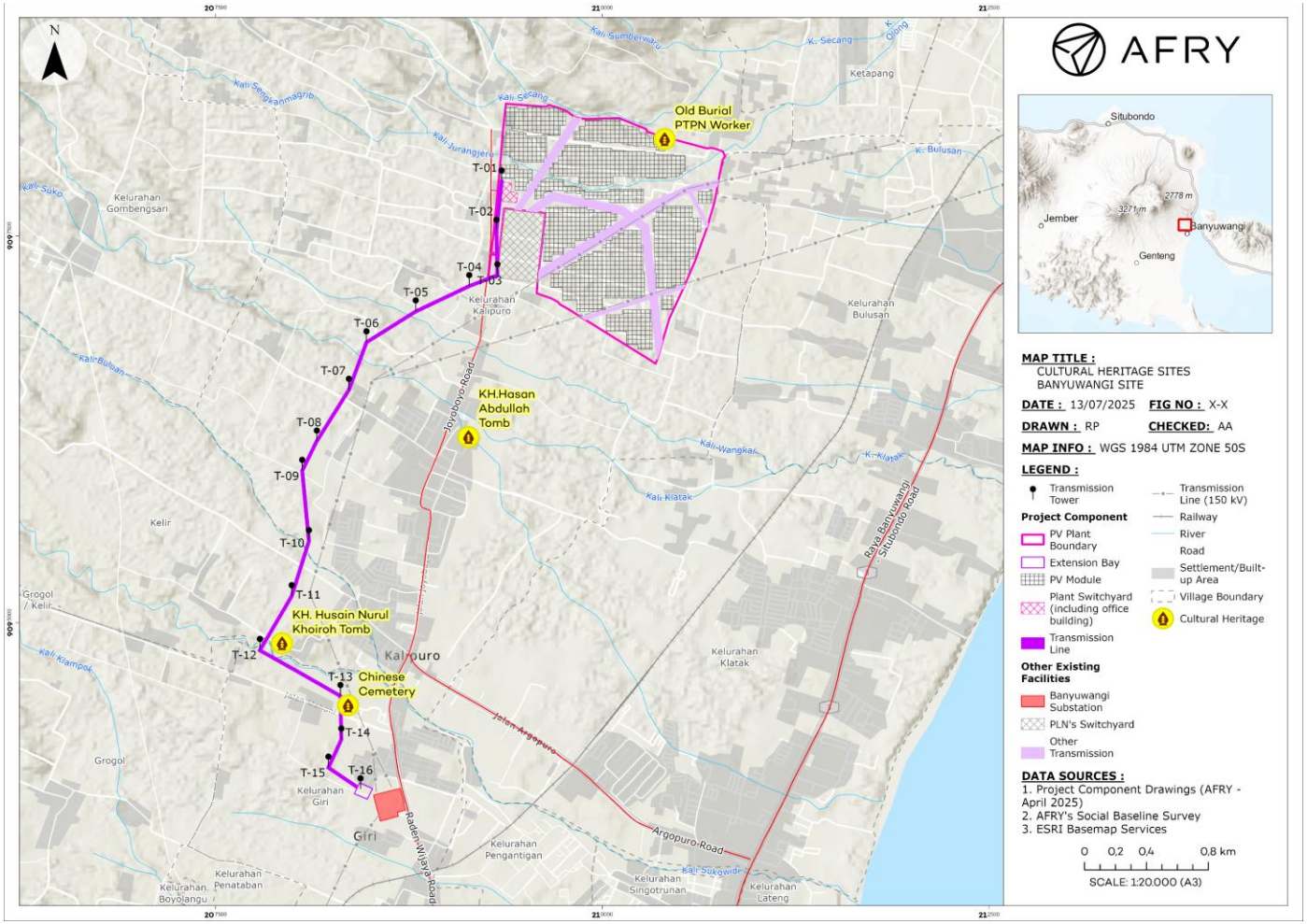


Figure 4-121 *Map of Cultural Heritage Distribution Surrounding the Project Area*

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Table 4-61 *Physical Cultural Heritage Surrounding the Project Area*

No	Types of CH	Cultural heritage sites	Location	Description	Overlapped with project component	Impact	Level of impact	Proposed mitigation
1.	Grave	Old Burial PTPN Worker   *(Source: Field Survey, 2023)*	Wangkal Hamlet	This location is the old grave of PTPN workers in the past. The old grave complex is located within PTPN land near the wangkal settlement, characterized by the presence of a natural fence in the form of several hedgerows surrounding the grave complex. Inside the grave complex, there is one grave with a *cungkub* (roof) and there is a gravestone without writing. The other tombs only have stones or no markings at all. According to the villagers, the entire area of the tomb complex is filled with tombs. The area of the tombs has also decreased a lot because in their memory it used to be three times the area that exists now. When the plantation began to implement sugar cane, where there are several graves that were also affected by the plow to prepare the land for sugar cane in the early days Before becoming a sugar cane plantation, PTPN's land was randu and coconut so there was a lot of labour, it is likely that this tomb complex is the grave of these	Overlapped with solar panel area	Direct (within the project area boundary)	Rank 2 (significance impact/high risk of damage/remove to CH)	- Consultation with PTPN XIII and the community in Wangkal Hamlet - Provide sign/marker on the site - Provide access for the community to the site location

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No	Types of CH	Cultural heritage sites	Location	Description	Overlapped with project component	Impact	Level of impact	Proposed mitigation
				workers. Between 73-74 the plantation changed commodities from coconut and randu to other commodities, thus removing many workers who had to move out of the PTPN plantation area. This grave site is no longer used to bury bodies, nor are there people who come for pilgrimage to this site.				
2	Tomb	KH.Hasan Abdullah Tomb  *(Source: Field Survey, 2023)*	Krajan Hamlet, Kalipuro Village 209135, 9096200	The location of the tomb of KH. Hasan Abdullah is in the Hikmatul Khumairah Islamic Boarding School complex (currently the boarding school is no longer active). Before entering the dining, area there is a gate that reads the name KH. Hasan Abdullah. The dining complex consists of a building for pilgrimage and the grave of KH Hasan Abdullah and his wife. The area of the tomb and the building is estimated at 4x12 m^2. According to Agus Kholik, the grandson and grave guardian of KH. Hasan Abdullah explained that his grandfather was a religious figure and freedom fighter in Kalipuro. KH. Hasan Abdullah established a boarding school since 1919. Some of his students came	None	In direct (Access Road) During the Haul event, there is potential for crowds that will disrupt transportation access to the project site.	**Rank 4** (low impact/low risk of CH damage)	During the construction phase of the project, it is necessary to coordinate and consult with the haul manager KH. Moh. Hasan Abdullah when there is a haul event or monthly pilgrimage.

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No	Types of CH	Cultural heritage sites	Location	Description	Overlapped with project component	Impact	Level of impact	Proposed mitigation
				from outside the Kalipuro area, such as from Surabaya, Situbondo, Jember and Madura. As a fighter, Hasan Abdullah joined the Hizbullah Army during the independence era. Hasan Abdullah was honored as a warrior with a pointed bamboo sign with a red and white flag on his grave. Hasan Abdullah's grave is visited by pilgrims during Haul in the month of Rajab every year. Every Friday night legi (month) and every Friday night.				
3	Tomb	KH. Husain Nurul Khoiroh Tomb  *(Source: Field Survey, 2023)*	Pekarangan Hamlet, Kelir Village 207930, 9094867	The grave of the founder of Nurul Khoirah boarding school and his family. The dining yard is estimated to be 8x15 m^2 and is located about 500 m from the boarding school. This tomb is visited by pilgrims, especially during the haul and graduation of students. Usually, the santri family at the time of graduation goes on a pilgrimage to the grave ofKH. Husain Nurul Khoiroh.	None	In direct	**Rank 5** (no impact direct/ low risk of CH)	none

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No	Types of CH	Cultural heritage sites	Location	Description	Overlapped with project component	Impact	Level of impact	Proposed mitigation
4	Graveyard	Chinese Cemetery  *(Source: Field Survey, 2023)*	Kluncing Hamlet, Giri Village 208357, 9094466	This cemetery is located on the side of the Banyuwangi-Ketapang provincial road. The area of this tomb complex is about 3 ha. This location is not far from the Tread Tower T 14 point. This tomb is specifically for ethnic Chinese with various religious backgrounds. This tomb is visited by pilgrims every Chinese New Year and grave pilgrimage.	None The location of this cemetery is about 20 m from the footprint of tower 14.	In direct One of the access roads to get to tower 14 point is through the access road in the cemetery.	Rank 4 (low impact/low risk of CH damage) Location of tower 14 is close to the cemetery location. The results of observations of one of the access roads to get to the tower 14 site location is through the access road at the cemetery.	Consultation and permission to the cemetery manager is required if during construction the tower footprint uses access roads in the Chinese cemetery area.

- **Rank 1** (significance impact/high risk of annihilation to CH)
- **Rank 2** (significance impact/high risk of damage/remove to CH)
- **Rank 3** (medium impact/medium risk to CH damage)
- **Rank 4** (low impact/low risk of CH damage)
- **Rank 5** (no impact direct/ low risk of CH)

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Based on identification of the cultural heritage sites around the project area above, it's recognized that within the Kalipuro, Giri, and Kelir villages, there exist physical heritages that have the potential to be affected by the project component, categorized as both direct and indirect impacts. There is one site potentials directly affected CH, included:

Old Burial PTPN Worker

It is located in Wangkal Hamlet characterized by the presence of a natural fence in the form of several hedgerows surrounding the grave complex. This location is the grave of PTPN workers in the past, precisely when the plantation was still a Kapok and Coconut plantation. Inside the grave complex, there is one grave with a cungkub (roof) and there is a gravestone without writing. The other tombs only have stones or no markings at all. According to the villagers, the entire area of the tomb complex is filled with tombs. Based on discussion with the cultural heritage representative, this night location is no longer used for burials, nor is there any attachment from the local community nor from the families of workers who were buried here in the past. The sites are abandoned, which no further replication and relocation. If possible, only provide access and markers/sign.

From the figure below, it can be observed that the cemetery area is inside the plantation, bordering the Wangkal Hamlet of Kalipuro Village, as a barrier between the cemetery area and the plantation area there is a natural fence of vegetation surrounding the cemetery area. Inside there is one grave that has a roof (*cungkub)* and several headstones and stones that do not have the names of the bodies buried here.



Figure 4-122 *Location (left) and condition (right) of the Old Tomb Complex inside the PTPN Plantation borders the Wangkal Hamlet of Kalipuro Village*

There are three site potentials indirectly affected CH in study area, included:

KH. Hasan Abdullah Tomb

It is located in in the Hikmatul Khumairah Islamic Boarding School complex (currently the boarding school is no longer active). Before entering the dining, area there is a gate that reads the name KH. Hasan Abdullah. The dining complex consists of a building for pilgrimage and the grave of KH Hasan Abdullah and his wife. The area of the tomb and the building is estimated at 4x12 m^2.

According to Agus Kholik, the grandson and grave guardian of KH. Hasan Abdullah explained that his grandfather was a religious figure and freedom fighter in Kalipuro. KH. Hasan Abdullah established a boarding school since 1919. Some of his students came from outside the Kalipuro area, such as from Surabaya, Situbondo, Jember and Madura. As a fighter, Hasan Abdullah joined the Hizbullah Army during the independence

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era. Hasan Abdullah was honored as a warrior with a pointed bamboo sign with a red and white flag on his grave. Hasan Abdullah's grave is visited by pilgrims during Haul in the month of Rajab every year and every Friday night.



Figure 4-123 *Location (left) and Condition (right) of KH. Hasan Abdullah Tomb*

To develop mitigation and management measures, the project needs to consult with related stakeholders, including Village Elder about the implementation of the Haul ceremony or the annual commemoration of the death of KH. Hasan Abdullah. Because when the ceremony is held, it is certain that Kalipuro Village, especially the location around the tomb, will be crowded with visitors who attend the commemoration of the death. So there needs to be communication, so that there is no transportation of tools or materials when the ceremony is held.

KH. Husain Nurul Khoiroh Tomb

It is the grave of the founder of Nurul Khoirah boarding school and his family. The dining yard is estimated to be 8x15 meter per square and is located about 500 m from the boarding school. This tomb is visited by pilgrims, especially during the haul and graduation of students. Usually, the santri family at the time of graduation goes on a pilgrimage to the grave of KH. Husain Nurul Khoiroh.



Figure 4-124 *Location (left) and Condition (right) of KH. Husain Nurul Khoiroh Tomb*

There is no need for mitigation preparation because the location is quite far from the project site and the location is within the village of Kelir Village Pekarangan Hamlet, the possible impact on the increase in traffic flow at the project site.

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Chinese Cemetery

It is located on the side of the Banyuwangi-Ketapang provincial road. The area of this tomb complex is about 3 ha. This location is not far from the Tread Tower T 14 point. This tomb is specifically for ethnic Chinese with various religious backgrounds. This tomb is visited by pilgrims every Chinese New Year and grave pilgrimage.



Figure 4-125 *Location (left) and Condition (right) of the Chinese Cemetery*

From the figure above, it can be observed that the location of this cemetery complex is very close to the existing transmission line tower leading to the substation in Giri Village. there is a potential impact on this cemetery access if the access road for the distribution of materials to build the transmission line project through the existing cemetery access road. Thus, it is necessary to prepare a mitigation plan.

To develop mitigation and management measures, the project needs to consult with related stakeholders, including consultation and permission to the cemetery manager is required if during construction the tower footprint uses access roads in the Chinese cemetery area.

In addition, there are also several intangible heritages around the project area which are not designated by Ministry of Education, Culture, Research and Technology. The intangible heritage includes the *Salamatan* and *Suronan/Mauludan* carried out by the community at the site area. UNESCO's 2003 Convention for the Safeguarding of the Intangible Cultural Heritage proposes five broad 'domains' in which intangible cultural heritage is manifested: 1) Oral Traditions and Expressions, including language as a vehicle of the intangible cultural heritage, 2) Performing Arts; 3) Social Practices, Rituals and Festive Events, 4) Knowledge and Practices Concerning Nature and the Universe, and 5) Traditional Craftsmanship.

The following **Table 4-62** shows the intangible cultural heritage found around the project area. It can be identified that there are 3 intangible cultural heritage findings. The Salamatan, an intangible cultural heritage practiced in the sugarcane area, holds potential vulnerability due to the ongoing project development. Organized by PTPN, this ritual occurs annually before the commencement of the harvest period, which typically spans around 150 working days. The purpose of conducting the Salamatan is to ensure a smooth and successful harvest, yielding optimal results to meet the set targets. It is noteworthy that despite the ongoing project, the communities surrounding the area continue to actively engage in and uphold this intangible cultural heritage.

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Based on the results of the analysis and explanation above, it can be concluded that at the location of the Ground-Mounted PV construction plan at Banyuwangi Site there is no need to conduct a Cultural Heritage Management Plant (CHMP) study.

Table 4-62 *Intangible Cultural Heritage Surrounding the Project Area*

No	Intangible Cultural Heritage	Location	Description	Domain	Potential impact on project activities	Mitigation
1	*Selamatan*	Plantation area of Wangkal affdeling	Every year before the sugar cane harvest, all employees and day labourers of PTPN XII Afdeling Wangkal hold a selamatan event to ask for work safety and production results according to the target. The plantation invites religious leaders and community leaders around the plantation to participate in the event and lead the prayer. This event contains prayers and eating together with tumpeng rice (chicken, vegetables, and complementary dishes).	Rituals	Direct Impact This selamatan tradition will be disrupted/reduced if there is a Ground Mounted PV project that acquires sugarcane land. Because this tradition depends on the existence of sugarcane harvest.	Consultation and obtained agreements with PTPN as the organizer of this pre-harvest *Selamatan* ritual.
2	*Suronan / Mauludan / Ruwahan / Saparan / Rejaban*	All in area study	The diversity in the implementation of traditions within the communities all in area study remains very pronounced. This is evidenced by the regular occurrence of traditional ceremonies every month based on the Javanese calendar. Each implementation is also not significantly different; there will always be a communal feast accompanied by collective prayers for the sake of unity and the	Social practices	None	none

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No	Intangible Cultural Heritage	Location	Description	Domain	Potential impact on project activities	Mitigation
			emphasis on communal well-being.			
3	*Melabot/ rewang*	All in Area Study	The tradition of mutual assistance and gotong royong in the community that is carried out when there is a celebration or wedding party. Relatives and neighbors help the party that has a celebration according to their abilities.	Social Practises	None	none

4.2.2.10 Community Health

Public health in an area is influenced by four main factors; there are lifestyle, and environment, which include social, economic, political, and cultural factors, health services and hereditary factors (Bloom, 1974).

4.2.2.10.1 Houses Categories

The land and residential building ownership status among respondents in the study locations primarily consists of self-owned properties, accounting for 81%, while family-owned properties represent 12%. Meanwhile, as many as 4% of respondents rented land belonging to other people, and another 3% lived on land owned by *Perhutani.* Based on the interviewee, people who live on land owned by *Perhutani* are casual daily labourers tapping pine trees owned by *Perhutani.* However, forestry land on which there are settlements will be released for Agrarian Reform Object Land (***TORA***[54]***-*** *Tanah Obyek Reformasi Agraria*). An overview of the status of land and building ownership at the research location can be seen in **Figure 4-126**.

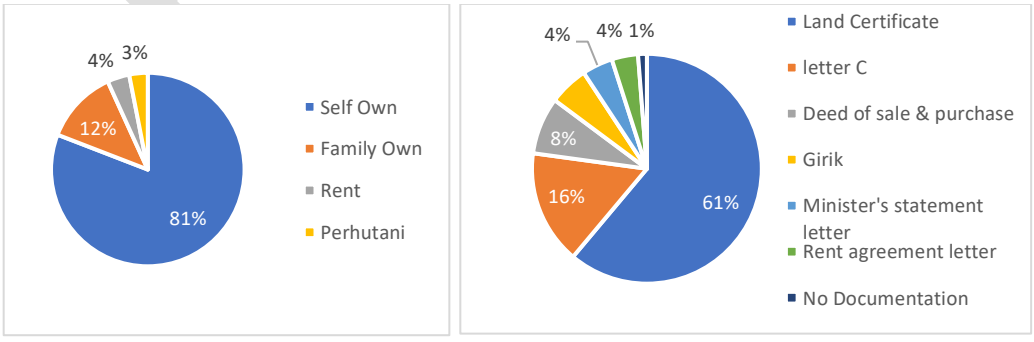


Figure 4-126 *Percentage of House or Building ownership status in Area Study (left) and Percentage of Documentation of House/Building Ownership in Study Area (right)*

[54] Agrarian Reform Object Land (TORA) is land controlled by the state and/or land owned by the community to be redistributed or legalized by Presidential Regulation Number 86 of 2018 concerning Agrarian Reform. The government program through the 2015 RPJMD targets the implementation of land redistribution, and legalization of assets identified as the forest area to be released covers an area of 4.1 million hectares.

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Figure 4-126 also explains the ownership of documents obtained by respondents in the project area. As many as 61% of respondents have land certificates for their residence. As many as 16% of respondents only have landownership documents in Letter C or SKT. 8% of respondents have proof of land ownership through a sale and purchase deed. As many as 6% of respondents have proof of land ownership for residence in the form of Girik. 4% of respondents have proof of land ownership from a Minister's statement letter. The minister's statement letter is a decree from the Minister of Forestry and Environment, SK NUMBER SK.485/ MENLHK/ SETJEN/PLA.2/5/2023 issued on 19 May 2023[55], which states that the area is excluded from forest functions. The decree is part of the government's agrarian reform program to redistribute land to the community. Currently, Land that has just been removed from the forest area function cannot yet become property rights. 4% of respondents have proof of land control through a rental agreement. However, 1% of the respondents do not have any documentation.

A house is a physical structure consisting of a room, yard, and surrounding area used as a residence and a means of family development (Indonesia Law No. 4 of 1992). Meanwhile, according to WHO, a house is a physical structure or building for shelter, a valuable environment for physical and spiritual health, and social conditions for the health of families and individuals (WHO Commission on Health and the Environment, 2001).

The house's condition indicates a healthy environment based on the respondent's house, which includes walls, floors, and roofs. Based on type, respondents' houses were divided into two, namely permanent and semi-permanent houses. The difference between permanent and semi-permanent houses is seen in the wall materials. The walls of permanent houses are brick while the walls of semi-permanent houses are made of wood/bamboo/half walls and wood/bamboo.

The graphic below depicts the condition of respondents' houses in the project area. As many as 91% of respondents have permanent houses. The permanent residences owned by the people of Banyuwangi consist of brick walls plastered with cement, ceramic floors, and tile roofs. 5% of the semi-permanent houses of respondents belonging to the community in the Project area are houses whose walls are partly made of wood, the roof is made of tiles, and the floor plastered with cement. 4% of the houses owned by respondents in the Project area are non-permanent houses whose walls are all made of wood, the roofs are made of asbestos, and the floors are made of plastered cement or compacted clay.

[55] The decision to release forest areas in Java for Agrarian Reform Object Land or TORA is based on the Decree of the Minister of Environment and Forestry or LHK. For the East Java area, SK NUMBER SK.485/ MENLHK/ SETJEN/PLA.2/5/2023 was issued concerning Approval of the Release of Forest Areas in the Context of Determining Forest Areas or PPTPKH covering an area of 2,385.64 hectares for the Banyuwangi Regency, Batu City, Malang Regency, Blitar Regency, Jember Regency, Madiun Regency, Nganjuk Regency, Ngawi Regency, Pacitan Regency. This Ministerial Decree of the Ministry of Environment and Forestry is based on the decision of the Director General of Forestry Planning and Environmental Management on behalf of the Minister of Environment and Forestry Number SK.7000/ MENLHK-PKTL/ PPKH/ PLA.2/9/2022 dated 6 September 2022 as amended by Decree Number SK. 8026/MENLHK-PKTL/PPKH/ PLA.2 / 10/2022 dated 18 October 2022.

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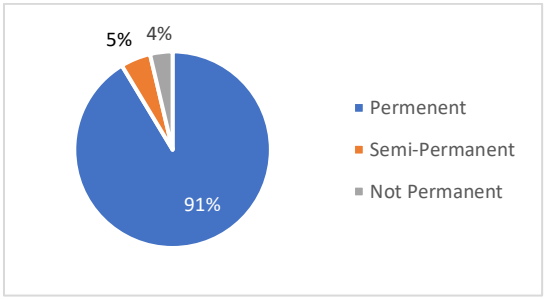


Figure 4-127 *Percentage of Residential House Categories in Area Study*

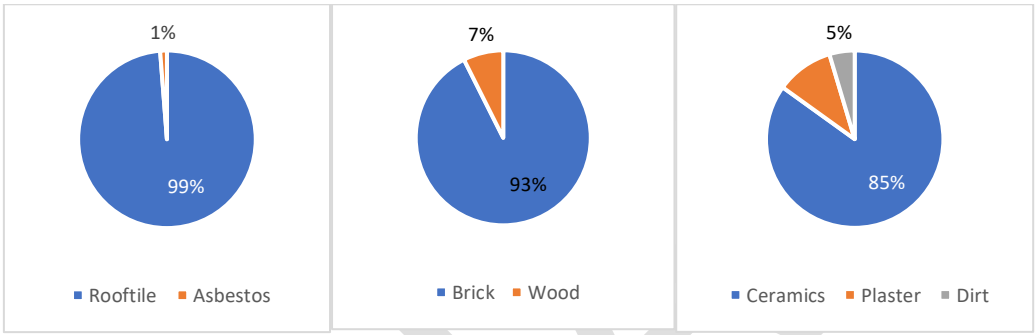


Figure 4-128 *Percentage of Roof Material in Area Study (left), Wall Material in Study Area (center), and Floor Material in Study Area (right)*

According to the Ministry of Health, healthy house-building materials[56] should not be made from materials that can emit substances harmful to the health of the occupants, and materials that can provide a place for growth and development of pathogenic microorganisms. For example, building materials not recommended by the Ministry of Health are made from asbestos.

Based on observations made during the survey, almost all respondents in the Project area have tile roofs, with a percentage of 99%. It is recommended by the Minister of Health regarding the use of roofs that do not contain carcinogenic substances. However, 1% of respondents had asbestos roofs (see **Figure 4-128** left).

One of the requirements for a healthy house is home wall-building materials that are easy to clean. From the observations during the survey, 93% of respondents had house walls made of bricks plastered with cement. Meanwhile, 7% of respondents have wooden walls, especially the front (see **Figure 4-128** center).

The use of walls is one of the welfare parameters based on the Decree of the Minister of Social Affairs of the Republic of Indonesia Number 146/HUK/2013 concerning Determining Criteria and Data Collection on the Poor and People with Disabilities. The use of bamboo walls indicates that the community is less prosperous.

The requirements for a healthy home are recommended by the Ministry of Health based on the Indonesian Ministry of Health in Decree number 829/Menkes/SK/VII/199; the floor must be airtight and easy to clean. Therefore, using airtight flooring material is important to address health issues. **Figure 4-128** (right) shows the materials used by respondents for home floors. Based on observations during the survey, 85% of respondents use ceramics as a floor material. 10% of respondents used plaster made

[56] Materails used to build parts of a house

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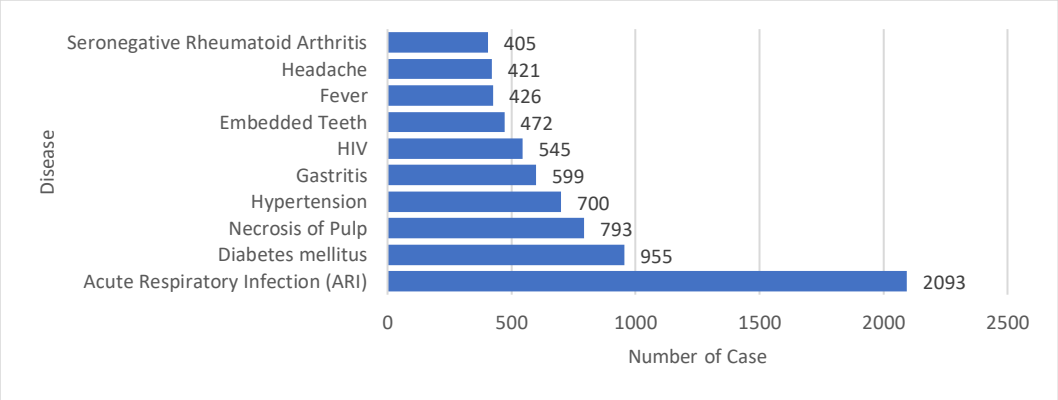
from cement for floor material. However, 5 % of respondents used dirt (soil floor from compacted clay).

4.2.2.10.2 Water Source

As presented in **Figure 4-77**, clean water source also used for irrigation. It is sourced from the river through irrigation channels to agricultural land. For domestic use, as presented in Section 4.2.2.5.9 regarding clean water facility, there are clean water management facilities in the village area, such as water reservoir (tandon) in Giri Village, and clean water pond in Kelir Village.

4.2.2.10.3 Prevalence Disease

Prevalence is the number of disease incidents obtained from a survey to show how big the burden of disease is in a population. This information is important in meeting public health service needs. Based on data from the Klatak[57] Community Healthcare Center, Kalipuro District, there are 10 cases of the highest prevalence of the disease. Acute Respiratory Infection (ARI) or ISPA recorded the highest number of cases with 2,093 cases, followed by Diabetes Mellitus with 955 cases, and Necrosis of Pulp with 793 cases. In addition, there were also HIV cases detected at the Klatak Community Healthcare Center.



Source: Primary Data, 2023

***Figure 4-129** Top Ten Prevalences Disease in Klatak Health Centre*

Based on data regarding ten disease prevalences from the Kelir Community Healthcare Center (seen in **Figure 4-130** below), it can be concluded that this community healthcare Centre handles many cases of Acute Respiratory Infection (ARI), with the number of cases reaching 1401. Followed by Hypertention, with 918 cases, Gastritis 496 cases and Common Cold with 423 cases. In contrast, the disease treated least frequently by the Kelir Community Healthcare Center is Dermatitis, with a total of 256 cases and Headache with 311 cases. This data provides an overview of the most common types of disease in the community around the Kelir Community Healthcare Center and can be used as a basis for more effective health service planning.

[57] Kalipuro district has a large coverage area, so there are two healthcare centers, Kelir Community Healthcare Center and Klatak Community Healthcare Center. Both healthcare centers provide health services to the community in the nearest village.

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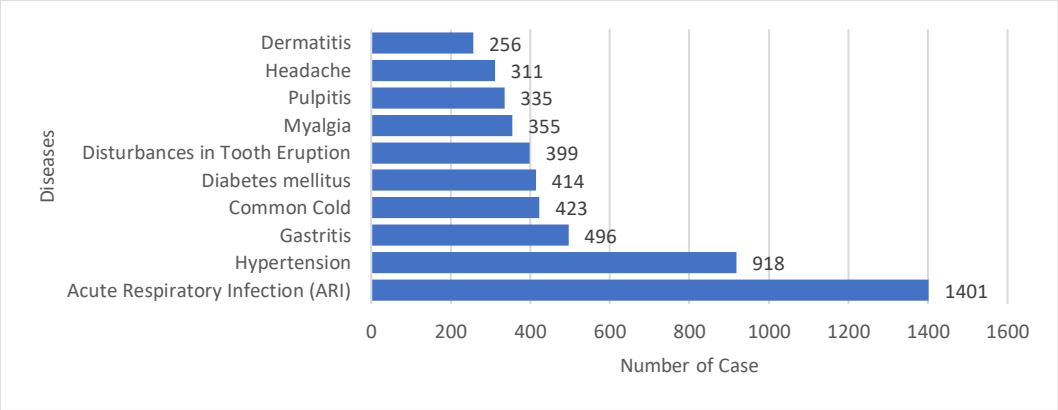


Figure 4-130 *Top Ten Prevalences Disease in Kelir Health Centre*

Based on data from the Giri Public Healthcare Center, the ten most prevalent disease cases found in Giri Village were Hypertension, with 178 cases, followed by Common cold, with 113 cases, and Myalgia, with 46 cases. Meanwhile, the disease that is least frequently encountered in Giri Village Healthcare Center (Pustu-Puskesmas Pembantu) is scabies, which is a skin disease that is transmitted by mites and causes itching and rashes on the skin.

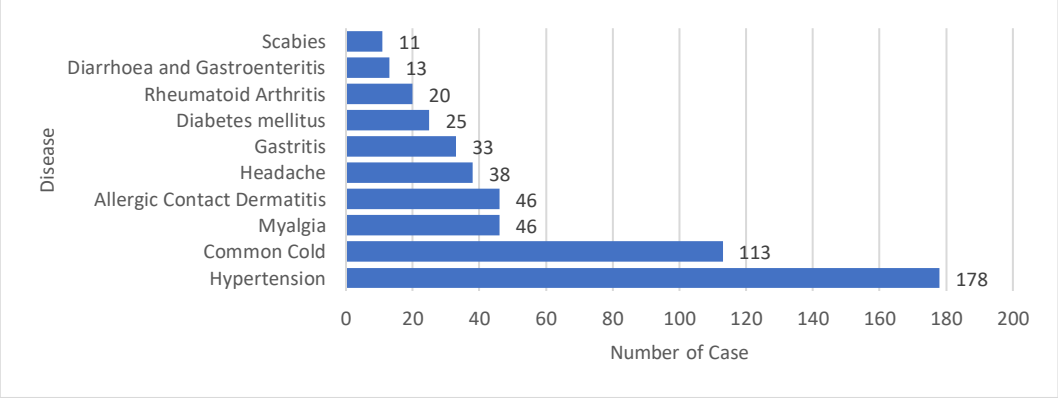


Figure 4-131 *Top Ten Prevalences Disease in Giri Health Centre*

Figure 4-132 provides an overview of the illnesses that respondents frequently experienced in the past year. Survey results show that fever is the disease most frequently experienced by respondents, reaching a percentage of 28%. The second most frequently found was influenza, with a percentage of 26%, and cough, with a percentage of 18%. On the other hand, the diseases that were least frequently experienced by respondents at the research location included toothache, ARI, and skin diseases, each with a percentage of only 1%.

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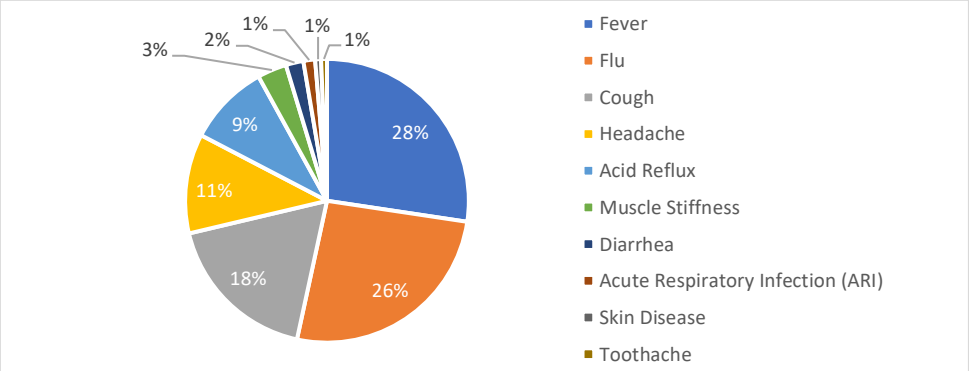


Figure 4-132 *Percentage of Common Suffered Disease in Study Area*

The graphic below explains the chronic diseases suffered by respondents in the Project area. The survey results show that 82% of respondents stated that they did not suffer from chronic diseases, while 18% of respondents admitted that they had chronic diseases. The study results show that the most frequently experienced chronic disease is Diabetes, reaching a percentage of 21%, followed by gout with a percentage of 17%, and stroke and cholesterol, each with a percentage of 10%. Meanwhile, chronic diseases that respondents rarely experienced involved depression, Parkinson's, and bone fractures, with a percentage of 3% each.

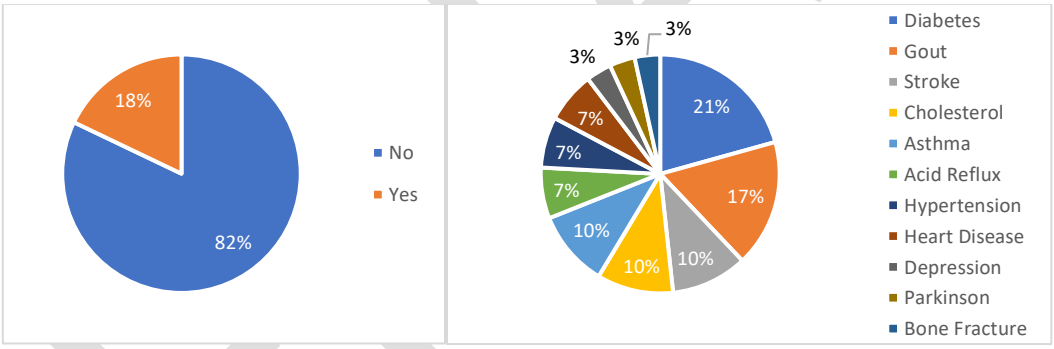


Figure 4-133 *Percentage of Chronic Disease in Study Area (left) and Type Chronic Disease in Study Area (right)*

4.2.2.10.4 Healthcare Facilities and Services

Based on the survey results, the places for treatment that respondents usually visit when they are sick in the study location are very diverse; most of the respondents usually visit the Community Healthcare Center for treatment, with a percentage of 49%. 14% of respondents go to a doctor when they are sick, 13% of respondents go to traditional medicine, 11% of respondents go for treatment to a nurse (Mantri), 7% of respondents go for treatment to a hospital, and 6% of respondents go for treatment to a midwife. An overview of the places of treatment that respondents usually visit when they are sick at the location can be seen in **Figure 4-134.**

Respondents who went for treatment at the health center was mostly found in Kelir Village, while most respondents who visited the doctor for treatment were found in Giri Village. Respondents who sought alternative medicine were mostly found in Kelir and Kalipuro Villages. The reason respondents sought traditional medicine was due to limited costs and not having health insurance from the government, such as BPJS (Social

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Security Administering Body) Health[58] or KIS (Indonesia Health Card). Respondents who sought treatment from nurses (Mantri) were most often found in Kalipuro Village. The lowest percentage was found among respondents who sought treatment from midwives in Kalipuro Village.

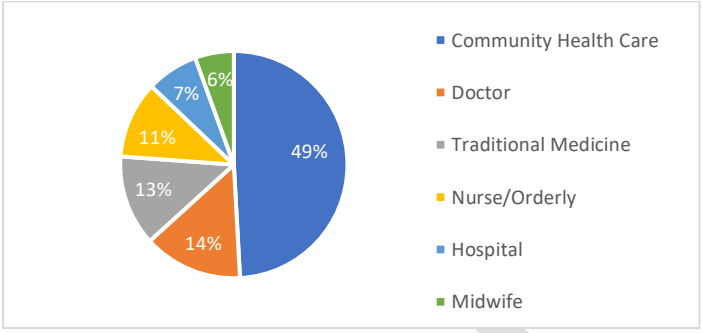


Figure 4-134 *Percentage of Preferred Healthcare Facilities in Study Area*

This study also looked at respondents' ownership of health benefits. The results of the study showed that the majority of respondents in the study location did not have health benefits in the form of BPJS, with a percentage of 67% and 33% of respondents having health benefits or BPJS. The lack of access to health benefits in the study location is more influenced by the respondent's inability to pay BPJS contributions regularly. Respondents who do not have health insurance in the study location is mostly found in Kalipuro and Giri Villages, followed by Kelir Village. Economic limitations and lack of access to information about health insurance from the government cause a high percentage of respondents who do not have health insurance.

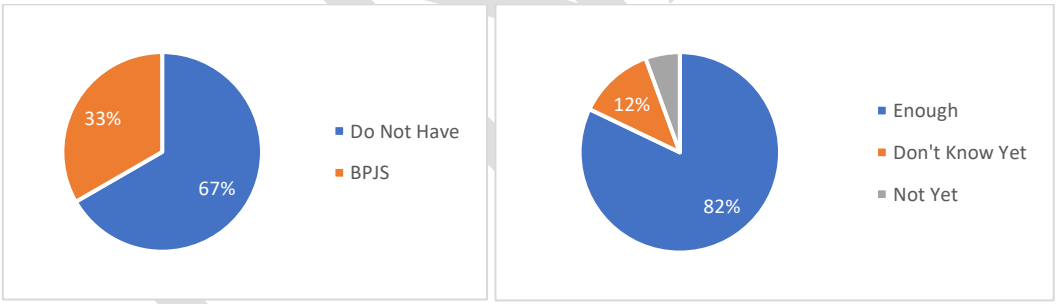


Figure 4-135 *Percentage of Health Insurance Ownership (left) and Community Perception on the Healthcare Facilities (right) in Study Area*

Figure 4-133 (right) shows the respondent's perceptions of health facilities and services in the project area. This health service facility is related to the availability to handle health problems in the village. The results of the study show that most respondents have the perception that existing health facilities and services are sufficient, with a percentage of 82%. As many as 12% of respondents answered that they did not know about the perception of available health facilities and services, and 6% of respondents were not satisfied with the existing health facilities and services at the study location.

[58] BPJS Health is a government program that functions to implement health insurance programs as mandated by Law number 40 of 2004 regarding the National Social Security System. The law states that health insurance is organized nationally based on the principles of social insurance and equity with the aim of ensuring that participants receive health maintenance benefits and protection in meeting health standards. In the survey area, most respondents already have health benefit coverage

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4.2.2.10.5 Sanitation

This research also evaluates the clean and healthy living behaviour of respondents in the project area. The first aspect to focus on is the defecation habits of respondents, both during the rainy and dry seasons. The research results showed that most respondents (87%) defecated in private latrines at home. Meanwhile, 10% of respondents use private latrines outside the house, 2% still defecate in the river, and 1% of respondents use a neighbour's latrine to defecate. Further details regarding respondent's behavior regarding defecation at the research location can be found in **Figure 4-136.** This data also indicates that in Giri Village, the high number of respondents who use private latrines at home and also a high number of respondents who defecate in the river.

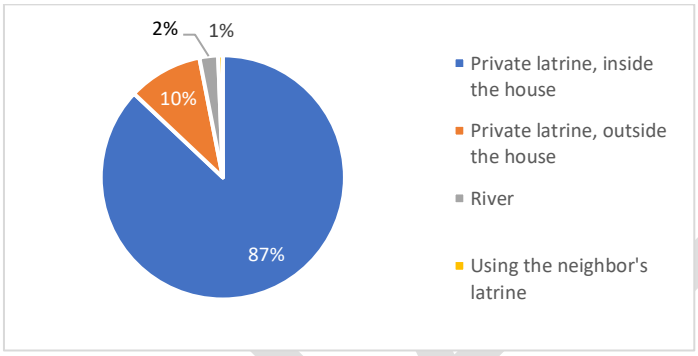


Figure 4-136 *Percentage of Defecation Place During the Dry and Rainy Seasons in Study Area*

Even though the Village Health Center has declared its area free of open defecation (ODF), there is still a high percentage of respondents who practice open defecation at the research location. It is reflected in the results of an interview with Midwife Vita, one of the midwives at the Giri Village Healthcare Center (Puskesmas Pembantu or Pustu), staterd that regarding open defecation behavior, the status of Giri Village is ODF-free. However, it cannot be denied that there are still residents who are accustomed to defecating in the river, and this is more than just a customary factor, and generally, people who are old.

The existence of sanitation and living behavior influence cleanliness and health. Sanitary conditions are an indicator of cleanliness and health at the household level. Sanitation as an indicator of environmental health includes waste disposal, clean water supply, and the ecological condition of the house.

4.2.2.10.6 Household Waste Disposal

Sources of household waste come from the kitchen, bathroom, and leftovers from food processing. **Figure 4-137** (left) explains that most respondents at the research location have disposed of defecation waste into septic tanks with a percentage of 90%. Meanwhile, 9% of respondents still dispose of defecation wastewater in rivers, and 1% dispose of defecation wastewater in gardens and on land.

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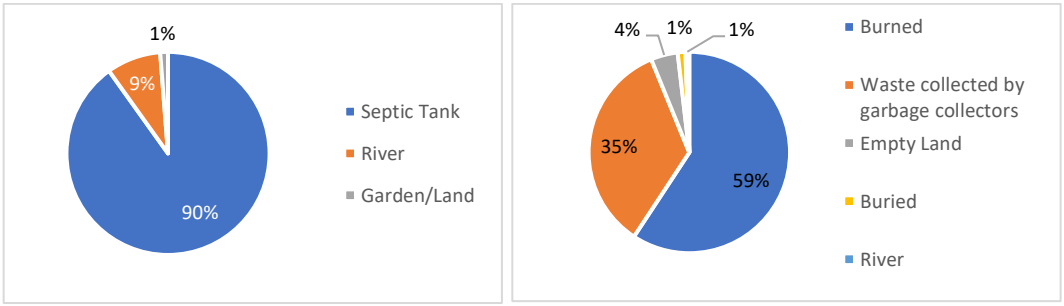


Figure 4-137 *Percentage of Sewage Disposal Method in Study Area (left) and Waste Disposal Method in Study Area (right)*

Meanwhile, for household waste management (see **Figure 4-137**, right), most respondents in the study location manage household waste by burning it at 59%. As many as 35% of respondents manage household waste by collecting it and then having it picked up by officers. 4% of respondents throw household waste onto empty land. 1% of respondents buries household waste, and 1% throws waste into the river. The results of observations at the study location are that temporary rubbish dumps are rarely found, so the behaviour of burning rubbish and throwing it on empty land and into rivers is common at the study site.

4.2.2.10.7 Household Wastewater

he management of household liquid waste in the research location varies, with the highest percentage of household liquid waste being discharged into the gutter with at 33%. As many as 29% of respondents have liquid waste drainage channels to gardens and land. As many as 23% of household waste drains into the IPAL[59], and 15% of respondents drain liquid waste into the river around their residence.

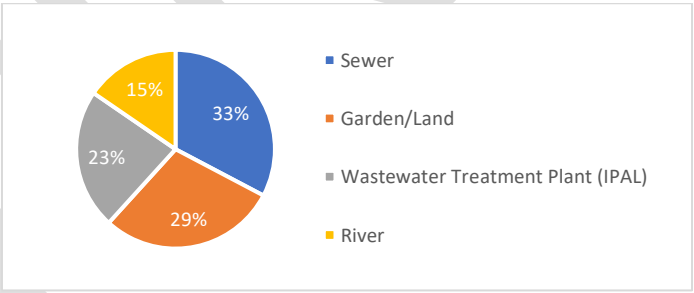


Figure 4-138 *Percentage of Domestic Wastewater Disposal in Study Area*

4.2.2.11 Community Safety and Security

In the social baseline study for solar PV projects, community safety and security are central considerations. Assessing current safety practices and understanding community perceptions, particularly regarding installing and maintaining solar PV systems, informs the development of targeted safety measures. The study also presents data about safety and security risks in society.

[59] IPAL is an abbreviation for *Instalasi Pengolahan Air Limbah* or Wastewater Treatment Installation. In Indonesia, a WWTP is a structure designed to remove biological and chemical waste from the air, thereby allowing the air to be used for other activities. The function of IPAL is urban wastewater treatment for the disposal of human and other household waste.

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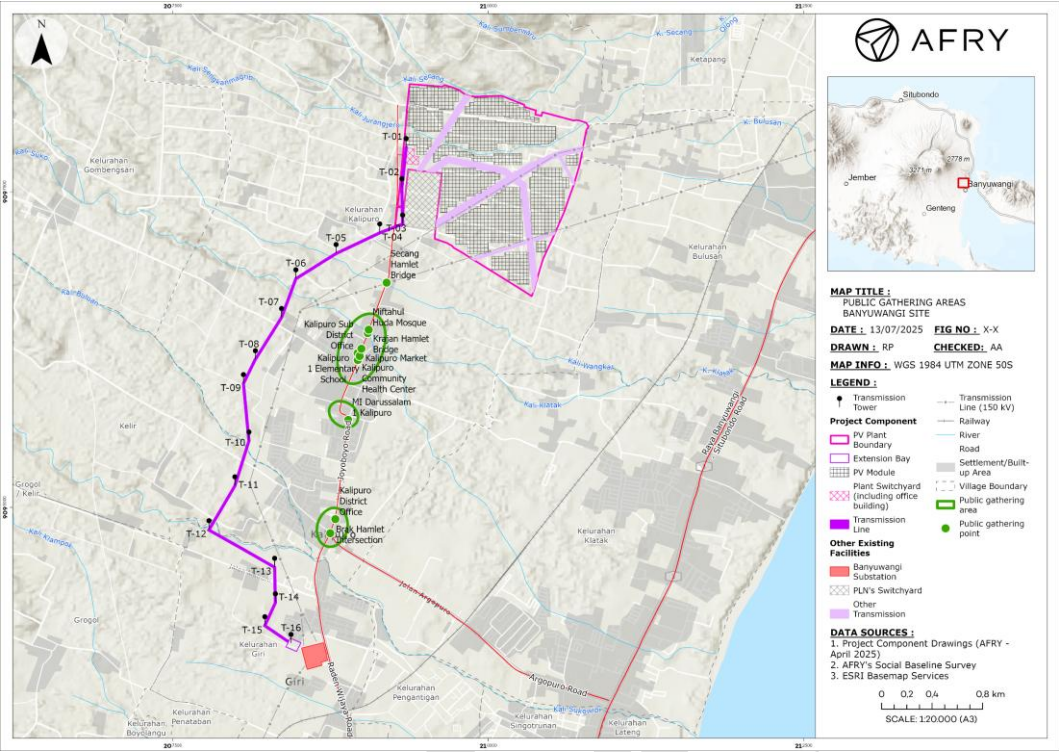


Figure 4-139 *Map of Public Gathering Areas in Study Area*

The construction project of the Ground-Mounted PV has the potential to impact on the surrounding community. The development will involve the use of heavy machinery and the distribution of construction raw materials. In Kalipuro Village, the roads designated for the distribution of construction materials and heavy machinery encounter points of congestion. The mapping results indicate ten crowded locations within the Project area. These locations include the Kalipuro Village Office, Kalipuro Community Health Center, Kalipuro District Office, Kalipuro weekly market, Krajan Hamlet Bridge, Secang Hamlet Bridge, Darussalam 1 Islamic Elementary School Kalipuro, Brak Hamlet Intersection, Kalipuro 1 Elementary School, and Miftahul Huda Mosque (see **Table 4-63**).

Table 4-63 *Potential Congestion Areas in the Study Area*

Public Gathering Location	Location	Description
Kalipuro Village Office 	208964, 9096221	The Kalipuro Village Office is the center of government and administration in Kalipuro Village, providing administrative services for residents of Kalipuro Village. It is open on weekdays from Monday to Friday from 08.00 - 16.00.
Kalipuro Community Health Center	208966, 9096167	Kalipuro auxiliary health center is a health facility that is a place of treatment for residents of Kalipuro Village, this auxiliary health center is open from 08.00 - 12.00 every Monday-Saturday.

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Public Gathering Location	Location	Description
		
Kalipuro District Office 	208789, 9094908	The kecamatan office's working days are Monday-Friday. The working hours of the district office are from 7:30 a.m. to 4:00 p.m., with a break from 12:00 to 13:00.
Kalipuro Market 	208981, 9096199	Kalipuro Market is a semi-permanent market that is held every Wednesday. Market hours are from morning to noon.
Krajan Hamlet Bridge 	209046, 9096381	A bridge that is often passed by the community. The width of the bridge is approximately 3m with a length of approximately 20m.
Secang Hamlet Bridge 	209194, 9096780	A bridge that is often passed by the community. The width of the bridge is approximately 3m with a length of approximately 5m.
Brak Hamlet Intersection	208748, 9094795	The intersection connects Kelir Village, Giri Village, Kalipuro Village and Ketapang Harbor Area. The Brak intersection is often traversed by heavy vehicles from Ketapang Harbor heading to Jember Regency.

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Public Gathering Location	Location	Description
		
MI Darussalam 1 Kalipuro	208889, 9095693	MI Darrussalam 1 Kalipuro is an Islamic school equivalent to elementary school. Teaching and learning activities are carried out from Monday to Saturday at 07.00 and go home at 13.00 WIB.
Kalipuro 1 Elementary School	208995, 9096257	Teaching and learning activities are carried out from Monday to Saturday at 07.00 and school dismissal at 13.00 WIB.
Miftahul Huda Mosque	209052, 9096407	The five daily prayers are regularly held in congregation. Friday prayers are the most crowded time at this location.

Source: Primary Data, 2023

Busy and Crowded Traffic Times on The Highway

The most congested periods on the highway occur in the morning, typically between 07:00 and 09:00 AM, as people commence their workday and children head to school. Additionally, peak hours are observed in the afternoon, around 03:00 to 05:30 PM, when individuals return home from work or school, and farmers venture out to procure grass or animal feed.



Figure 4-140 *Factory Workers' Transportation (left), and a Farmer Transporting Animal Feed (right)*

Congestion Point

A congestion point refers to a specific location where traffic flow experiences a significant slowdown or bottleneck due to various factors. Typically occurring in urban areas, these points become focal areas of traffic congestion, causing delays, longer travel times, and

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frustration among commuters. Several factors contribute to congestion points, including high traffic volume, inadequate road capacity, poorly synchronized traffic signals, and the convergence of multiple transportation routes.

Based on the results of observations, it was found that congestion and crowd points have the potential to cause traffic jams.

- Kalipuro market area and surrounding areas, in this area there are several public facilities in proximity, such as Kalipuro Village Office, Kalipuro Village Healthcare Center and State Elementary School 1 Kalipuro.
- The Brak Hamlet intersection is situated along the Banyuwangi provincial road axis leading to Ketapang Harbor. This access road serves as the route to Kelir Village, Kalipuro Village, Giri Village, and Ketapang Harbor. Near the Brak intersection, there is the Kalipuro district office, and several residents engage in selling activities in the surrounding area.



Figure 4-141 *Kalipuro Market (left) and Brak Crossing Road (right)*

Accident-Prone Location

An accident-prone area is a region that exhibits a high risk of accidents. This condition can be attributed to various factors, including the physical environment, road user behavior, and inadequate infrastructure. In this area, the presence of accident risks can significantly increase, demanding more intensive attention and preventive measures.

However, it is worth noting that several accidents have occurred at the Brak Crossing Road due to the absence of traffic lights. Additionally, during football events held in the city, the Brak crossing road has been used for altercations on multiple occasions, as expressed by one informant that at the Brak crossing road, it is bustling with passing vehicles, but there are no traffic lights, so there have been several accidents. Also, during football events in the city, it is often used as a meeting point for people, leading to fights.

Considering these circumstances, strategic planning and coordination become even more crucial to minimizing inconveniences and ensuring the smooth progress of the Ground-Mounted PV construction project. Moreover, it is important to mention that on August 16th, there will be a Tirakatan60 event organized by the residents near Brak crossing road to commemorate Indonesia's Independence Day. During this event, the

[60] "Tirakatan" is an activity carried out by neighborhoods or villages for collective prayers honoring the fallen heroes who fought for and defended Indonesia's independence. It includes a communal meal.

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Brak intersection will be closed, requiring large trucks to take detours. This additional information emphasizes the need for careful consideration of community events in project planning to avoid disruptions, as expressed by one informant that they usually hold a 'Tirakatan' on August 16 at the near Brak crossing road for collective prayers and a communal meal. In the past, if a truck passed through, they would ask it to turn back.



Figure 4-142 *Brak Sub-Village Intersection (left) and Traffic Conditions Near the Brak Sub-Village Intersection (right)*

4.2.2.12 Local Labour Rights and Working Conditions

The main sources of income for the people in the study location come from the agricultural/plantation sector, small and medium businesses, the industrial sector, and services. Livelihoods in the agricultural and plantation sectors involve various jobs such as agricultural labourers, farmers, daily labourers on plantations, and livestock breeders. The small and medium business sectors involve trading, plantation, material, and craft businesses. Meanwhile, the industrial and service industries generally include factory workers, private employees, artisans, drivers, and household assistants. Most of the workforce for these various work sectors comes from local communities and from outside the village. This sub-chapter explains the working conditions of the surrounding community and workers from outside the area, especially those affected by project activities.

1. Daily workers sugarcane Plantation Afdeling Wangkal (unskilled labour)

   The daily workers for the Afdeling Wangkal plantation are local workers who operate in the sugar cane plantation area. Most of these workers come from the people of Kalipuro Village (Secang, East Secang, Secang Mangir, Wangkal, and Papring hamlet) and Ketapang Village (Pancoran hamlet). The total number of daily workers who regularly work on sugar cane plantations reaches 70. According to information from the Afdeling Wangkal plantation management, around 70% of the total daily workers are women aged 30 to 50.

   In carrying out their work, daily workers work in groups, where each group consists of around 20-25 people. Each of these groups is led by a plantation foreman tasked with managing the distribution of time and labour requirements for each task on the sugar cane plantation. Labour absorption is highly dependent on the volume of work available. Daily workers' absorption and working time increase when the volume of work is according to the needs of the plantation. When the volume of work is minimal, the foreman regulates the composition and working time of day labourers by alternating or "applauding" (a local term) within one group.

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The division of tasks and absorption of labour on plantations generally involves communication between workers and daily workers, usually carried out one day before the workday at the same time as the division is implemented.

When working, daily workers do not have a written work contract with the plantation, they usually submit work requests verbally to the supervisor or are sought by the supervisor. The only requirement for work is an attached photocopy of the worker's KTP submitted directly to the supervisors. Daily workers and supervisors are generally residents or neighbors who live in the same neighborhood or village.

The types of work carried out by daily labourers in the Wangkal plantation area include land clearing, land processing, planting, fertilizing, spraying, embroidering, *klentek*, cutting, and harvesting. There is no occupational difference between male and female daily labourers as all workers are involved in the same work, which tasks vary at certain times, such as picking up fertilizer from male workers and distributing it to plantation locations.

Daily workers' working hours at PTPN are from 06.00 am to 12.00 noon. Before starting work, workers gather to get instructions regarding work scope and safety from the supervisor. When working, daily workers use safety Equipment, including boots, long sleeves, gloves, and hats. The equipment was provided by the workers themselves, without assistance from PTPN. If a work accident occurs, such as an injury to the hand or foot, workers do not receive support for treatment from PTPN, unless they report it to the supervisor or PTPN. However, most workers rarely report work accidents and prefer to treat by themselves. They also do not get health insurance from PTPN.

Every year workers receive a holiday allowance of IDR 125,000 which is paid every year before Eid al-Fitr. Daily workers' wages are given in two ways, namely daily wages outside the harvest period of IDR 45,000/day, which are given every 5th and 19th of each month. During the harvest or sugar cane cutting period, wages are measured based on the cargo produced by daily labourers, with a wage of IDR 50,000/ton. During the harvest season, daily labourers work in groups, and wages are paid once every three days or after one sugar cane truck is completed. The process of fulfilling one truck takes 2-3 days.

Sugarcane plantation daily workers are one potential source of local labour who do not have special skills at the project location. The daily labour group is also a vulnerable group directly affected by the loss of jobs and household income during the construction of the Ground-Mounted PV project at the study location.

2. Harvest Labour Plantation from Outside Banyuwangi (Unskilled Labour)

PTPN XII Kaliselogiri Afdeling Wangkal carries out the labour requirements for harvesting sugar cane during the harvest or cutting season. This increase in demand aims to meet sugar company demand quotas and reduce the risk of sugar cane damage due to long cutting or harvest times. The plantations regularly need 50 harvest workers. These harvest workers come from outside Banyuwangi, such as Jember, Situbondo, and Asembagus.

PTPN already has a contact list of labour coordinators in each city. The harvest labour coordinator will find his labour according to the plantation's needs. Two

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people, the Andy Group with 30 workers and the Hariyanto Group with 20 workers, coordinate the harvest workers.

There is no contract between PTPN and the harvest labour coordinator; the working relationship is more of a trust relationship, and PTPN has been a partner since the beginning of planting sugar cane.

The wages received are calculated based on tonnage, with one ton being IDR 50,000. In one day, harvest workers can produce between 13 and 15 tons. Their work includes cutting or harvesting sugar cane and loading sugar cane stalks onto trucks with the help of grab loaders.

Harvest workers who come from outside Banyuwangi live in PTPN plantation housing during the harvest period. If the houses can't accommodate them, they rent houses from residents around the plantation. Harvest workers are potential unskilled local workers during Ground-Mounted PV construction, but they are potential project-affected people and may experience loss and lack of income when the Ground-Mounted PV project starts operation.

3. Plantation Non-Permanent Employees

These non-permanent employees are functional workers at the PTPN XII Kaliselogiri Afdeling Wangkal plantation, consisting of five supervisors and two plantation security officers. The foreman and security officers come from residents around the Kalipuro District and outside the district. The supervisor's duties involve the division of work, timing, and distribution of labour based on the volume of work on the plantation. Meanwhile, security officers are responsible for maintaining the security of assets and activities at the PTPN XII Afdeling Wangkal location. The supervisor reports all daily activities to the head of supervisors, while the security officer reports daily activities to the garden assistant.

The Supervisor and security working hours are Monday-Saturday, with work details as follows:

Table 4-64 *Non-Permanent Employee's Working Schedules PTPN XII Kaliselogiri Afdeling Wangkal*

Working	Days	Hours	Break	Remarks
Supervisors	Monday-Thursday	05.30 – 12.30	09.30 – 10.00	
	Friday	05.30 – 11.00		
	Saturday	05.30 – 12.00	09.30 – 10.00	
Security	Everyday	06.00 – 12.00	09.30 – 10.00	Shift 1
	Everyday	12.00 – 19.00	15.30 – 16.00	Shift 2

Source: Primary Data, 2023

Occupying the position of Supervisor is usually done through a proposal from plantation management. The names proposed to become supervisors generally come from daily workers who have worked for a long time at PTPN. Offering or appointing daily workers as supervisors is based on the daily worker's performance, discipline, and leadership abilities. The PTPN takes the final decision regarding the plantation management proposal.

Non-PTPN employees receive a monthly salary, with the foreman amounting to IDR 2,600,000 per month and security amounting to IDR 1,600,000 per month. Apart

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from the monthly salary, non-permanent employees also receive a Holiday Allowance (THR) equivalent to one month's salary, health benefits/BPJS, and workers' social security. When the harvest season arrives, the supervisor receives a bonus of IDR 10,000 per truck or load of sugar cane. Usually, this bonus is shared with daily labour members.

Temporary employees are one source of local labour with reliable skills for the project. The supervisor has the potential to coordinate with superiors and subordinates and organize work among workers. Meanwhile, security have relevant security skills and certification from the police. If the Banyuwangi Ground mounted Solar PV project is carried out, project activities can directly affect them, potentially losing jobs and family income.

4. Farm Labour

Farm labourers are local workers who cultivate other people's farms or plantations in exchange for wages. Farm labourers in this study area generally come from the surrounding area or residents of the same or neighbouring villages. Their tasks involve land clearing, soil preparation, planting and harvesting.

Farm labour activities take place almost year-round, both on agricultural land (paddy fields and gardens) and on plantation land (yards and moorlands). The labour absorption of farm labourers increases during the planting and harvest seasons on agricultural land, as well as the harvest season on plantation land. Commodities commonly grown by the community in agricultural locations include chillies, peanuts and corn, while in plantation land, commodities include coffee, fruit trees, bananas and coconuts.

In working, farm labourers receive wages ranging from IDR 80,000 to IDR 100,000 per day. There is a difference in wages between male and female farm labourers, with the wage for female farm labourers being around IDR 80,000 per day due to the difference in workload between men and women. In addition, farm labourers also receive one meal a day. The working time of farm labourers generally start from morning (07.30) to afternoon (16.00), with a break of about 1 hour at midday (12.00-13.00).

The process of labour absorption does not involve special recruitment; farm labourers work based on invitations from fellow farm labourers and a trusting relationship with the landowner so that they get a job call from the landowner. Farm labourers at the work site are also among the groups temporarily affected by project activities, especially during the construction of the transmission line footprint. Farm labourers can be an alternative source of local labour without specific skills at the project site.

5. Factory Labourers and Private Workers at Ketapang Port

Many people around the plantation of PTPN XII Kaliselogiri Afdeling Wangkal work as labourers or factory employees in the port area of Ketapang, Banyuwangi. Most are involved in shrimp processing plants, Bosowa cement packaging plants, Bulog warehouses, *Pusri* fertilizer packaging, and loading and unloading workers at Ketapang port.

Labourers working in the Ketapang Port area generally apply for jobs and are mostly junior and senior high school graduates. They work on various shifts, both morning

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and night. The monthly salary this factory workers receive is in line with the Banyuwangi Regency Minimum Wage, which is around IDR 2,600,000 - IDR 2,800,000. In addition to the monthly salary, they also receive a holiday allowance equivalent to one month's salary and health and Social Security benefits.

To reach the work location around Ketapang Port from Kalipuro Village and its surroundings, factory workers usually use the access road through the sugar cane plantation area of PTPN XII Kaliselogiri Afdeling Wangkal. From observations, this access road is used by the community and factory workers when leaving for work (in the morning) and returning home (in the afternoon).

When the Ground-mounted Solar PV Banyuwangi project will be implemented, Ketapang factory workers were among the groups directly affected, especially related to road access often passed in their work routine because the access road in the plantation area is currently the nearest road access for them to work. However, the factory workers were not a priority for local employment during the construction of the Solar PV project, as they did not experience job loss or reduced household income.

In addition to the description of labour conditions above, the study also identified the types of activities or occupations of daily labourers in the Project area. A detailed description of the identification results of the types of labourers' jobs in the study location can be seen in the **Table 4-65**. Based on the table above, in the location there is diversification of labour jobs, this diversification of labour jobs shows that there are many job opportunities with low labour absorption, job opportunities are based more on experience and do not require a high level of formal education.

Table 4-65 *Types of Labour Jobs and Wages in the Study Area*

No	Types of Labour Jobs	Daily Wages (IDR)	Working Description
1	Plantation daily labour	45,000	Work according to the available work volume, working time from 06.00 - 12.00
2	Harvest Plantation labour	100,000	Piece work system and wages based on tonnage IDR 50,000/ton
3	Labourer Peeling coconut	150,000	Coconut peeling wage IDR 150 / grain, 1 day can peel a maximum of 1000 grains
4	Coconut climbing labourer	100,000-125,000	Coconut climbing wage IDR 5,000/tree, 1 day can be 20-25 trees
5	Bulog labourer	93,000	Minimum wage, work every day from morning to evening
6	Shrimp factory labour	93,000	Minimum wage, work every day from morning to evening
7	Pine tapping labour	45,000	Working at *Perhutani,* wages are based on the weight of sap, 1 kg of sap is paid IDR 4,500 /kg.
8	Meubelair labour/ cutting wood	100,000	Work 6 days/week, working time 07.00 -16.00
9	Labour for Coconut leaves bones craft (lidi)	10,000	Wages IDR 50 / pcs, a day can be 200 bundles.
10	Besek craft labourer (kind of	30.000	Wage 1 besek IDR 1,250 /pcs

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No	Types of Labour Jobs	Daily Wages (IDR)	Working Description
	woven bamboo basket)		
11	Equipment fishing labour	25,000	Wage IDR 120/pcs, a day can reach 200 pcs
12	Brick labour	100,000	Work in groups with 6 working days/week. Working hours are 07.00 -16.00
13	Cracker factory labour	21.000	Rewarded based on the number of doughs, in a day can work on 6-7 doughs with a wage of IDR 3,000 / dough.
14	Farm Labour	80.000-100.000	Working time 07.00-16.00
15	Construction labour	100.000-110.000	Working time 07.00 -16.00
16	Wooden labour (TPK[61]- *Tempat Pengumpulan Kayu*)	100.000	Working time 07.00 – 16.00
17	Cement Factory labour	93,000	Minimum wage, work every day from morning to evening
18	Housemaid	20.000	Work every day with 2-3 hours of working time per day
19	Bamboo collective labour	75.000	In one day can collect 100 pcs of bamboo
20	Bird Repellent labourers in rice fields	15,000	Work from morning to evening, get 1 meal.

Source: Primary Data, 2023



Figure 4-143 *Brick Workers (left) and Besek Craft Workers (right) in the Study Area*

4.2.2.13 Gender and Vulnerable Group

This section will discuss gender roles and Vulnerable groups in the Project area. In the Solar Power Plant (Solar PV) project in Banyuwangi, implementing gender aspects and paying attention to vulnerable groups is very important. Gender and vulnerable groups, such as women and low-income communities, have a unique role in equal access to and benefits from this project. Efforts to ensure the active involvement of women in all stages of the project, as well as the protection and empowerment of vulnerable groups, are the

[61] A place to collect wooden product from Forestry company (Perhutani)

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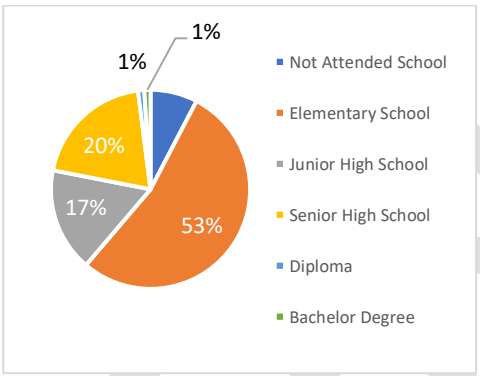
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main foundation. Through this inclusive approach, it is hoped that the Solar PV project will not only have a positive impact in terms of clean energy but also make a positive contribution to gender equality and empowerment of vulnerable groups in the region.

Gender

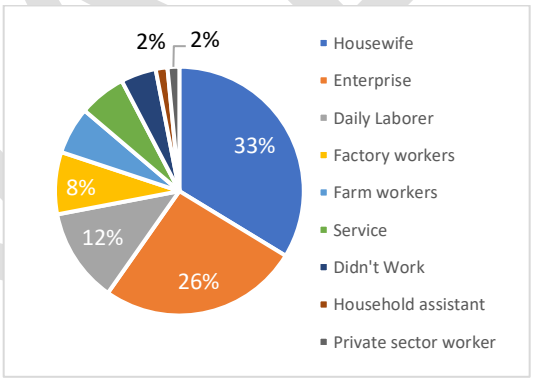
Gender issues are an essential aspect of the development process. Gender equality is inseparable from the success and sustainability of a project. Including a gender perspective is vital to ensuring that project benefits are shared equally by the entire community, regardless of gender. Issues such as access to employment, training, and women's participation in decision-making must be addressed with an inclusive approach.

Access to education indicates gender equality, as it means that men and women can have the same rights and opportunities. According to survey result shown in the graphic below, most of the female respondents are attending school, most female respondents graduate from elementary school at 53%. 20% of female respondents graduated from senior high school and 17% graduated from junior high school. These results show that women's participation in accessing education is high, at least having completed elementary school (**Figure 4-144**).



Source: Primary Data, 2023

Figure 4-144 *Percentage of Female Education*



Source: Primary Data, 2023

Figure 4-145 *Percentage of Female Occupation in the Study Area*

Efforts for gender equality in access to employment continue to grow, emphasizing equal opportunities for men and women to pursue careers and contribute to various sectors. Furthermore, this result shows how the employment opportunities are for women. Based on the graphic above, most of the female respondents are in the informal sector, such as farmers/planters, businesses, housewives, labourers, and odd jobs. Work as housewives is mostly done by female respondents in the Project area at 33%, enterprise with 26%, and daily labourer 12%. The fewest jobs carried out by female respondents are private sector workers at 2% (**Figure 4-145**).

Gender Issue in the Project area

<u>Economic</u>

As many as 70 casual daily workers are routinely called to work during the sugar cane production process in Wangkal and Secang Hamlet. The proportion of female workers in daily work reaches 70%. Within a year, these daily labourers are routinely called by supervisors to get work that suits PTPN's needs. Work at the PTPN location for men and women is almost the same, including hoeing *(sulam)*, planting, applying fertilizer and

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spraying pesticide. The salary received by both male and female workers is the same and is paid twice a month, namely on the 5th and 18th, with a wage of 45,000/day for 6 hours of work. Sunday is a holiday, except during the harvest period when workers must continue to work according to schedule, without days off.

The harvesting process is carried out for 120 days, following the plot according to the sugar cane planting age. To speed up the harvest process, PTPN also brought in 50 daily workers from Bondowoso, Jember, and Situbondo, most of whom were women.

Within the PTPN environment, there are four permanent supervisors and five casual daily supervisors who are responsible for coordinating labourers. The worker recruitment process is carried out by the foreman, who is responsible for coordinating the workers. However, this recruitment method only involves a job offer by a foreman who communicates with the service provider company. The service provider company will contact the required workers. This process is carried out through verbal communication without a written employment contract.

Based on the results of interviews with female workers, they hope that the Solar Power Plant (Solar PV) project in Banyuwangi will not be carried out in the PTPN plantation area because this could reduce their income. They consider working as daily labourers at PTPN quite ideal because working hours are only 6 hours from morning to afternoon. After work, they have time to take care of their families and find feed for their livestock.

Child Marriage

Child marriage in Banyuwangi is still an issue that needs serious attention. In 2022, Banyuwangi climbed to fourth place with the highest number of child marriage cases in East Java. The data shows that there were 877 applications for early marriage dispensation, with most applicants aged 15-16 years. Kalipuro district recorded the highest number of child marriages in this district, with 92 cases of child marriage in the same year based on data from the local Religious Affairs Office (KUA)[62].

Even though the data for 2023 is not yet available, interviews during the survey confirmed that cases of child marriage still occur in several villages in Giri District and Kalipuro District. According to Midwife Vita from the Giri Health Center, early marriages often occur in Karangente Hamlet and Kopenbayan Hamlet, with an estimated 4-5 cases of marriage in 2023. Generally, children who are married off are around 14-15 years old, usually after graduating from junior high school.

Factors causing early marriage to involve various aspects, including cultural factors. Most of the child marriages in Kalipuro Villages and Giri Villages come from the Madurese ethnic group, where parents feel the need to marry off their children to avoid the sin of adultery due to promiscuity. Economic challenges may also encourage parents to marry off their children at an early age when children are considered a family burden that can be reduced after marriage. In addition, out-of-wedlock pregnancies among students are also a significant factor in the practice of early marriage.

Based on an interview with a Posyandu cadre in Kalipuro Village, it is known that early marriage is one of the factors causing stunting cases. Currently, the local government has taken mitigation steps to overcome the problems of early marriage and stunting. One of the measures taken is only to permit marriage if the age has reached the specified

[62] Source : online news https://radarbanyuwangi.jawapos.com/liputan-khusus/75920945/angka-pernikahan-dini-banyuwangi-peringkat-empat-sejatim acces in 17 January 2024

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limit. The village government, through the Family Assistance Team (*Tim Pendamping Keluarga-TPK)*, assists newly married couples. Family Assistance team is responsible for monitoring everything from pregnancy to food nutrition for babies. With these steps, it is hoped to reduce cases of early marriage and contribute to the high rate of stunting in the region.

Poverty

In the villages around the PTPN Kaliselogiri plantation and the Banyuwangi ground-mounted solar PV land area, several female heads of households also face the challenge of poverty. Based on the results of interviews with informants regarding poverty parameters in Banyuwangi, this condition is characterized by income below the Banyuwangi Regency Minimum Wage (UMK) of IDR 2,528,899. Some female heads of household who are still of productive age are involved in informal work, such as working as pine tappers on forestry land, casual daily labourers on PTPN-owned plantations, or farm labourers on residents' land. Meanwhile, older women receive daily support from their families or children. Some also receive social assistance from the government, such as the Family Assistance Program (*Program Keluarga Harapan* - PKH), Non-Cash Food Assistance (*Bantuan Pangan Non-Tunai* -BPNT), and *Raskin* (*Beras Miskin*). Assistance also comes from fellow residents, such as *Zakat*, which is received every year before Eid al-Fitr. In Giri Village, there is a SEGO community that assists low-income families and older people. If the Banyuwangi ground-mounted Solar PV project starts, there will be temporary business opportunities for them to develop businesses in the service or culinary sectors.

Vulnerable Group

The characteristics of vulnerable groups, such as: (1) Elderly, (2) Women Headed Households, (3) Disable Persons, (4) Poor Households, (5) Living below Poverty Line, and (6) Ethnic Minorities. The table below details the vulnerable groups in around the Groundmounted Solar PV Banyuwangi project area. There is some overlap in the categories of vulnerable groups, such as Household income less than UMR and Household expenses under the poverty line are one household. These households are very economically vulnerable.

Table 4-66 *Cross Vulnerability Components*

Vulnerable Group	Social Unit	Total
Women Headed Household	HHs	16
Household Income Less Than UMR	HHs	33
Household Expenses Under Poverty Line	HHs	1
Household Government Program Recipient	HHs	44
Elderly Headed Household (>64 years old)	HHs	22
Disable Headed Household	HHs	0
Household income less than UMR and Household expenses under poverty line	HHs	1
Household income less than UMR, household government program recipient	HHs	7
Household income less than UMR, women headed household	HHs	5
Household income less than UMR, elderly headed household (>64 years old),	HHs	5
Household income less than UMR, household government program recipient, women headed household	HHs	3
Household income less than UMR, household government program recipient, elderly headed household (>64 years old),	HHs	3

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Vulnerable Group	Social Unit	Total
Household income less than UMR, women headed household, elderly headed household (>64 years old)	HHs	2
household government program recipient, women headed household	HHs	1
women headed household; elderly headed household (>64 years old)	HHs	1

Source: Primary Data, 2023

As a result of the survey, there is an important issue regarding the potential impact of involuntary resettlement. Involuntary resettlement is an economic displacement which may disproportionately affect vulnerable households, included PTPN casual daily workers in Kalipuro Village, PTPN harvest workers (labourers from outside Banyuwangi Regency), and poor households in each affected village.

The majority of daily sugarcane plantation workers in Afdeling Wangkal are women (50 out of 70 workers) from Kalipuro and Ketapang villages. Meanwhile, additional workers during the harvest are brought in from outside the area, such as Jember, Situbondo, and Asembagus. Daily workers do not have a written work contract; they generally submit job requests verbally by attaching a photocopy of their identity card (*KTP*).

The salary received by daily workers outside the harvest period is IDR 45,000 per day and is paid every two weeks. During harvest, daily labourers' wages are assessed based on the tonnage of sugar cane they produce at a rate of IDR 50,000 per ton. They do not receive health benefits and only receive a holiday allowance of IDR 125,000 per year. This daily salary is quite far below the 2024 Banyuwangi Regency UMR, which is IDR 2,638,628.

The potential vulnerability due to the absence of binding employment contracts, no health insurance and wages below the minimum wage will be compounded by the potential loss of their jobs as the plantation area is used as a solar panel installation site. This shows the importance of consideration and mitigation measures to protect and involve workers. daily plantations in project planning and implementation. An important mitigation step in implementing this project is disclosure to this group.

Furthermore, based on AIIB ESF in involuntary resettlement safeguards, poor households may also be potentially impacted by economic displacement. AIIB requires the project proponent to improve the standard of living for this group and other vulnerable group that will potentially be economically displaced.

4.2.3 Characteristic of the Potential Affected Livelihood Groups

4.2.3.1 Overview of the Potential Affected Livelihood Groups

Based on this study, the implementation of a ground mounted solar PV project carries the potential to impact various livelihoods within the community, both directly and indirectly. This impact will mainly be felt by the workforce working in the Wangkal plantation such as daily labourers, harvest labourers, permanent and non-permanent employees of PTPN XII Kaliselogiri Afdeling Wangkal and third parties appointed by PTPN for activities on the plantation land. Farmers, breeders that source grass as animal feed from the plantations, landowners, and plantation farm labourers will be impacted. The construction of Ground-Mounted PV also has an impact on the tourism sector, especially for the managers of Homestay and cafe Omah Telu. In addition, there is a potential impact on public facilities in the form of road access for the community and labourers who use the road in the Wangkal sugar cane plantation area.

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Table 4-67 *Potential Affected Livelihood Group Based on Sectors, Category of Impact and Location*

Sectors	Livelihood	Category of Impact	Impacted by Project Component	Location
Sugarcane Plantation	Daily plantation workers	Direct Permanent Impact	Ground Mounted Solar PV Module Plant switchyard	Kalipuro
	PTPN permanent and non-permanent employees	Direct Temporary Impact (for PTPN permanent employee) Direct Permanent Impact (for casual employees)	Ground Mounted Solar PV Module Plant switchyard	Kalipuro
	Sugarcane Harvest Workers	Direct Permanent and Temporary Impact	Ground Mounted Solar PV Module Plant switchyard	Kalipuro
Agriculture and Farm	Forage grass seeker	Direct Permanent Impact	Ground Mounted Solar PV Module Plant switchyard	Kalipuro
	Landowner Farmers	Direct Permanent Impact (for landowner in transmission tower) Direcet Temporary Impact (for landowner in RoW)	Transmission Line	Kalipuro, Kelir and Giri
	Farm Labourer	Direct Permanent Impact	Transmission Line	Kalipuro, Kelir and Giri
Tourism	Homestay Entrepreneur	Direct Temporary Impact	Ground Mounted Solar PV Module Plant switchyard	Kalipuro
Public Facilities (road access)	Factory Labourer	Direct Tempoorary Impact	Ground Mounted Solar PV Module Plant switchyard	Public
	Communities around the plantation and in general	Direct Temporary impact	Ground Mounted Solar PV Module Plant switchyard	Public

Source: Primary Data, 2023

4.2.3.2 Livelihood Group of Sugarcane Daily Labourer

Overview of the livelihood group

The survey results show that sugarcane day labourers are one of the livelihood groups directly affected by the construction of the Banyuwangi Solar PV Ground Mounts. This group of daily sugarcane workers generally comes from the surrounding communities of Papring, Secang, East Secang, Secang Manggir and Wangkal hamlet of Kalipuro Village and the Pancuran hamlet of Ketapang Village. Meanwhile, the harvest process (once a year) also brings in daily labourers from Bondowoso, Jember and Situbondo.

The proportion of women in daily labourers is approximately 70%. In PTPN there are 4 permanent foremen and 5 freelance daily foremen. The recruitment process is through the foreman who coordinates the labourers. Where the process is only limited to oral communication without a work contract.

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Human Capital

Most of the daily sugar cane workers who work in the Wangkal sugar plantation area are women aged 30-50 years. Generally, they have a low level of education (elementary school level), so they are only able to work as unskilled labourers (non-skilled). All daily sugarcane labourers working in Plantation XII Kaliselogiri Afdeling Wangkal do not receive health benefits/BPJS from the company and only receive a holiday allowance of 125,000/year.

Social Capital

The community members engaged in daily labour within the plantation areas are typically familiar with one another. Generally, they come from the same village. Those involved in the daily harvesting of sugarcane operate within organized groups, each overseen by a supervisor. The foreman takes charge of communicating the work schedule and task specifics to the labourers a day in advance. The allocation of tasks heavily relies on the foreman's judgment, as they possess insights into the capabilities and efficiency of the workers within their respective teams.

Throughout the harvest season, labourers operate in smaller, independently formed groups consisting of 5-10 individuals. The composition of these groups is determined based on the close relationships and performance levels of the workers themselves. The selection of the group's size is a collabourative decision, considering that it significantly impacts the wages earned by the labourers involved in the harvesting process.

Economic Capital

On normal days, if the workload is quite heavy, these labourers can work for 24-25 days a month, while on lighter workloads, their working days are only 14-16 days. The foreman regulates the division of his subordinates' working hours. The working hours of these daily labourers are from 06.00 to 12.00. The monthly wages for labourers outside the harvest season range from a minimum of IDR 720,000 to a maximum of IDR 1,125,000.

During the harvest season, the working hours of daily workers increase. This is because the wages of daily workers are tied to the amount of sugar cane tonnage produced, with wages of IDR 50,000 per ton. The higher the daily tonnage achieved, the higher the wages will be. The performance of workers is highly dependent on the composition and capabilities of the group. On average, each group can harvest between 6-13 tons per day, or equivalent to IDR 300,000 - 650,000 per day. This data illustrates that in general the wages of daily workers at PTPN depend on working hours.

After working on the sugarcane plantation, in the afternoon these female workers usually look for grass for animal feed or help their husbands who work as farm labourers.

Physical Capital

The location of the PTPN The Jalan Surabaya, an asphalt road with a diameter of 5 meters and is on the north side of the sugar cane plantation area. Jalan Surabaya is the main access for PTPN XII to distribute sugar cane harvests to factories in Situbondo. Village road access around Papring and Secang to the plantation area is a village road in the form of a dirt road that has been hardened and is 2-2.5 meters wide and can only be passed by one car and motorbike.

Meanwhile, the production road access in the plantation area is a dirt road that has been hardened, at some points the road condition is bad and has potholes, so need to be careful when driving. This production road is quite wide and can be passed by trucks,

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ordinary cars, and motorbikes. Many production roads are still dirt roads, causing these access roads to be dusty when vehicles pass by during the summer.

Natural Capital

The air temperature at the location is quite hot, which is partly due to the vast expanse of sugar cane plantations without shade trees, making mornings and evenings the optimal periods to appreciate the surrounding views. Not all sections of this vast plantation are dedicated to sugar cane cultivation; there are areas where wild grass thrives, providing breeders with a resource during the rainy season. However, in contrast, the growth of this wild grass is stunted, and it even perishes during the summer. Additionally, during the harvest season, the company permits local communities to utilize cut sugarcane leaves as fodder for animals.

Vulnerability / Sensitivity to Impact

The Banyuwangi Solar PV development plan in the PTPN XII Kaliselogiri Afdeling Wangkal plantation area has a direct impact on daily sugar plantation workers. Most of the daily workers are women with low levels of education who are at risk of losing their jobs if the plantation area is used as a Solar PV Power Plant location. The lack of skills possessed by daily labourers make it very difficult for this group to compete for jobs elsewhere. Among the female workers, there are also widows who are heads of households who are very vulnerable to losing their jobs and sources of household income. This concern about losing their jobs has caused some vulnerable groups to hope that this Solar PV Power Plant project will not be built. This was expressed by a daily worker who is the widow of the head of the household, she mentioned that if there are no more sugar cane plantations, she concerned about where else to look for food for life and her children.

Current Status of the Affected Plantation Laborers

The land acquisition and resettlement study for the Banyuwangi identified approximately 75 workers with the majority of whom are elderly and most of them live in villages near the affected plantation area (Wangkal area). This work has been passed down through generations within their families.

During the visit to the project site, it was reported by staff of the state plantation company (PTPN) that the affected workers had been relocated to work on a coffee plantation since October 2024, which the area also owned by PTNP.

Based on in-depth interviews with a representative of affected plantation workers, after being relocated to work on the coffee plantation, this group has faced significant challenges, including the following:

- The working hours for laborers at the new coffee plantation site in Tetelan Kaliselogiri are approximately 6 to 7 hours per day, typically from 06:00 AM to 13:00 PM. The distance between this new plantation site and the worker's place of residence in Wangkal is approximately 30 kilometers. This significant distance necessitates additional time commitments from the workers beyond their official working hours, particularly for commuting purposes. Based on interviews with representative of the workers, it was reported that they generally depart from a designated meeting point in Wangkal no later than 05:00 AM and return home between 15:00 or 15:00 PM. Consequently, the total time spent by the daily laborers, including both working hours and commuting time, amounts to approximately 10 to 10.5 hours per day.
- Typically, laborers travel using open-bed pick-up trucks equipped with side and rear support bars for safety during transport. The transportation provided is deemed inadequate, consisting of old open-back trucks that frequently break

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down. As a result, workers often have to walk to and from the coffee plantation. Safety concerns are also a common complaint, as the roads are still gravel-based and the trucks are in poor condition due to their age. In addition, the pick-up trucks are considered to neither comfortable nor safe. This is primarily due to the lack of a tarp or cover on the vehicles, which often results in daily laborers being exposed to direct sunlight and rain during their commute to and from the coffee plantation worksite.

- Increased monthly transportation expenses, which are considered significant by the workers. Daily laborers spend approximately IDR 360,000 per month on transportation costs (based on a full work schedule of 24 days). This amount represents around 23% of their total monthly wages
- According to the workers interviewed, the natural conditions and topography of the new working area at the Tetelan Kaliselogiri coffee plantation consist of hilly terrain, with access roads primarily made of gravel. The poor road conditions, combined with the uneven and sloped landscape of the plantation, present significant challenges for the former sugarcane laborers from Wangkal. These workers frequently express concerns about the difficult terrain and limited accesibility. Nevertheless, such complaints are often disregarded by the workers themselves, as the continue to endure the conditions in order to support their fammilies economically. At the present, they have No. viable alternative source of employment.
- The new tasks of involving in harvesting coffee cherries, in this process, female daily laborers are often required to climb coffee trees using ladders. This practice has raised concerns among some workers, who express fear and anxiety about the risk of falling, especially given the absence of safety equipment such as harnesses or securing ropes. These concerns are heightened by the fact that many of the coffee trees are located on slopes or in hilly valleys, further increasing the perceived danger.
- Disruptions to domestic household responsibilities, such as neglected laundry, limited time for childcare, and the need to complete household tasks earlier in the day, resulting in reduced rest time, as workers must wake up before dawn each day.
- The impacts experienced by the relocated plantation laborers will be further analyzed in the LALRP study to clearly identify and present the nature and extent of the impacts resulting from the conversion of plantation land for the Banyuwangi Solar PV project area. This analysis will also serve as the basis for determining appropriate entitlements and designing effective livelihood restoration interventions to mitigate the impacts experienced by the affected workers.

4.2.3.3 Livelihood Group of Livestock Breeder Around the Afdeling Wangkal Plantation Area

Overview of the livelihood group

The results of the study found that one form of savings owned by respondents in the study location was livestock, mainly cows and sheep. The percentage of respondents who use livestock as savings is highest in Kalipuro Village, 15% and Kelir Village, 9%.

Generally, these livestock are kept by their owners themselves and kept by other people or kept together. The distribution of livestock products by means of farming is usually divided between the owner and the keeper, this can be divided between the sales

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proceeds or the share of the profits from owning the calf. The profit sharing of the calf is usually the first calf for the keeper and the second calf for the owner of the cow.

The livestock that are often kept by residents are cows, sheep, and free-range chickens. These cattle and sheep are kept in cages and are rarely kept in cages. Sources of feed for cattle and sheep generally consist of forage grass, straw, corn leaves and sugar cane leaves. Many livestock owners living around the Afdeling Wangkal plantation area take animal feed in the form of grass from the plantation area. During the sugar cane harvest season, many livestock owners take sugar cane leaves as a source of animal feed. Farmers' activities to take forage sources in plantation areas are not carried out every day but depend on needs. The intensity of taking forage increases during the rainy season and vice versa. As a form of savings, livestock are sold when there is an urgent need in the household. The price of cow with *simental* or *limo* species is IDR 30,000,000/cow and cow with Bali species IDR 12,000,000 – 13,000,000/cow.

Human Capital

Livestock owners are generally farmers and agricultural labourers in the study location. Raising cattle and sheep is done independently by the owner, sometimes also assisted by members of the farmer's family. Farmers almost every day look for or collect animal feed for their cows, when looking for animal feed they generally look in the nearest area and if there is no new feed, they look outside the Kalipuro Village. Generally, farmers and day labourers who own livestock have a low level of education, and they can be classified as unskilled labour.

Social Capital

In the Wangkal Hamlet, Kalipuro Village, there are people who act as livestock reporting posts. Most of the livestock farmers around the Afdeling Wangkal plantation area have a network with livestock reporting posts. The livestock reporting post officers play a role in facilitating farmers with veterinarians if there are sick livestock. Farmers in the East Secang area formed the Petanang Jaya Farmers and Livestock Group which consists of 35 people with a total livestock of around 70 cows. The Petanang Jaya farmer and livestock group holds group meetings once a month. In addition to the Petanang Jaya Farmer and Livestock group, around the PTPN plantation area there is also a Bina Lestari farmer group, Bina Lestari group membership generally comes from the Wangkal Hamlet with a total of around 250 members, most members of the Bina Lestari farmer group also raise livestock and utilize grass in the PTPN plantation area.

Economic Capital

Livestock owned by farmers function more as savings, these savings can be exchanged for money if there is an urgent need or urgency due to economic conditions. Livestock owners already know and have livestock collectors in the study location. This relationship is not based solely on economic interests but also has a bond of mutual trust. Livestock prices for cow with Simental species range from IDR 30,000,000/cow and cow with Bali species to IDR 12,000,000 – 13,000,000/cow.

Physical Capital

Livestock owned by farmers are generally kept in cages, the location of the cage is usually not far from the owner's house. The cage is made of wood and has a tile or tin roof. In the cage there is also a container for animal feed and a place for livestock to drink. To keep livestock from escaping from the drum, farmers usually tie livestock with ropes and use barriers around the livestock drum. Apart from cages, farmers also need motorbikes to look for animal feed outside the district, usually the time for searching

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until leaving the district occurs during the summer. Generally, farmers who look for grass do not pay attention to the safety of themselves and other road users. The results of observations found that many grass seekers who use motorbikes do not wear helmets, grass loads that exceed capacity can disturb other road users.

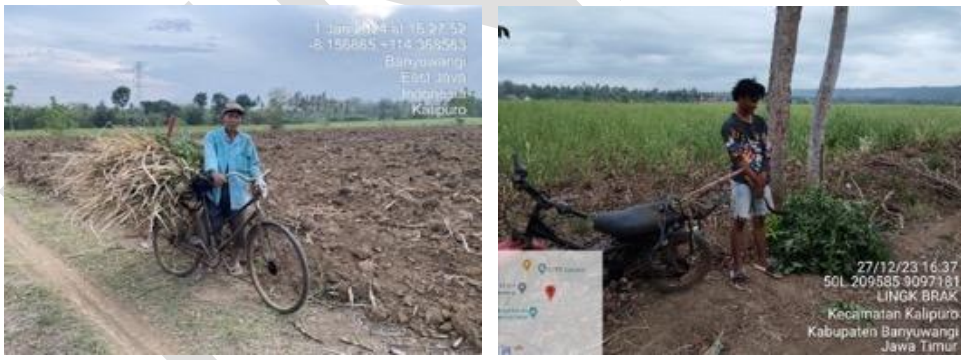
Natural Capital

The rainy season is highly anticipated by farmers in the Afdeling Wangkal plantation area. During this season, farmers can collect animal feed from sugarcane plantation area. Farmers do not routinely look for animal feed in tthe plantation area only, as sometimes they look outside the village, such as Pesucen, Karangrente and Kelir. During the dry season, many farmers buy animal feed, usually in the form of straw and corn leaves.

The sugarcane harvest season is also a time awaited by farmers around the sugarcane plantation area as they can take harvested sugar cane leaves as a source of animal feed according to their needs. The plantation gives permission to farmers to take sugarcane leaves during the harvest season on condition that they do not damage the sugarcane plants.

Vulnerability / Sensitivity to Impact

Farmers located around the Wangkal plantation area are also directly affected by the construction of ground mounted solar PV Banyuwangi. The direct impact felt by these farmers is the loss of the nearest location to take forage sources for animal feed. Estimates of farmers affected by the construction of this project are around 200 farmers. The impact to farmers and grazers of the solar power plant is the loss of nearby access to animal feed, causing farmers and grazers to allocate additional funds to purchase animal feed.



Source: Primary Data, 2023

Figure 4-146 *Farmers Using Forage at the Afdeling Wangkal Plantation Location in the Form of Sugarcane Leaves (left) and Mahogany Tree Leaves (right)*

4.2.3.4 Livelihood Group of Employee PTPN XII Kaliselogiri Afdeling Wangkal

Overview of the Livelihood Group

PTPN XII Kaliselogiri Afdeling Wangkal employees consist of permanent employees and non-permanent employees. Permanent employees are employees who have a permanent working relationship with the company and include state-owned employees. Non-permanent employees are employees who have a non-permanent working relationship with the company.

There are 7 permanent employees, consisting of 1 Plantation Manager, 1 Plant Assistant, 1 finance and administration assistant, 1 Head of Supervisor and 3 Supervisor. Non-permanent employees consist of 7 people, 5 Supervisor and 2 securities. These

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permanent and non-permanent employees have a clear job description and routinely report the results of their work to the Plantation Manager.

Permanent and non-permanent employees work from Monday to Saturday, during the harvest season the intensity of working time for permanent and non-permanent employees increases and sometimes there are no days off. Permanent and non-permanent employees receive a monthly salary, health allowance, labour allowance, 1 month's holiday allowance and 1 set of clothes.

These permanent and non-permanent employees are the groups that are directly affected by the construction of ground mounted solar PV. The direct impact for permanent employees is changing job assignments or transferring to other location within the same company operation, while the direct impact for non-permanent employees is they lose their jobs and sources of household income.

Human Capital

Permanent employees are employees who have education above high school and are skilled workers, especially in managerial skills, finance and technical expertise. Permanent employees generally come from outside the region and often experience shifting work locations within the Company.

Non-permanent employees generally come from the local workforce from Kalipuro Village and outside Kalipuro Village. The education level of non-permanent employees varies, with some having graduated from elementary school, junior high school, and senior high school. These non-permanent employees can be categorized as skilled workers. Permanent and non-permanent employees receive health benefits, labour benefits and holiday allowances. To support productivity, some permanent employees receive employee housing facilities in the plantation area.

Social Capital

PTPN XII Kaliselogiri Afdeling Wangkal Plantation is led by a garden manager. In carrying out his work, the manager is assisted by garden assistants, administrative and financial assistants, and foremen. All employees who work consist of permanent and non-permanent employees. These permanent and non-permanent employees have their respective duties and jobs according to their position and position in the organizational structure. Permanent and non-permanent employees outside of working hours still have a close relationship.

Economic Capital

Permanent and non-permanent employees in the Afdeling Wangkal environment receive wages or salaries based on their position in the organizational structure. While non-permanent employees who are generally foremen and security get different wages: foremen get IDR 2,600,000 per month and security IDR 1,600,000 per month. Non-permanent employees after working in the plantation have other activities such as raising livestock or farming, done to supplement income for plantation work.

Physical Capital

In carrying out their work, permanent and non-permanent employees are supported by facilities such as office areas, housing, warehouses, and other plantation production facilities (carts, and spray equipment). For mobility, permanent and non-permanent employees have motorized vehicles, which are generally privately owned. At work, permanent and non-permanent employees receive K3 clothing and equipment (boots, clothes, and hats).

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For some work in the plantation environment, the plantation hands over work to third parties, such as loading sugar cane (load grabber, transportation facilities (trucks) and mechanization tools in planting sugar cane. In the sugar cane plantation area, there is a production road with an average width of 5-7 meters, in good condition.

Natural Capital

Rainwater is one of the sources of irrigation for the large plantation area of Afdeling Wangkal. The absence of water tanks or *embung* facilities for irrigation sources causes the rainy season to be eagerly awaited by the plantation. The rainy season also causes wild grass to flourish, and this grass can be utilized by the community as animal feed. In addition, the presence of trees around the plantation area is quite helpful for daily labourers who work for protection from the hot sun.

Vulnerability / Sensitivity to Impact

Permanent and non-permanent employees at PTPN XII Kaliselogiri Afdeling Wangkal are groups that are directly affected by the Ground-Mounted PV development plan. The direct impact experienced by PTPN employees is different between permanent employees and non-permanent employees. The direct impact experienced by permanent employees is being transferred to other PTPN business units. While the direct impact felt by non-permanent employees is job loss, especially for employees who become foremen and security, totalling 7 people. This is as stated by finance, and administration assistant for Afdeling Wangkal, that who are permanent employees are not too badly affected, if later the Solar PV Power Plant Project is built, their permanent employees can still work, at most they will be transferred to other places, the most severe impact is felt by non-permanent employees, if it is built, they will lose their jobs and look for work elsewhere.

4.2.3.5 Livelihood Group of Farmers Landowner (Transmission Line)

Overview of the livelihood group

The survey results show that the livelihoods of the community in the study location other than in the business sector are as day labourers, farmers, and farm labourers. These groups of farmers, farm labourers and day labourers are groups that are directly affected by the Ground-Mounted PV transmission line component. The transmission line passes through agricultural land, plantations and at some points is close to people's homes.

The location of the Kalipuro site and transmission line passes through a lot of agricultural and plantation land on dry/forested land. In Kelir Village and Giri Village, some of the footprint points and transmission lines are located on dry plantation land and some are on wet or paddy agricultural land. The most common commodities grown by farmers on agricultural and plantation land are coconut, coffee, bananas, chilies, corn, and rice. Processing of agricultural land and plantations in the study location is carried out by the landowners themselves, farm labourers and tenant farmers.

The construction of the project site and transmission line impacts landowners, farm labourers, coconut tree climbing labourers and tenant farmers. Wages of farm labourers at the site range from IDR 80,000 - 100,000 per day and wages of coconut climbing labourers IDR 5,000 per tree. The land parcels directly affected by the construction of the site and transmission line are generally owned and rented with ownership documents such as land certificates and lease agreements.

Human Capital

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The survey results found that farmers and planters were among the top three main livelihoods of respondents in the study locations. Farmers and planters are found in Kalipuro Village at 21% and Giri Village at 6%, and 3% in Kelir Village.

The cultivation of agricultural land and plantations is mostly done by the landowners themselves, sometimes assisted by hired workers for land cultivation, planting and harvesting. The absorption of farm labour is mostly for agricultural commodities, such as rice, corn, chilies, and vegetables. Meanwhile, the absorption of farm labour on plantation land is more for land clearing and harvesting, such as harvesting coconut, coffee, and other fruit crops.

Social Capital

Around the sugar cane plantation area of Afdeling Wangkal, there is one Bina Lestari farmer group in Wangkal Hamlet of Kalipuro village with 300 members. In Kelir Village there are also 5 farmer groups and 1 Gapoktan with an estimated 120 members. These farmer groups routinely hold monthly meetings, and the farmer group in Wangkal often invites agricultural extension workers to their regular meetings. In addition to meetings, the Bina Lestari farmer group also actively organizes field school activities to increase the capacity of group members. According to one of the administrators of the Bina Lestari Farmer Group in Wangkal, Kalipuro Village, they regularly hold monthly group meetings. One such meeting was holding of a coffee field school, a place to share experiences and practices with fellow farmers.

Besides joining farmer groups, some farmers also have relationships with hired labourers and middlemen. Farmers' relationships with farm labourers are formed from cooperation and mutual trust, while relationships with middlemen are more economic in nature and market agricultural and plantation products.

Economic Capital

Agricultural and plantation commodities often grown by farmers are corn, rice, chili, horticulture, coffee, banana, and coconut. The study results show that commodities that contribute highly to household income are coconut 66%, maize 17% and rice 8%. The high value of these three commodities is inseparable from their potential, production, and marketing access. An overview of agricultural commodity production in the study locations can be seen in the **Table 4-68**.

Table 4-68 *Agricultural Commodity Production in the Study Area*

Commodity	Harvest	Price (IDR)/unit	Market
Coconut	Every 40 days	2,500-3,000/unit	Local Middleman
Corn	Twice a year	1,8000-2,000/Kg (Bushel) 4,500-5,000/Kg (Grain)	Local Middleman
Rice	Twice or third a Year	6,000/kg (grain)	Local Middleman
Coffee	Once a Year	30,000-40,000/Kg (bean)	Local Middleman
Banana	Twice a Year	5,000/Bushel	Food stall and Local Middleman
Chili	Once a Year	35,000-40,000/Kg	Local Middleman

Source: Primary Data, 2023

The coconut commodity contributes the most to household income because it can be grown in yards, moorlands, and agricultural land. In addition to coconut fruit, coconut

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leaves or *janur*[63] are also widely sold by farmers in the study locations. The marketing of *janur* is mostly to Bali, usually for religious rituals and handicrafts.

Physical Capital

Farming communities currently have sufficient physical capital to support their agricultural activities. This can be seen from the availability of access roads to existing agricultural locations. Although not all of them are asphalt roads, they help farmers distribute seeds, fertilizer, and crops. The average farmer has a two-wheeled motorized vehicle which is used as a means of daily transportation.

It was also observed that farmers use horses to carry coconut harvests from the garden to the side of the road or to a place that is accessible by car where the collectors take the coconuts.



Source: Primary Data, 2023

Figure 4-147 *Horse (left) Pick-up Car (right) as a Means of Transporting Coconut Plantation Products at the Study Area*

Natural Capital

Generally, farmers rely on irrigation and rainfed irrigation sources in agriculture. The survey results show that 74% of respondents rely on rainfed irrigation and 23% of respondents source their irrigation from rivers. Farmland with sufficient irrigation water is mostly planted with rice and horticultural commodities, while farmland and plantations that rely on rainfed water plant corn, coffee, bananas, and coconut. Farmers also utilize agricultural land by planting elephant grass, which can be used as animal feed.

Vulnerability/Sensitivity to Impact

The construction of Ground Mounted Solar PV Banyuwangi also has an impact on farmers who own land in the study area. Farmers who are directly affected are farmers whose land is affected by the construction of footprints and transmission lines, these affected farmers are scattered in Kalipuro Village, Kelir Village and Giri Village.

The construction pf the PV sites and transmission lines in Kalipuro and Giri villages will mostly affect plantation land with coconut, coffee, bananas, fruit plants and Sengon *(Paraserianthes falcataria)* commodities, while the transmission lines in Kelir village will pass through mostly rice fields and horticulture gardens.

Additionally, the construction of this transmission line has an impact on farm labourers and coconut pickers as it will disrupt the activities of farmers and labourers causing reduced household income. There are an estimated 50 farmers and labourers affected by the construction of this transmission line.

[63] Januar is the young leaves of several types of large palms, especially coconut, enau, and thatch. Janur is commonly used by a number of ethnic groups in the archipelago as a tool for daily life. The Balinese, Javanese and Sundanese tribes used to use janur to weave for various needs.

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4.2.3.6 Livelihood Group of Port Workers/Labours (Road Users)

Overview of the livelihood group

In this household study, it was found that 8% of respondents had private workers as their main livelihood and 4% of respondents had factory workers as their main livelihood. There are quite a number of private workers or factory labourers in the study location due to the proximity to the Ketapang port area and the Ketapang or new Banyuwangi railway station. Around the port area and train station, there are many seafood industries, shrimp factories, UPP Meneng Pusri, PT Semen Bosowa and other food processing factories.

These industries absorb local labour, including the labour force from the study location. Labourers work weekdays based on shifts (day or night). The wages received are generally equivalent to or above the Banyuwangi minimum monthly wage range of IDR 2,600,000 - 2,800,000. Private sector workers and factory labourers also receive BPJS health benefits, holiday allowances and labour social security (*Jamsostek*).

private workers or factory workers who come from Kalipuro village use the access road in the Afdeling Wangkal plantation area to go their work in the port and train station as the it serves as a shortcut to save on travel time.

Human Capital

Private workers and factory labourers generally have elementary and secondary education levels. To work in factories or private companies, they go through a selection process and meet the requirements set by the company. These private workers and factory labourers are skilled workers.

Social Capital

Private workers and factory workers in companies generally have a work contract mutually agreed between the employer and the worker. This employment contract stipulates the rights and obligations of workers.

Economic Capital

Private workers and factory labourers working in the vicinity of Ketapang Port receive an average monthly wage in line with the Banyuwangi Regency Minimum Wage (UMK), ranging from IDR 2,600,000 to IDR 2,800,000. They also receive health benefits from the Social Security Agency (BPJS), employment benefits, and holiday allowances.

Physical Capital

One of the frequently used access routes by private workers and factory labourers is the production road in the Afdeling Wangkal plantation area. This road is one of the closest routes to Ketapang District. The road is sufficiently wide to accommodate both cars and motorcycles. The access road is unpaved, but it remains in relatively good condition. Motorcycles and cars are common means of transportation used by private workers and factory labourers for commuting to and from Ketapang District.

Natural Capital

The road conditions, mostly unpaved, have the potential to generate dust during the dry season and become muddy during the rainy season. This situation prompts road users, especially motorcyclists, to use protective gear such as helmets to reduce the risk of dust on the access roads to the sugarcane plantations.

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Vulnerability / Sensitivity to Impact

Private sector workers, factory workers, and the communities around the sugarcane plantations who frequently use the access roads in Wangkal afdeeling are directly affected groups by the construction of the Solar PV plant. The direct impact includes the loss of public facilities, leading to increased transportation costs and travel time to work. This group of private sector workers and factory labourers represent a skilled workforce. They are not considered vulnerable as they have regular income and tenure at work.

4.2.4 Stakeholder Engagement, Grievance Redress Mechanism, AIIB PPM and Community Perceptions

Based on AIIB ESF, Consultation and participation are central to achieving the safeguards policy objectives. The consultation carried out by the project proponent needs to be meaningful consultation. Meaningful consultation is a process that:

1. Begins early in the project preparation phase and carried out throughout the project cycle.
2. Provides timely disclosure of relevant and adequate information that is understandable and accessible by the local community.
3. Undertaken in an atmosphere free of intimidation and coercion.
4. Gender inclusive, responsive, and tailored to the needs of affected and vulnerable groups.
5. Enables incorporating all relevant views of affected peoples and other stakeholders into decision-making, such as project design, mitigation measures, consultation on benefits and opportunities, and implementation issues.

4.2.4.1 Project Stakeholder Engagement

An effective impact assessment requires engagement with relevant stakeholders. This assists in understanding stakeholder views on the Project and in identifying issues that should be considered in the prediction and evaluation of impacts, also in project planning.

Stakeholder engagement is expected to be a continuous process throughout project stages, undertaken through a broad range of consultation during the identification of impacts, information disclosure and partnership building. Maintaining good relations with stakeholders becomes the Project main concern, not only as social license to operate, it is also an important means of receiving community feedback on project related concerns and also disseminating project related information to the community.

4.2.4.1.1 During EIA Consultation

The Client had already made efforts towards stakeholder engagement particularly with the communities of the villages fall within the Project's area of influence (AoI). As part of the EIA or locally known as AMDAL, the Project had completed an initial public consultation for in the Banyuwangi Solar PV Power Plant Project. **Appendix B** provide a summary of the public consultation undertaken as part of the regulatory EIA requirement.

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Figure 4-148 *Public consultation as part of the regulatory EIA requirement for the Banyuwangi Solar PV Power Plant Project*

4.2.4.1.2 During ESIA Scoping

During the ESIA scoping site visit conducted on 24th to 25th July 2023, AFRY on behalf of the Project carried out stakeholder consultation consistent to international standard requirements to the potentially affected community in Kalipuro, representative of plantation worker, and to the management of PTPN XII Afdeling Wangkal. Several issues / topics were covered during the consultations such as issues related to land area within the plantation, plantation workers, local economic and culture, and issue related to sugarcane harvesting mechanism and livelihood profile of the plantation workers.

The stakeholder consultations were also conducted to identify any sensitive environmental and social impact receptor, and level of knowledge of the local community on the proposed project (perception and expectation), and initial feedback on the project potential impact.

To conduct meaningful consultation, the identification of stakeholders should be carried out. AIIB ESF required the project proponent to identify stakeholder groups and stakeholder engagement activities that have been carried out.

Table 4-69 *Identification of Stakeholder*

Villages	Stakeholder Representative	Issues
Kalipuro	Head Village	Coordination and socialization of the project
Kalipuro	Hamlet Representative	Coordination and socialization of the project
Kalipuro	Farmer Groups	Farmer Livelihood
Kalipuro	Education Representative and Affected Group	Coordination and socialization of the project
Kalipuro	Education Representative and Affected Group	Coordination and socialization of the project
Kalipuro	Tourism and Affected Group	Tourism Livelihood
Kalipuro	Tourism	Tourism Livelihood
Kalipuro	Affected Breeder	Breeder Livelihood
Kalipuro	Affected Breeder and Affected Labourer	Breeder and Labourer Livelihood
Kalipuro	CH Representative	Cultural Heritage
Kalipuro	Youth Representative and Community Social	Coordination and socialization of the project
Kalipuro	Youth and Access Road	Farmer Livelihood
Kalipuro	Access Road	Coordination and socialization of the project
Kalipuro	Hunter and Affected Group	Coordination and socialization of the project

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Villages	Stakeholder Representative	Issues
Kalipuro	Affected Labourer and Affected Group	Labourer Livelihood
Kalipuro	Public Health Center	Coordination and socialization of the project and Community Health
Kalipuro	Youth Representative	Coordination and socialization of the project
Kalipuro	PTPN and Affected Labourer	Labourer Livelihood
Kalipuro	Affected Labourer	Labourer Livelihood
Kalipuro	Education Community	Education
Kalipuro	Affected Transmission Line	Coordination and socialization of the project and Land Acquisition
Kalipuro	CH Representative	Cultural Heritage
Kalipuro	Affected Labourer	Labourer Livelihood
Kalipuro	Affected Breeder	Breeder Livelihood
Kalipuro	Affected Breeder	Breeder Livelihood
Kalipuro	Public Health Center	Coordination and socialization of the project and Community Health
Kalipuro	PTPN and Affected Labourer	Labourer Livelihood
Kalipuro	PTPN and Affected Labourer	Labourer Livelihood
Kalipuro	Youth Representative	Coordination and socialization of the project
Kalipuro	Education Representative	Education
Kalipuro	Public Health Center	Coordination and socialization of the project and Community Health
Kalipuro	Public Health Center	Coordination and socialization of the project and Community Health
Kalipuro	Affected Land Acquisition Affected Transmission Line	Coordination and socialization of the project and Land Acquisition
Kalipuro	Affected Land Acquisition Affected Transmission Line	Coordination and socialization of the project and Land Acquisition
Giri	Head Village	Labourer Livelihood
Giri	Youth Representative	Coordination and socialization of the project
Giri	Education Representative	Education
Giri	Public Health Center	Coordination and socialization of the project and Community Health
Giri	Community Social	Coordination and socialization of the project and Empowerment
Giri	Community Social	Coordination and socialization of the project and Empowerment
Kelir	Head Village	Coordination and socialization of the project
Kelir	Village Goverment	Coordination and socialization of the project
Kelir	Village Goverment	Coordination and socialization of the project
Kelir	Affected Farmer and Affected Transmission Line	Farmer Livelihood and Land Acquisition
Kelir	Education Representative and Affected Transmission Line	Education and Land Acquisition
Kelir	Education Representative and Affected Transmission Line	Education and Land Acquisition
Kelir	Farmer Groups	Farmer Livelihood
Kalipuro	Head Village	Coordination and socialization of the project
Kalipuro	Hamlet Representative	Coordination and socialization of the project
Kalipuro	Farmer Groups	Farmer Livelihood
Kalipuro	Education Representative and Affected Group	Coordination and socialization of the project
Kalipuro	Education Representative and Affected Group	Coordination and socialization of the project
Kalipuro	Tourism and Affected Group	Tourism Livelihood
Kalipuro	Affected Breeder	Breeder Livelihood

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Villages	Stakeholder Representative	Issues
Kalipuro	Affected Breeder and Affected Labourer	Breeder and Labourer Livelihood
Kalipuro	Youth and Access Road	Farmer Livelihood
Kalipuro	Access Road	Coordination and socialization of the project
Kalipuro	Hunter and Affected Group	Coordination and socialization of the project
Kalipuro	Affected Labourer and Affected Group	Labourer Livelihood
Kalipuro	Public Health Center	Coordination and socialization of the project and Community Health
Kalipuro	Youth Representative	Coordination and socialization of the project
Kalipuro	PTPN and Affected Labourer	Labourer Livelihood
Kalipuro	Affected Labourer	Labourer Livelihood
Kalipuro	Affected Transmission Line	Coordination and socialization of the project and Land Acquisition
Kalipuro	Affected Labourer	Labourer Livelihood
Kalipuro	Affected Breeder	Breeder Livelihood
Kalipuro	Affected Breeder	Breeder Livelihood
Kalipuro	Public Health Center	Coordination and socialization of the project and Community Health
Kalipuro	PTPN and Affected Labourer	Labourer Livelihood
Kalipuro	PTPN and Affected Labourer	Labourer Livelihood
Kalipuro	Public Health Center	Coordination and socialization of the project and Community Health
Kalipuro	Affected Land Acquisition Affected Transmission Line	Coordination and socialization of the project and Land Acquisition
Kalipuro	Affected Land Acquisition Affected Transmission Line	Coordination and socialization of the project and Land Acquisition
Giri	Head Village	Labourer Livelihood
Giri	Youth Representative	Coordination and socialization of the project
Giri	Public Health Center	Coordination and socialization of the project and Community Health
Giri	Community Social	Coordination and socialization of the project and Empowerment
Kelir	Head Village	Coordination and socialization of the project
Kelir	Village Goverment	Coordination and socialization of the project
Kelir	Village Goverment	Coordination and socialization of the project
Kelir	Affected Farmer and Affected Transmission Line	Farmer Livelihood and Land Acquisition
Kelir	Education Representative and Affected Transmission Line	Education and Land Acquisition
Kelir	Education Representative and Affected Transmission Line	Education and Land Acquisition
Kalipuro	Head Village	Coordination and socialization of the project
Kalipuro	Hamlet Representative	Coordination and socialization of the project
Kalipuro	Farmer Groups	Farmer Livelihood
Kalipuro	Education Representative and Affected Group	Coordination and socialization of the project
Kalipuro	Education Representative and Affected Group	Coordination and socialization of the project
Kalipuro	Tourism and Affected Group	Tourism Livelihood
Kalipuro	Affected Breeder	Breeder Livelihood
Kalipuro	Affected Breeder and Affected Labourer	Breeder and Labourer Livelihood
Kalipuro	Youth and Access Road	Farmer Livelihood
Kalipuro	Access Road	Coordination and socialization of the project

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Villages	Stakeholder Representative	Issues
Kalipuro	Hunter and Affected Group	Coordination and socialization of the project
Kalipuro	Affected Labourer and Affected Group	Labourer Livelihood
Kalipuro	Public Health Center	Coordination and socialization of the project and Community Health
Kalipuro	Youth Representative	Coordination and socialization of the project
Kalipuro	PTPN and Affected Labourer	Labourer Livelihood
Kalipuro	Affected Labourer	Labourer Livelihood
Kalipuro	Affected Transmission Line	Coordination and socialization of the project and Land Acquisition
Kalipuro	Affected Labourer	Labourer Livelihood
Kalipuro	Affected Breeder	Breeder Livelihood
Kalipuro	Affected Breeder	Breeder Livelihood
Kalipuro	Public Health Center	Coordination and socialization of the project and Community Health
Kalipuro	PTPN and Affected Labourer	Labourer Livelihood
Kalipuro	PTPN and Affected Labourer	Labourer Livelihood
Kalipuro	Public Health Center	Coordination and socialization of the project and Community Health
Kalipuro	Affected Land Acquisition Affected Transmission Line	Coordination and socialization of the project and Land Acquisition
Kalipuro	Affected Land Acquisition Affected Transmission Line	Coordination and socialization of the project and Land Acquisition
Giri	Head Village	Labourer Livelihood
Giri	Youth Representative	Coordination and socialization of the project
Giri	Public Health Center	Coordination and socialization of the project and Community Health
Giri	Community Social	Coordination and socialization of the project and Empowerment
Kelir	Head Village	Coordination and socialization of the project
Kelir	Village Goverment	Coordination and socialization of the project
Kelir	Village Goverment	Coordination and socialization of the project
Kelir	Affected Farmer and Affected Transmission Line	Farmer Livelihood and Land Acquisition
Kelir	Education Representative and Affected Transmission Line	Education and Land Acquisition
Kelir	Education Representative and Affected Transmission Line	Education and Land Acquisition

Source: Primary Data, 2023

4.2.4.1.3 During ESIA Baseline Study

Stakeholder engagement in this baseline merely covers a general overview of what has been done by PT PLN Indonesia Power as the project proponent in the process of engaging and consulting with stakeholders who have interests and influence concerning the Ground mounted PV Banyuwangi. The detailed stakeholder engagement will be referring to Stakeholder Engagement Plan (SEP) document.

Table 4-70 *Consultation carried out with Project Stakeholders*

Date	Stakeholders	Description	Remarks
30 March 2023 Kalipuro Village Hall	Interest Group • Energy and Mineral Resources agency of East Java Regency • Plantation Agency of East Java Regency	The public consultation has been conducted as a stage in the Environmental Impact Assessment (AMDAL). This	The conducted socialization has only been carried out once and has been recorded. The socialization needs to be improved, as indicated by the Environmental Impact Assessment (AMDAL) Report,

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Date	Stakeholders	Description	Remarks
	• Environmental Agency of Banyuwangi Regency • Regional Development Planning Agency (BAPPEDA) of Banyuwangi Regency • Publik Works, Spatial Planning, and Land Agency of Banyuwangi Regency • Manpower, Transmigration, and industry Agency of Banyuwangi Regency • Transportation Agency of Banyuwangi Regency • Health Agency of Banyuwangi Regency • Health Agency of Banyuwangi Regency • Regional Civil Service Police Unit (Satpol PP) of Banyuwangi Regency • Head of Kalipuro District • Military Commander of Kalipuro District • PTPN XII Kebon Kaliselogiri Wangkel Division • NGO • Head of Kalipuro Village • Head of Bulusan Village • Head of Klatak Village • Community Representative of Kalipuro Village • Community Representative of Bulusan Village • Community Representative of Klatak Village	public consultation discussed the plan for Solar PV Banyuwangi (including the project owner, location, timeline, and planned activities).	most of relevant stakeholders participating in public consultations are at the district and provincial levels. Therefore, it is necessary to involve interest groups at the village level, such as community organizations, etc.
None	Direct Group	There hasn't been any socialization conducted for the indirect affected groups.	The Community already knows the construction planning of Solar PV in informal ways. There has not been any further socialization to direct affected group.
None	Indirect Group	There hasn't been any socialization conducted for the indirect affected groups.	The Community already knows the construction planning of Solar PV in informal ways. There has not been any further socialization to indirect affected group.

Source: Primary Data, 2023

Based on in-depth interviews with stakeholders in the study area, it is known that the community has strong ties with the Islamic boarding schools around the study area. Islamic boarding schools have a strong position in the Banyuwangi community.

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Especially boarding schools that have the possibility of being affected by projects such as Nurul Khoiroh Islamic Boarding School which is affected by the transmission line where in the interview explained that the boarding schools need to be involved as one of the key stakeholders to overcome the issues circulating in the community. It is because the boarding school has a strong social position and traditional structure in the Banyuwangi community.

4.2.4.1.4 During ESIA Disclosure

The ESIA disclosure was conducted on May 6, 2025, in Kalipuro Village and May 7 in Giri Village. The ESIA study results presentation session was conducted in front of an audience and the discussion session was separated into small groups according to participants and types of impacts. This approach was taken to better accommodate input and responses from all participants so that the consultation process becomes more meaningful.

The following is a summary of input, concerns and responses from participants in the discussion results.

The PLTS Banyuwangi project has raised various community concerns that highlight the importance of inclusive and transparent planning. One major issue is the potential for jealousy or tension during labor recruitment, as seen in previous projects like the GITET 500 kV in Kalipuro. To avoid repeating this, it is recommended that recruitment prioritize affected households and involve early coordination with local stakeholders. Additionally, the construction phase may disrupt the daily routines of harvest workers due to longer commutes, increasing the burden on household responsibilities. There are also concerns about the potential health and environmental impacts of the solar panels, including temperature changes and effects on crops and livestock. Misunderstandings about the project's scope have led to confusion, emphasizing the need for clear communication, particularly about the overhead transmission lines and their safety zones.

The community has expressed hopes that the PLTS project can bring long-term benefits, such as developing local tourism and improving livelihoods. To support this, Corporate Social Responsibility (CSR) initiatives are encouraged, particularly in empowering local MSMEs and improving education, with a focus on impacted communities. Internal social tensions—like those between youth groups—also require attention to maintain cohesion. Safety concerns were highlighted, especially regarding children playing near transmission lines. Residents also emphasized the need for fair compensation for affected land and plants, and for construction activities to be managed safely, ideally scheduled after 4:00 PM to minimize disruption. Overall, the community urges PT Indonesia Power and its partners to prioritize transparency, fairness, safety, and local empowerment throughout the project's implementation.

4.2.4.1.5 During LALRP Disclosure

LALRP consultations were conducted twice. The first was conducted in general with a large number of participants in 1 session in mid-February 2025. Meanwhile, the second disclosure was conducted on May 6 and 7, 2025 in Kalipuro Village and Giri Village. This second disclosure accommodated participants into small groups to ensure meaningful consultations. The LALRP disclosure discussion in Banyuwangi was divided into 6 sessions with participants divided according to village location and type of impact. The following are the main points that are the results of the discussion of land-affected community groups:

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Community concerns across various locations centred on fair and timely compensation, livelihood loss, land value decline, safety near project sites, unclear construction timelines, limited local job opportunities, and delays in grievance handling. Many also raised issues about non-certified land rights, inaccessible complaint channels, and miscommunication about project scope. In response, PT PLN Indonesia Power stated that compensation will follow legal and market-based appraisals, with disbursement targeted by December 2025. A Livelihood Restoration Program (LRP) is being prepared to support affected communities through training and MSME development. Construction is scheduled for 2026 pending permits, with recruitment prioritizing affected and qualified locals. Issues like missed assets, safety zones, and local commuting difficulties are being addressed, and grievance channels will be improved through clearer communication and coordination with stakeholders.

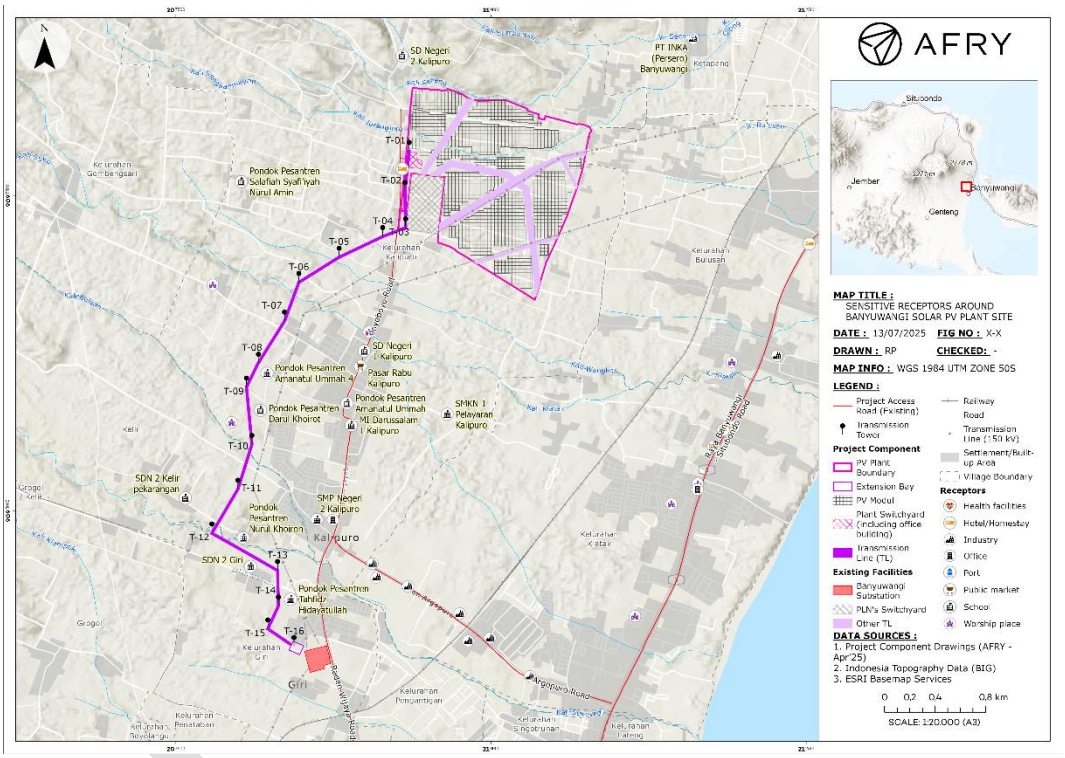


Figure *4-149* *Potential Sensitive Receptors Around Project Area*

4.2.4.2 Grievance Redress Mechanism for Project Affected Communities

The Grievance Redress Mechanism (GRM) is an integral component of the Stakeholder Engagement, which was formulated following the completion of the baseline study. AIIB mandates that the project proponent establishes and sustain the GRM to address and assist in handling the concerns and grievances of the affected individuals. The GRM will be implemented throughout each stage of project development, extending into the operational phase of the Groundmounted Photovoltaic.

This grievance mechanism is designed to receive and facilitate resolution of affected communities' concerns and grievances related to the Project's environmental and social performances. The grievance mechanism is scaled to the risks and adverse impacts of the Project and have affected communities as its primary users. It will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate and readily accessible, and at no cost and without retribution to

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the party that originated the issue or concern. PT PLN Indonesia Power will inform the affected communities about the mechanism early in the course of the stakeholder engagement process.

The general flow of the GRM to be implemented by the Banyuwangi Solar PV Project in identifying appropriate resolution for each of the received grievance is proposed as illustrated in **Figure 4-150**.



Figure 4-150 *General steps of Grievance Tracking Redress Mechanism*

Detail description of the proposed Grievance Redress Mechanism for the Banyuwangi Ground Mounted Solar PV Power Plant Project is presented in **Table 4-71.**

Table 4-71 Detail steps of Project Grievance Redress Mechanism

Step	Description	Timeline	PIC
Step 1: Receipt of Grievance	Receiving and keeping track of grievances by recording them as they come in, registering them in a central place and tracking them throughout the processing cycle to reflect their status an important detail. The Project will keep track of cases by using a grievance log in the form of table or matrix. This process is suggested to be quickly implemented, within 3 to 5 days after receiving complaints. Clear involvement of contractors from this early stage is essential to ensure all complaints (including those received by contractor on-site personnel) are recorded and tracked.	3 – 5 Days after receiving complaints.	GRM officer/ management of Project SPC and EPC Contractor
Step 2: Record / Delegate			
Step 3: Fact Finding	Reviewing and investigating grievances by appointing the right investigation team (no conflict of interest), developing clear tasks and	7 – 14 Days after receiving complaints	GRM officer/management of Project SPC

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Step	Description	Timeline	PIC
	responsibilities, and conducting the meeting with complainants and visiting the site if appropriate. Grievance review will include categorisation of significance of the complaint, with consideration of the impact scale of the complaint. This process is suggested to be undertaken within 7 – 14 days (depend on the grievance category) from when the complaint is received. Should any complaints be related to construction activities/impacts, investigation will also involve contractors.		and EPC Contractor
Step 4: Resolution / Appeal	Developing resolution options, preparing a response to be communicated, and consulting the options with the complainants. This stage will include a circular process of going back to the complainant to communicate the grievance resolution. Grievance resolution implementation is expected to be completed within 30 days of receiving of the complaint.	30 Days after receiving complaints	GRM officer/management of Project SPC and EPC Contractor
Step 5: Feedback / Close out	Monitoring and evaluation of the effectiveness of the implemented grievance resolution through feedback, which will be continuous and circular process.	After the completion of the grievance resolution.	GRM officer/management of Project SPC and EPC Contractor

The disclosure and communication of the Project grievance redress mechanism will begin early in the Project lifecycle and continue an on-going basis as grievances arise. It will be disclosed in a culturally appropriate manner in the local language and format that is understandable to the project affected people. The following information will be disclosed:

- Who can raise complaints (focusing on affected communities);
- Where, when, and how community members can log complaints;
- Who is responsible for receiving and responding to complaints, and if any external parties can receive complaints from communities;
- What type of responses complainants can expect from the Project including timing of responses; and
- The benefits that complainants can receive from using the grievance mechanism.

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It is essential that the local government (and all contractors) also fully understand the mechanism to enable them to communicate the step-by-step process to the project affected people, particularly in the case where the grievances are submitted to them for resolution.

PT PLN Indonesia Power as the Project Proponent has committed for implementation of the on-site based grievance mechanism to be initiated align with the commencement of the Project pre-construction activities

As of the current stage of the Project development, for any grievances it can be submitted / communicated to the Project Proponent at the following contact number and address as presented in **Table 4-72**.

Table 4-72 GRM contact point for the Banyuwangi Solar PV Project

PT PLN Indonesia Power	
Address	Jl. Jenderal Gatot Subroto Kavling 18, Kuningan Timur Setiabudi, South Jakarta, 12950
PIC	Amir Hakim
Telephone	+62 812 1691 8158
Email/Website	amir.h@plnindonesiapower.co.id

4.2.4.3 AIIB Project-Affected People's Mechanism (PPM)

AIIB's Policy on the PPM applies to this Project. The PPM has been established by AIIB to provide an opportunity for an independent and impartial review of submissions from Project-affected people who believe they have been or are likely to be adversely affected by AIIB's failure to implement the Environmental and Social Policy in situations when their concerns cannot be addressed satisfactorily through the project-level GRM or the processes of AIIB's Management.

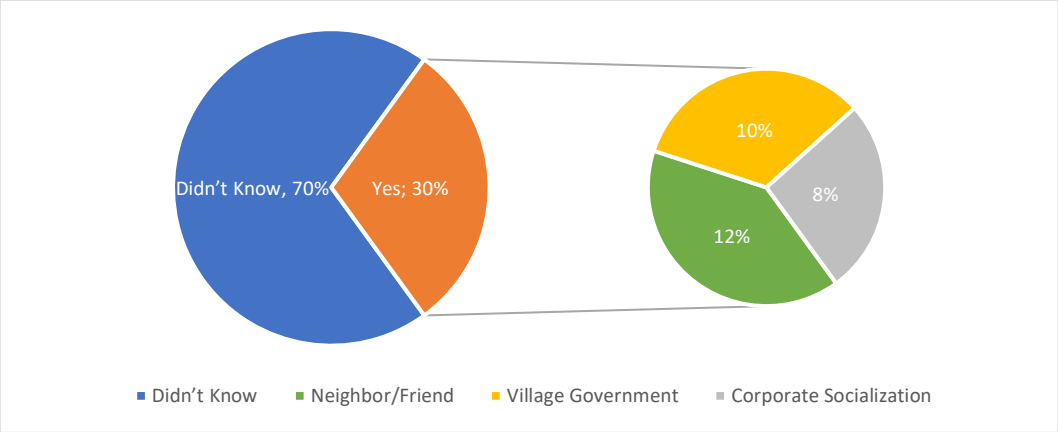
Information on AIIB's PPM is available at the following link:

https://www.aiib.org/en/about-aiib/who-we-are/project-affected-peoples-mechanism/how-we-assist-you/…

4.2.4.4 Community Perception on the Project

The community's perception of a project significantly influences its success and impact on the surrounding environment. This report will explore various community perspectives related to this project, encompassing diverse viewpoints that reflect various values, needs, and expectations of the community. Through this assessment, it is hoped that a deeper understanding can be gained of how the involved community perceives and comprehends the project. As depicted in the graph below, most of the community (70%) don't know about the project, while 30% of respondents are informed about it. Respondents who are aware of the project obtain information from neighbors or friends (12%), village government (10%), and corporate socialization (8%).

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Source: Primary Data, 2023

***Figure 4-151** Percentage of Community's Knowledge of Solar Power Plant Development in the Study Area*

The survey data above indicates that most respondents in the study area are not yet aware of the Ground-mounted Solar PV Banyuwangi project plans. The lack of awareness among respondents regarding this project is attributed to the limited socialization events about the project to the community. Public outreach or consultations involving the community and stakeholders have only been conducted once on March 23, 2023, at the Kalipuro Village Meeting Hall. This has resulted in a lack of information about the project plans among respondents in the Giri Village and Kelir Village.

However, during an interview with the Head of Kelir Village, he expressed his ignorance regarding the project plan, as stated that the community had not heard of the Ground-Mounted PV construction plan, the village government also only found out when the Baseline Social team came to the village office, and only found out that there were two towers entering the area. However, they did not object if the affected community received appropriate compensation for the impact. GRM in Kelir Village is usually conveyed in the following scheme: RT, RW, Kadus, Kades and upholding deliberation.

The interviews also managed to summarize the distribution of information that occurs at the grassroots of the project area, where local communities obtain information from word of mouth. Based on the results of interviews with local communities in Secang Sub-village who obtained information about the project plan, the information that is developing in the community is that PTPN land will be used as an electricity substation to supply electricity to Bali. The information was received by residents from PLN officers who were maintaining the network and electricity poles in the Kalipuro Village area, this issue has been widely known by the community around the plantation location. However, many residents are unaware of the Ground-Mounted PV construction. In the community's opinion, it must be getting hotter in this area because there is a reflection of light from the panels.

General Perception of the Potentially Affected Community Toward the Project

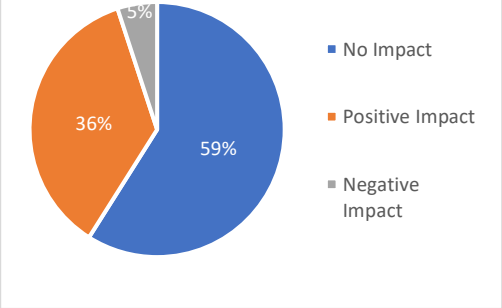
The limited awareness among respondents about the project plans also influences their perceptions of the impacts resulting from the project development activities. 59% of respondents perceive no impact, 36% perceive positive impacts, and only 5% perceive negative impacts from the project development activities. A detailed overview of respondent's perceptions regarding the impact of the planned project development activities can be seen in the **Figure 4-152**.

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The positive impact according to respondents was more about Ground-Mounted PV technology being more environmentally friendly, providing benefits to the surrounding community, such as street lighting, absorption of local labour and was a government program whose purpose was for the national interest and prosperity of the wider community. Meanwhile, the reasons for negative impact on the surrounding community from respondents were the loss of jobs as sugar cane labourers, the location was close to the community's settlement, there might be residents who refused because their land was affected by the project, the reduction of green land, the temperature around the location increased in heat and there was no socialization about the project which did not provide space for the community to assess and criticize the project plan.

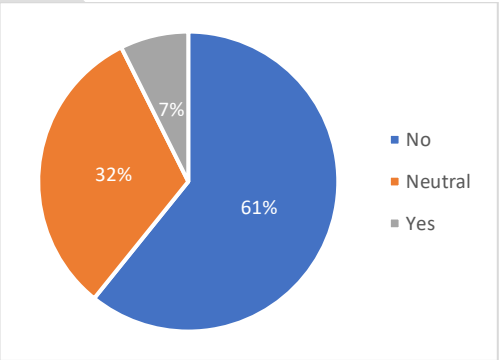
Based on Kalipuro Youth Representative, the youth expect that the construction of Ground-Mounted PV can absorb quite a lot of labour for construction and maintenance so that it can have a positive impact on the surrounding community. Youth accept the development plan on the condition that it involves local labour and provides benefits as well as providing free access to electricity for street lighting in the sub-villages around the Ground-Mounted PV. As long as there are benefits for the surrounding community, the development plan can be supported.

Respondents at the study site also assessed whether the planned project activities disturbed the scenery around the sugarcane plantation area, 61% of respondents considered that the project development activities did not disturb the view, 32% of respondents were neutral and 7% of respondents considered that the project development activities disturbed the surrounding scenery. The reason the respondents found the project activities disturbing was because they could not see the view of the Bali Strait, lose the green sugar cane land, and change the Ground-Mounted PV solar panels. An overview of respondents' assessments can be seen in the **Figure 4-153**.



Source: Primary Data, 2023

Figure 4-152 *Percentage of Community Information Source Solar Power Plant Development*



Source: Primary Data, 2023

Figure 4-153 *Community Perception About Solar Power Plant Visual Pollution in the Study Area*

Issues, Concerns, and Expectations Toward the Project

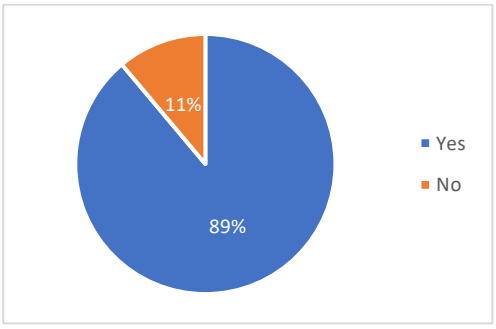
In this study also looked at the perception of respondents' expectations of the Ground-Mounted PV development activity plan at the study site, the study results found that most respondents had expectations of the project activity plan with a percentage of 89% and 11% of respondents had expectations regarding the Ground-Mounted PV project activity plan. Respondents' expectations of Ground-Mounted PV project development activities were mostly related to the absorption of local labour, economic development

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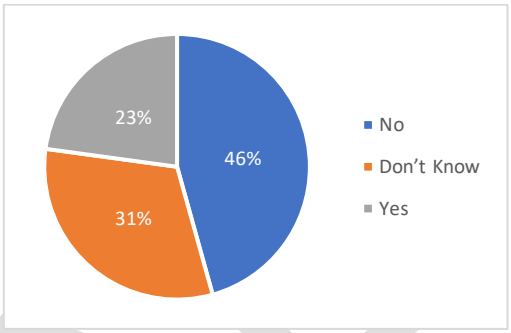
of the surrounding community, improvement of road infrastructure, lighting, and educational assistance.

However, based on interviews in the field with the administrators of Fathul Ulum Islamic School, they explained that the board of the boarding school and the surrounding residents support the development. There is an expectation to continue to open access roads for residents and the public considering that the road is an alternative penetrating road that is widely used by the community.



Source: Primary Data, 2023

Figure 4-154 *Percentage of Community Expectation on Ground-Mounted PV Development in Study Area*



Source: Primary Data, 2023

Figure 4-155 *Percentage of Community Perception of Solar Power Plant Impacts in Study Area*

Based on the results of the study, 46% of respondents in the study location had no concerns related to the Ground-Mounted PV development activity plan, 31% of respondents answered that they did not know and 23% of respondents had the perception that there were concerns related to the Ground-Mounted PV development activity plan. The high percentage of respondents who are not worried about the planned project activities is more due to the location of the project development far from the settlements and the project is carried out by experts and considers safety aspects. Meanwhile, respondents who felt worried about the Ground-Mounted PV project development activities were worried about losing their jobs in sugarcane fields, lack of animal feed, worried about the impact of radiation from the SUTT network (*Saluran Udara Tegangan Tinggi* - High Voltage Overhead Line) and loss of land due to the transmission line tower site. Respondents who had a perception of worry related to the Ground-Mounted PV development activity plan were found in Kalipuro Village and Giri Village. The high level of concern in these two locations is because these two villages are the locations where most of the Ground-Mounted PV components are built, such as the location of solar panel modules and the addition of a location for the PLN substation.

Level of Acceptance on the Project

One of the important points of this study was to see respondents' perceptions of whether they supported or rejected the planned solar power plant project development activities. The results of the study showed that 57% of respondents supported the project development plan, 42% chose neutral and only 1% of respondents rejected the Ground-Mounted PV project development activity plan (**Figure 4-156**).

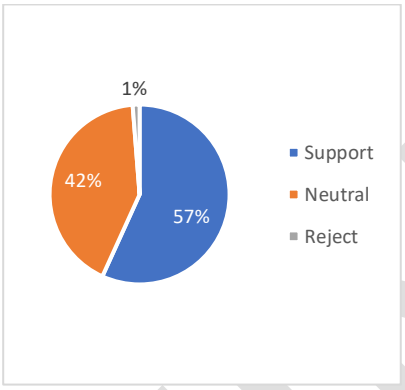
Respondents with favourable perceptions considered the Ground-Mounted PV project to be in the public interest, providing benefits to the community, opening employment opportunities for local people, and improving the local economy. Respondents with neutral perceptions were found in Giri Village and Kelir Village. Respondents who were neutral were respondents who did not know the details of the project plan, so they

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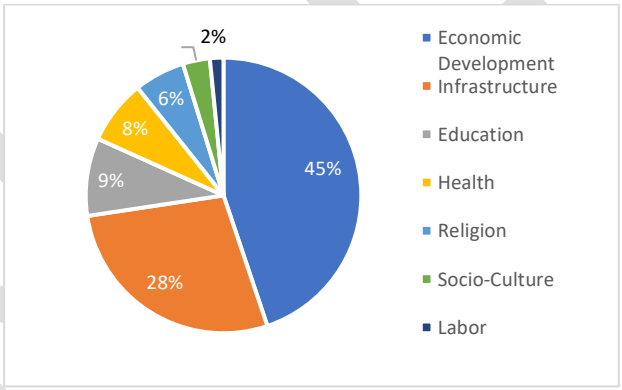
preferred to leave it to the government to implement the project. The study also found respondents in Kelir and Kalipuro Villages who rejected the Ground-Mounted PV project development plan. The emergence of respondents' perceptions that rejected the Ground-Mounted PV project development caused a decrease in the productivity of coconuts affected by the project and loss of jobs and sources of income.

However, there was resistance from owner of Omah Telu Homestay, a tourism support facility because of the possibility of the project having a direct impact on their business. The Omah Telu Homestay and Café just opened on December 15, 2023 on a rented land and building renovated to be used as lodging and restaurant facilities. Building leases began in early 2023 and renovations and adjustments were made. The land is rented initially for for two years and may be extended (5-10 years) in the future. The choice of this location was due to a good view and information from the owner that the land is a plantation green belt so there is no development of any kind. The business owner was not aware of the plan for a Ground-Mounted PV Plant. The owner oppose the development as this may affect his business, potentially ceasing operation if the Ground-Mounted PV is built.



Source: Primary Data, 2023

Figure 4-156 *Percentage of Community Perception of Solar Power Plant Development in Study Area*



Source: Primary Data, 2023

Figure 4-157 *Percentage of the Program Expected by the Community if there is a Solar Power Plant Project in the Study Area*

Regardless of the decision to support or oppose the construction of Solar PV, respondents have expectations that the implementation of Solar PV will bring about programs for them. Based on the survey results (**Figure 4-157**), there are seven programs that respondents anticipate, namely: (1) Economic Development, (2) Education, (4) Health, (5) Religion, (6) Socio-Culture, dan (7) Labour.

It is evident that most respondents in all villages within the study area desire economic development. Respondents wish for infrastructure programs, which may involve road repairs or widening due to the limited road access in Kulurejo Village, considering its relatively high population density. However, the desire for job programs or employment opportunities is expressed only by respondents in Kalipuro Village and Giri Village. Local workforce absorption would be prioritized, especially considering the availability of both skilled and unskilled labour that can be tailored to the needs of businesses and the capabilities of the local community.

The conclusion drawn from respondent's preferences for desired programs is outlined below:

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- Kelir Village:

Respondents in Kelir Village mostly supported the planned activities for the construction of the Ground-Mounted PV project, respondents also hoped that by supporting the project there would be assistance for the community such as economic development, infrastructure improvements and educational assistance. In Kelir Village, the impact of project development is minimal, with more landowners and farmers affected by the transmission line. Although the impact is very minimal in Kelir village, respondents also hope that there will be project socialization to the affected communities by involving representatives of community leaders and government authorities.

The emergence of the importance of project socialization in Kelir Village is based on the results of the study which found many neutral perceptions from respondents, this neutral perception is more about the lack of knowledge and the absence of complete information about the project to the community. In Kelir Village there were also respondents who rejected the project development plan, this rejection was more based on the experience experienced by the community when there was a felling of coconut trees for the PLN transmission line, the felling of coconut trees was not compensated even though for the community coconut plants were the main source of income.

- Kalipuro Village:

Kalipuro Village is the area most affected by the project when compared to other villages, the project components in Kalipuro include ground mounted solar PV modules, switchyard plants and transmission lines. Most respondents in Kalipuro Village are aware of the project and support the Ground-Mounted PV development project plan. Respondents also expect the construction of the Ground-Mounted PV project to provide benefits and positive impacts on the surrounding community, the results of surveys and interviews there are several points expected by the community and respondents in Kalipuro village:

- The absorption of local labour is in accordance with the skills required by the contractor. The absorption of local labour is prioritized to the young generation and daily labourers who work in the plantation.
- Not closing the existing road access in the plantation, still providing road access with a position outside the built Ground-Mounted PV facility.
- Repairing access roads used during the construction project, especially main roads, and bridges.
- Provide street lighting for the community around the project site.

In addition to the above points, at the community level, especially those directly affected, it is necessary to hold a meeting with PT PLN Indonesia Power so that the affected community knows and understands the project more fully.

One of the vulnerable groups directly affected by the project in Kalipuro village is the daily labourers of sugarcane plantations in the Afdeling Wangkal. Working as day labourers as the only job and main source of income causes some day labourers to reject the Ground-Mounted PV development plan. For this reason, special affirmation is needed for the group of daily sugarcane labourers who are directly affected, especially for female daily labourers who are heads of households.

- Giri Village:

Most respondents in Kelurahan Giri supported the planned solar power plant project. Respondents also hope that with this support there will be economic development programs, infrastructure, and health assistance. The absorption of local labour is the

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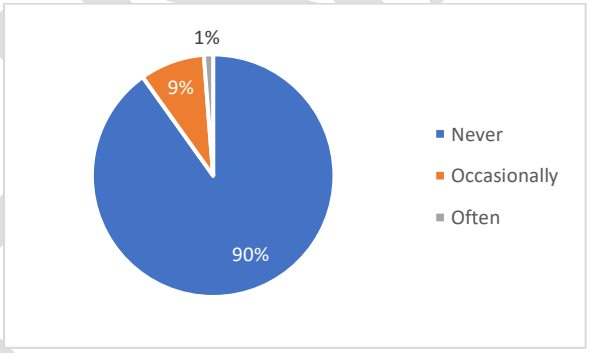
main point expected by respondents, in addition to assistance to support health programs, especially to overcome social welfare problems (elderly, stunting, disabled and poor families). In Kelurahan Giri itself, there is already a community that has been concerned with social welfare issues (*Sego Lansia* community - Alms for the Elderly) so that it can become a partner for the company in the future.

In addition, stakeholders and respondents in Giri Village also expect that there will be socialization of the Ground-Mounted PV development project to community representatives and affected communities, considering that in Giri Village there are also many similar projects that confuse the community.

The results of interviews in the field provide an overview of the expectations of affected communities that can be considered by the project, as explained in the interview that in general, the community support Ground-Mounted PV and hope that the project will provide road access to the community who often use the road access from the sugar cane plantation to Ketapang (factory and port), local employment, repairing road facilities after being used by Ground-Mounted PV, facilitating street lighting, involving youth and youth organizations in securing transportation and securing the Ground-Mounted PV area.

Potential Disputes in the Study Area

The community's perception of conflicts within the community is crucial for mitigating potential issues as a solar power project commences. In the event of conflicts, the community's perception serves as the initial step in approaching conflict resolution. Data from respondents reveal the frequency of conflicts: 90% reported never experiencing conflicts, 9% stated sometimes, and 1% claimed conflicts occur frequently (see **Figure 4-158** below).



Source: Primary Data, 2023

***Figure 4-158** Percentage of Community Perception about Conflict in Study Area*

Interviews conducted by researchers with several parties who can be categorized as stakeholders in the study area succeeded in summarizing several issues and responses that need to be considered by project implementers so that they do not have an impact on becoming a bigger issue or can lead to rejection of the project to be implemented in the study area. The results of these interviews include:

- Based on interviews with Wangkal Resident, in general, the residents of the Wangkal Hamlet do not reject the Ground-Mounted PV construction plan, but they ask to continue to be given an access road for mobilization to Kalipuro. This road is one of the alternative accesses that connects the Kalipuro area with the Ketapang area, many residents use this road to shorten travel time. So, the existence of this road is one of the most important things that support the activities of residents in Kalipuro. If this road is eliminated, there is a possibility

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that residents will act against the development. Residents asked to make an access road like the one in Inka even though a fence is installed but there is a public road that can be accessed by the community. The important thing is that this development does not violate the activities of residents. if no road access is given then the community will have difficulties, and certainly will not approve the development. Residents do not reject the plan as long as they are involved in the construction and maintenance, and the community is given an access road like the one in Inka. In addition to receiving the benefits of the road, local residents can also help secure the Ground-Mounted PV facilities to be built.

- Opinions from supervisor of the sugarcane plantation PTPN in Kalipuro Village were also obtained through interviews, which explained that Kalipuro Village is a strategic area crossed by various SUTT lines from Paiton and Ijen, so many residents are confused about the project that will run. The perception of PTPN employees regarding the construction of Ground-Mounted PV is that they are anxious about where they will be moved. The foremen and casual labourers are confused about where they will work because they have been working at PTPN every day. PTPN workers found out about the Ground-Mounted PV development plan after a survey conducted by Survey Indonesia. PTPN workers and the community have not been given socialization regarding the Ground-Mounted PV development plan, so the community and workers know about the Ground-Mounted PV development plan from the surveyors.
- The supervision's perception of the presence of Ground-Mounted PV is that the PTPN foreman supports it because it is a national project and the location is on state-owned land, feels worried about losing his job as a daily foreman (he has worked for a long time and is comfortable in the Afdeling Wangkal) and has the hope of being involved or absorbed into the workforce when the Ground-Mounted PV project is running.
- Based on interviews with PTPN Garden assistants, residents utilize the garden road as a road between sub-village. People who often pass through the garden road are boarding school students, residents of Wangkal, East Secang and Pancur hamlets. When the access road is closed, people who work at the port and shrimp factory will have to go further with a distance of approximately 30 minutes.

The opinion of one of the landowners who is planned to be affected by the transmission line (T-07) was also successfully obtained through interviews, this opinion can be a reference for the project in carrying out the land acquisition process where he explained that he has no problem if his house has to be passed by a tower cable, provided that the compensation is in accordance with what is regulated by law, as well as the correct procedure when coming to the community. His concern is that the land or house that is passed by the tower will drop in price and will not sell. However, he understands that the construction of this solar power plant will certainly have a positive impact for the benefit of the wider community. Prior to the planned construction of the tower in T07, there had already been similar electricity tower construction nearby, so this development is not new and does not have the potential to get resistance in the community if the approach is correct. He suggested forming a group of affected landowners so that the information or discussion will only go through one door to minimize miscommunication.

Field interviews also managed to obtain information from cattle farmers in Kalipuro Village who utilize PTPN land as one of the sources of feed for their livestock, in the interview he explained that the construction of Ground-Mounted PV has an impact on

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farmers and residents who have livelihoods around the plantation. The community will lose their jobs and find it difficult to find animal feed close by project. People who take grass and become labourers generally come from Secang, Papring, Wangkal, Bulusan, east Ketapang who work as labourers. The impact on farmers is quite a lot because during the rainy season and the sugar cane harvest season everyone goes to PTPN's sugar cane land to collect feed, ensuring they don't damage PTPN's plants. And according to the Informant there are about hundreds of people who take animal feed on PTPN land every day (harvesting sugar cane, scratching). His perception is related to the plan to build Ground-Mounted PV in the location of PTPN Afdeling Wangkal, if Ground-Mounted PV is built according to the informant along with his other colleagues will lose their jobs. The presence of Ground-Mounted PV is very disruptive to the economy because the livelihoods of the women here are only in PTPN and there are no other jobs outside. Generally, those who work as labourers are from Papring, Wangkal, Secang, Sumber Potat Hamlet and all from the surrounding villages, for cutting sometimes labour is brought in from outside, namely Jember and Situbondo.

Based on information from PTPN Garden Assistants, many local people use sugarcane tops for animal feed during the harvest season. After the harvest is done PTPN will burn the remaining harvest in the garden. There are people around the plantation who rent their houses for harvest workers to live in. The community is worried that when there is a solar power plant construction, they will have to look further for animal feed. The community hopes that the construction will provide access to the road from west to east, so that the community does not need to make a detour.

Field interviews also managed to obtain the views of vulnerable groups who are plantation day labourers and sugarcane harvest labourers who are often involved with PTPN sugarcane plantation activities. The conditions experienced by these vulnerable groups can illustrate how dependent they are on sugarcane plantations managed by PTPN:

- "*The five of us in one group only work as labourers and have no other jobs, at most after working at PTPN we glean for cows, that's the only job we have, so if the PTPN Plantation is closed at this time we are already thinking about what else to do. We are old, it is impossible to work in a factory and there are also those who do not have husbands (widows). The hope is that the Ground-Mounted PV will not be built, with the hope that we can work, if we work outside or in the factory, we are old and cannot afford the working time in the factory which is until late afternoon. Workers at PTPN work until noon, so that in the afternoon they can dig or look for grass. If the Ground-Mounted PV is built, those of us who look for grass will find it difficult and farther away, looking for grass has gone south and is expensive. The price of 1 pick-up of straw grass is IDR 300,000 and lasts for 1 month, provided that the grass is still weeded."* (Interview with female respondent involved as vulnerable Group).
- "Regarding *the conversion of PTPN's sugarcane plantation into a solar power plant, it is very unfortunate. This is because I am very dependent on the existence of sugar cane plantation. I hope that the construction will never happen. According to him, it is not only me who feels the impact of this development, most of my friends also only work as PTPN labourers, so they are also worried that their jobs will be lost. If there is no sugar cane plantation, I am confused about where to find food, I am not called to work for just a few days, I immediately look for ferns in the forest to pay for food, if I don't work at*

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all, how should I live." (Interview with male respondent involved as vulnerable group).

The Pancasila Youth Community Organization in the study area has a strong base and has a significant influence on youth and workers in the study area. Pemuda Pancasila has a branch office in the Ketapang area, and its members are spread throughout Kalipuro District. Based on respondents who is stone quarry owner and member of Pemuda Pancasila, there is no official information circulating in the community, as long as the construction of Ground-Mounted PV provides benefits to local residents in the form of employment and preparation of project building materials, the project can be continued. If there are no benefits to the community, then this organization can mobilize the community and mass organizations to act against the Ground-Mounted PV construction plan in Banyuwangi. They also already know the area of PTPN land that will be used for the solar power plant and have many relationships with large contractors who will carry out these activities.

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5 Environmental and Social Impact Assessment Methodology

5.1 Impact Assessment

The impact assessment stage will focus on assessing environmental and social changes from the baseline condition as a consequence of the Project's activities. Impact assessment process is presented in **Figure 5-1**.

- Impact prediction: this stage will identify impacts associated with Project's activities in relation to the environmental and social baseline condition as well as existing management plans. An interaction matrix will be developed.
- Impact evaluation: impact magnitude will be defined based on characteristic such as type, extent, duration, and scale of impact. Sensitivity/vulnerability/ importance of receptor will also be assessed. After that, the significance of each impact resulted from the impact prediction stage will be evaluated by comparing impact magnitude against the sensitivity of receptor.
- Impact mitigation: mitigation measures will be developed where a significant impact is identified.
- Residual impacts: significance of residual impacts will be again evaluated but with taking into account the mitigation measures.

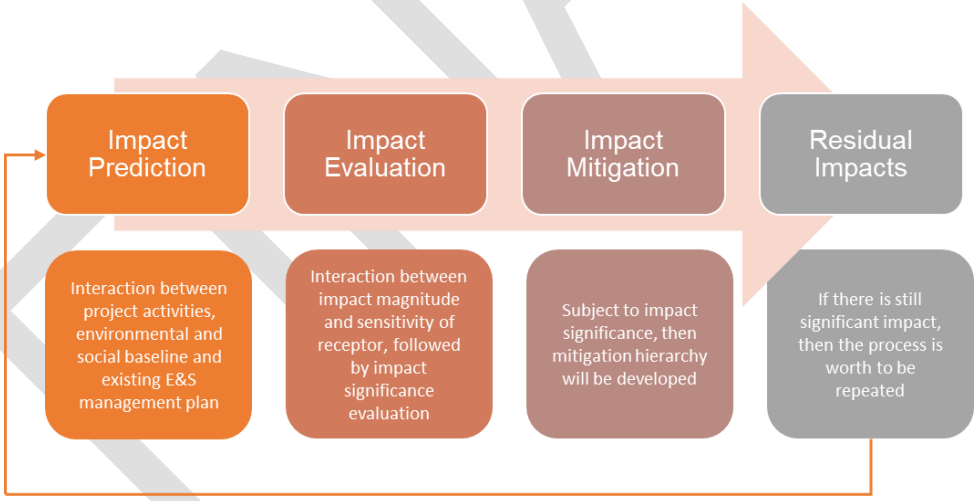


Figure 5-1 *Impact Assessment Process*

5.2 Impact Prediction

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

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5.3 Impact Evaluation

The objective of impact evaluation is to assess the significance of the potential impact based on impact magnitude prediction and receptor sensitivity. By understanding the impact significance, then next action is to identify the mitigation measures to minimize the adverse impacts. Then, the residual impact will be assessed again after taking into account the mitigation measures.

Impact Magnitude

The magnitude in this case is the size or degree of change caused by impact identified and is a function of several factors including:

- Scale (the degree of change resulting)
- Duration (e.g., one hour versus several years)
- Extent (e.g., one household, versus villages, districts, etc)
- Frequency (e.g., one off activity verses permanent) and
- Likelihood (for unplanned events only)

An assessment of the overall magnitude of an impact is provided by considering all the dimensions of the impact described above to determine whether an impact is of negligible, low, medium, or large magnitude. **Table 5-1** provides idea of each characteristic of impact while **Table 5-2** presents the overall definition of magnitude/severity.

Table 5-1 *Impact characteristic terminology.*

Characteristic	Definition	Designation
Nature	The proposed Project is predicted to provide beneficial effects to environmental receptors.	Positive
	The Proposed Project is predicted to have adverse impacts on the environment	Negative
Type	Where the impact directly resulted (primary impact) of the Project activities/	Direct
	A secondary impact of the Project activities, often occurring away from the proposal or as a result of a complex biological or chemical pathway.	Indirect
Extent	The "reach" of the impact will be confined to a small area around the Project footprint.	Site
	The "reach" of the impact will affect the Project Area of Influence	Local
	The "reach" of the impact will affect beyond the Project Area of Influence but still within the region	Regional
	The "reach" of the impact defined as national or international	Widespread
Duration	The time period over which a resource/receptor is affected.	Temporary
		Permanent
	The impact is predicted to be only limited timescale (e.g only during construction period, 12 months or less).	Short term
	The impact is predicted to take place longer than 12 months (construction phase period), but less than operation phase period (25 years).	Medium term

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Characteristic	Definition	Designation
	The impact is predicted to take place beyond the construction phase period and extended throughout operation phase period.	Long term
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected). Defined from a numerical value or a qualitative description of "intensity"	Low
		Medium
		High

Table 5-2 *Definition of Impact Magnitude / Severity*

Magnitude/Severity Ranking	Definition
Negligible	Change remains within the range commonly experienced within the household of community.
Low	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Medium	Clear difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional, and impact may potentially be regional in scale.
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may be experienced over a regional or national area.
Positive	In the case of positive impacts, it is generally recommended that no magnitude be assigned, unless there is ample data to support a more robust characterization. It is usually sufficient to indicate that the Project will result in a positive impact, without characterizing the exact degree of positive change likely to occur

Vulnerability / Sensitivity

The assessment of the sensitivity of human receptors, for example a fishing community or wider social group, will consider their likely response to the change and their ability to adapt to and manage the effects of the impact. **Table 5-3** presents the definition of impact receptor vulnerability/sensitivity.

Table 5-3 *Definition of Receptor Vulnerability/Sensitivity*

Sensitivity	Description	Aspects
High	The Project area is located on a internationally recognized area in terms of conservation (e.g UNESCO World Heritage Site and Biosphere, Key Biodiversity Area, Ramsar Site and Endemic Birds Area)	Biodiversity
	The Project area has feature of steep slopes (e.g., 15 degrees) and/or has soils with poor structure, low cohesion, and low permeability	Erosion
	The Project area is susceptible to frequent or severe natural hazards such as floods, earthquake, volcanic eruptions and tsunamis.	Natural hazard

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Sensitivity	Description	Aspects
	The Project area characterized by poor air quality. Factors such as industrial activities, vehicular emissions, or geographical features may contribute to poor air quality.	Air quality
	Body of water near the Project area has been contaminated by sources such as industrial discharges, agricultural runoff, or improper waste disposal.	Surface water quality
	The reservoir water resources are relied upon locally with no other suitable alternatives or are important at regional or transboundary for provisioning services.	Hydrology
	The Project area experiences frequent or intense ground vibrations due to factors such as heavy industrial machinery, construction activities, or intense transportation infrastructure.	Vibration
	The Project area experiences frequent or intense exposure to electromagnetic radiation. Sources may include high-voltage power lines, radiofrequency (RF) transmitters, or industrial equipment.	Electromagnetic
	The Project area experiences frequent or intense traffic jams.	Traffic
	The Project component is visible from nearby receptors with changing the natural landscape	Landscape and Visual
	Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project.	Social
Medium	The Project area is located on area with conservation significance nationally including area which are classified as forest area	Biodiversity
	The Project area has feature while not as steep as those in high-risk areas, still pose a potential for erosion. The slope gradient falls within a moderate range (e.g., 5 to 15 degrees) and/or soils with a balanced mixture of sand, silt, and clay.	Erosion
	The Project area face occasional natural hazards such as floods, earthquake, volcanic eruptions and tsunamis.	Natural hazard
	The Project area experiences occasional air quality challenges which may result from factors such as seasonal variations, sporadic industrial emission or specific meteorological conditions.	Air quality
	Body of water near the Project area occasionally experience surface water quality challenges due to factors like periodic industrial discharges, agricultural activities, or localized pollution events and have local importance in terms of provisioning services, however there is adequate capacity for alternative sources.	Surface water quality
	The reservoir water resources have local importance in terms of provisioning services, however there is adequate capacity for alternative sources.	Hydrology
	Project area occasionally experiences vibrations resulting from factors like intermittent construction projects, moderate industrial activities, or regular transportation.	Vibration
	The Project occasionally experiences moderate exposure to electromagnetic fields, often due to lower-intensity sources such as household electronics, moderate-power transmission lines, or wireless communication infrastructure.	Electromagnetic

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Sensitivity	Description	Aspects
	The Project area occasionally experiences traffic delays and congestion, often during peak hours or due to specific events.	Traffic
	The Project component is visible from nearby receptors without changing the natural landscape	Landscape and Visual
	Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the Project.	Social
Low	The Project area is not located at any conservation significance area	Biodiversity
	The Project area characterized by gentle slopes with minimal risk of erosion. These areas typically have slope gradients below a certain threshold (e.g., less than 5 degrees) and/or soils that have good structure, high cohesion, and adequate permeability. Clayey soils, for instance, tend to resist erosion due to their cohesive nature.	Erosion
	The Project area experience infrequent or mild natural hazards, minimal seismic activity, or low flood potential, volcanic eruptions and tsunamis.	Natural hazard
	The Project area generally maintains good air quality with minimal instances of pollution.	Air quality
	The Project area generally maintains good surface water quality with minimal instances of contamination with little or no role in terms of providing as domestic uses (e.g. washing, bathing), agricultural, waterways for community.	Surface water quality
	The reservoir water has little or no role in terms of providing as domestic uses (e.g. washing, bathing), agricultural, waterways for community.	Hydrology
	The Project area generally has minimal instances of significant vibrations, often due to limited industrial activities, controlled construction practices, or well-managed transportation systems.	Vibration
	The Project area generally has minimal instances of significant exposure to electromagnetic fields, often due to limited sources of radiation and well-controlled infrastructure.	Electromagnetic
	The Project area generally has minimal instances of significant traffic delays, or lower vehicular density.	Traffic
	The Project component is not visible or insignificant visibility from nearby receptors, only visible from Project workers only	Landscape and Visual
	Minimal areas of vulnerabilities, consequently with a high ability to adapt to changes brought by the Project.	Social

Evaluation of Impact Significance

The evaluation of significance has taken into account the magnitude of the impact and the quality, importance or sensitivity of the affected resource or receptor.

Magnitude and receptor quality/importance/sensitivity are looked at in combination to evaluate whether an impact is, or is not, significant and if so its degree of significance (defined in terms of Negligible, Minor, Moderate and Major). Impacts classed as

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negligible include those that are slight or transitory, and those that are within the range of natural environmental and social change. This principle is illustrated schematically in **Table 5-4**.

Once the significance of the impact has been defined, then it will be interpreted using the following **Table 5-4** of interpretation of impact significance designations.

Table 5-4 *Impact significance rating*

Significance		Sensitivity		
		Low	Medium	High
Severity/Magnitude	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major
	Positive	Minor	Moderate	Major

Table 5-5 *Interpretation of Impact Significance Designation*

Significance	Negative Environmental/Biodiversity Impact	Negative Social Impacts	Negative Health Impacts	Positive Social Impacts
Negligible	The proposed Project or activity is unlikely to result in any significant adverse effects on the environment. The impact is so minimal that it is essentially inconsequential and does not require extensive mitigation measures. The project is not expected to cause any significant disruption or harm to ecological systems, human health, or natural resources.	Inconvenience is caused, but with no consequences to livelihoods, culture, health or quality of life.	Receptors may experience annoyance, minor irritation, or stress associated with change, minimal impact to perceived quality of life. Does not require treatment, No long-term consequences for the health of individuals and the community.	The positive effects are deemed to be imperceptible or is identified from natural background variations.

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Significance	Negative Environmental/Biodiversity Impact	Negative Social Impacts	Negative Health Impacts	Positive Social Impacts
Minor	The proposed Project or activity may have some measurable effects on the environment, but these effects are considered minor and manageable. Mitigation measures are typically feasible, and the overall impact is not expected to cause substantial harm to ecosystems, human health, or natural resources. The environmental consequences are within acceptable limits.	Impacts are short term and temporary and do not result in long term reductions in livelihood or quality of life.	Temporary reduction to health status of certain individuals that can be easily treated and does not result in long term consequences for community health. The impact may lead to greater health inequalities in Project area.	Benefits will tend to benefit those least vulnerable to changes brought by the Project (e.g., higher skilled, wealthier). Benefits may lead to greater inequity in the Project area.
Moderate	The proposed Project or activity has the potential to cause noticeable and moderate adverse effects on the environment. Mitigation measures are necessary to reduce or offset these impacts, and careful management is required to ensure that the effects are within acceptable thresholds. The Project may have some significant consequences, but they are generally manageable with appropriate measures.	Adverse impacts that notably affect livelihood or quality of life at household and community level. Impacts can mainly be reversed but some households may suffer long term effects.	High risk diseases or injuries as well as exposure to Project operational risks to the local community. May result in long-term but reversible community health impacts.	Benefits will be noticeable and cause a moderate opportunity to provide some opportunities for receptors to further themselves and improve livelihoods etc. Enhancement may be experienced by those who also suffer negative impacts.
Major	The proposed Project or activity is likely to result in substantial and significant adverse effects on the environment. The consequences may involve severe harm to ecosystems, human health, or natural resources. Extensive mitigation measures, rigorous management practices, and potentially alternative approaches are needed to minimize the adverse impacts	Diverse primary and secondary impacts that will be impossible to reverse or compensate for, possibly leading to long-term impoverishment or societal breakdown.	Loss if life, severe injuries or chronic illness requiring hospitalization. Exposure to and incidence of diseases not commonly seen previously in the area. Likely to have	Benefits will be experienced by a range of receptors that will provide significant opportunities for leveraging secondary benefits and significantly

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Significance	Negative Environmental/Biodiversity Impact	Negative Social Impacts	Negative Health Impacts	Positive Social Impacts
	and address the high significance of the environmental effects.		long term consequences for community health.	improving themselves and others.

5.4 Mitigation and Enhancement

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

Where a significant impact is identified, a hierarchy of options for mitigation is explored in **Figure 5-2**.

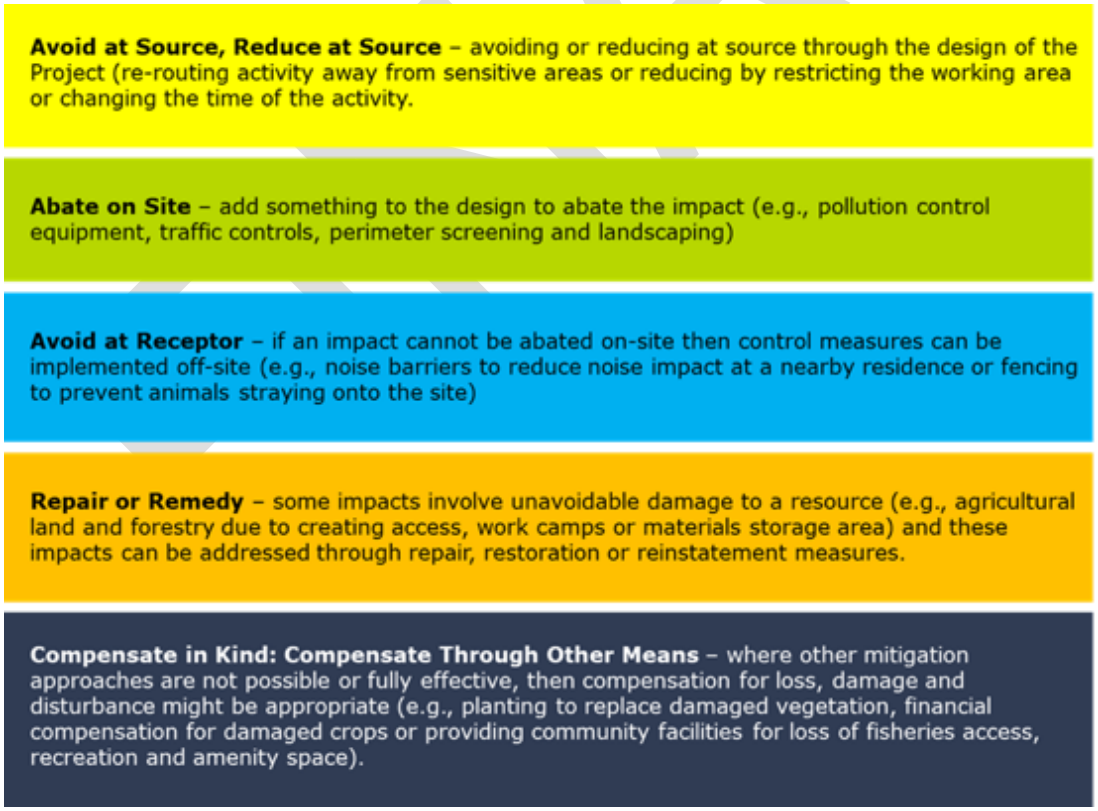


Figure 5-2 *Hierarchy of Options for Impact Mitigation Measures*

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5.5 Residual Impact Evaluation

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

- The predicted magnitude of an impact, taking into consideration all the mitigation measures; and
- The quality/importance/sensitivity of the receptor

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

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6 Environmental and Social Impact Assessment

6.1 Environmental Impact Assessment

6.1.1 Overview

This Environmental Impact Assessment chapter has been developed to assess project related impacts against the expectations of the Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF) and IFC Performance Standards Framework. The following sections identify and discuss the predicted positive and significant negative social and community health impacts associated with the mobilization, construction, and operation of the Banyuwangi Groundmounted Solar PV Power Plant Project. Key impact areas included in this section are:

- Erosion, Sedimentation, Soil Disturbance and Surface Water Quality
- Ambient Air Quality
- Noise and Vibration
- Solid Waste/Non-Hazardous Waste
- Hazardous Waste
- Traffic
- Greenhouse Gas Emission
- Terrestrial Biodiversity
- Aquatic Biodiversity
- Ecosystem Services

Based on feasibility study, the electromagnetic is excluded in impact analysis as long as the proponent implement and maintain the required minimum clearance between TL and the ground and any objects underneath including maintenance of tower bolts and foundation conditions, insulators, and repair damaged or corroded conductive wires (The Minister of Energy and Mineral Resources (MEMR) of Republic of Indonesia, 2021).

The tower design in feasibility study complies with the safety clearance regulations outlined in MEMR Regulation No. 13 of 2021. However, this ESIA still recommends mitigation and monitoring measures, as detailed in Section 9.2.

A summary of the environmental impact assessment results during the pre-construction, construction, operation, and post-operation phases is provided in **Table 6-1.**

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Table 6-1 *Summary of Environmental Impact Assessment*

Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
EIA01: Impact on Surface Water Quality due to Erosion, Sedimentation and soil disturbance during Land Preparation and Civil Works (including access road, drainage, TL tower footing and right of way) and Construction of Ground-mounted PV and Supporting Facilities	Project area Local community	**Moderate**	• The Project shall install construction boundary to avoid unnecessary clearing beyond the boundary. • Erosion management plan shall be prepared before the construction phase commenced; it includes but not limited to the construction of temporary drainage temporary selected sediment ponds and soil & vegetation disposal prior to commencement of any earthwork activities and designated disposal sites. • Ensure cleared debris is promptly removed from the site to prevent obstruction of drainage, reduce pest risk, and minimize potential impacts on soil quality. • Minimize vegetation clearing by restricting land disturbance to only areas essential for construction and preserve natural vegetation buffers, particularly near slopes and water bodies. • Conduct an inventory of other wood-producing plants before clearing. Where feasible, retain mature or healthy trees at buffer zones or transplant them to suitable nearby areas. Minimize run of water carrying soil from the tree uprooting for replanting that might result sedimentation in the nearby river. • Strip and store topsoil separately for future site rehabilitation or landscaping and protect topsoil stockpiles with tarpaulin or grass cover to avoid erosion. • Establishing temporary or permanent vegetation on disturbed areas to stabilize the soil and minimize erosion. • Material Handling Plan shall be developed to the safe, efficient, and environmentally responsible	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			handling, storage, transport, and installation of materials required for the ground-mounted solar PV and transmission line project. • Establish an effective grievance mechanism to document and address complaints related to spoil spillage, transmission line tower footing access, and right-of-way issues affecting nearby agricultural properties.	
EIA02: Impact on Surface Water Quality due to Wastewater Discharge during Construction Phase including Operation of Basecamp	Project area Local community	**Negligible**	• Erosion and drainage management plan shall be prepared before the construction phase commenced. Design and implement temporary surface drainage systems to control runoff, prevent ponding and uncontrolled flow across exposed soil surfaces. Sediment pond design with adequate volume to accommodate peak flow during rain events and allow sufficient detention time for sediment to settle. • Conduct land clearing and earthworks in phases to reduce exposed soil area. • Designated spoil disposal area to Identify and use clearly designated spoil disposal sites with appropriate containment. • Proper design of the wastewater treatment plant complies with applicable standards where the septic tank process and size align with the expected volume and characteristic of wastewater, and installed at a safe distance from water sources. • Vehicle washing will be covered in the wastewater management plan, which will specify the treatment methods and discharge procedures to ensure that wastewater from vehicle and equipment washing areas is directed to the sediment pond.	**N/A**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			• Wastewater management plan, shall be developed to ensure all wastewater is properly treated before being discharged into water bodies, including an emergency response procedure if any case the wastewater treatment is not working. • Secondary containment shall be ready at working area where oil or chemicals are handled to effectively manage any potential spills, leaks and others unplanned incident.	
EIA03: Impact on Surface Water Quality due to Wastewater Discharge from Solar Modules Cleaning	Project area Local community	**Negligible**	After evaluating the impact, its significance is Negligible, best practices are expected to be implemented by the Project as follow: • De-ionized water with a total hardness of less than 75 ppm, as recommended by the manufacturer and required by the Company, shall be used by the third party for cleaning ground-mounted PV module. • If de-ionized water is not available, rainwater or tap water shall be used as an alternative.	**N/A**
EIA04: Impact to Ambient Air Quality due to Mobilization of Equipment, Materials and Workers during Construction and Operation	Local community	**Moderate**	It is expected that the following mitigation measures will be embedded to all activity such as construction and installation of ground-mounted PV facilities, switchyard, construction of transmission line, gantry and extension bay. • Develop Air Quality Management Plan which include providing a tire washing facility for trucks/heavy vehicles that leave construction site, conduct dust/particulate matter suppression and maintenance and regular inspection on construction machinery; • Conduct maintenance and regular inspection on construction machinery;	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			• Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits; • Ensure all vehicles and equipment switch off their engines when stationary; • Avoid long queueing of vehicles outside the site for long duration by proper planning of receipt or dispatch of materials. If materials are delivered in bulk in several shipments, then prepare a Construction Logistics Plan to manage the sustainable delivery of goods and materials. • Carry out emission test for genset during commissioning stage although the genset is used as power back up to collect baseline data on the emission quality of the genset. Maintenance of genset and data record on the genset running hours to follow Minister of Environment and Forestry regulation No. 11 of 2021.	
EIA05: Impact on Ambient Air Quality due to Land Clearing, Civil Works and Construction of Transmission Line, Groundmounted PV with Supporting Facilities	Local community	**Minor**	• Develop Air Quality Management Plan which include providing a tire washing facility for trucks/heavy vehicles that leave construction site, conduct dust/particulate matter suppression suppression (water spraying on road) and maintenance and regular inspection on construction machinery. • The Project shall install construction boundary to avoid unnecessary clearing beyond the boundary. • Speed of vehicles on site will be limited to 10-15 km/hr which will help in minimising fugitive dust emissions due to vehicular movement. • Exhaust emissions from equipment operating within the site will be controlled by the contractor by	**Negligible**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			ensuring that emissions are minimized through regular servicing of machinery to meet the relevant emission standards. • Manage material transfer activities to minimize the fugitive dust arising from unloading/loading. • Ensure covering of soil stockpile on site (if any) with tarpaulins. • Conduct maintenance and regular inspection on construction machinery. • Re-vegetate earthworks and exposed areas/soil stockpiles shall be carried out as soon as practicable to stabilise surfaces. Once work in a specific area is completed, the soil shall be reinstated immediately before moving on to other areas. This approach will help to reduce dust emission.	
EIA06: Impact from Noise and Vibration due to Land Clearing, Civil Works and Construction of Transmission Line, Groundmounted PV and Supporting Facilities	Local community	**Moderate**	• Development and implementation of Noise and Vibration Management Plan; • Limit exposure of workers handling noisy and vibrating equipment; • Construction activities shall be limited to daylight hours although scheduling will require overnight operations on occasion; • Plan the layout of the site by considering using materials and other large structural equipment or even stockpile to act as noise barriers; • Use of hoarding/temporary noise barriers or permanent noise barriers where noisy activities are to be installed close to sensitive receivers; and • Develop an effective grievance mechanism to record and respond to noise and vibration complaints.	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
EIA07: Impact from Noise and Vibration due to Mobilization of Equipment, Materials and Workers	Local community	**Moderate**	• Development and implementation of Noise and Vibration Management Plan. • Limit the hours of operation for specific loud pieces of equipment or operations. Attention will be paid to operations in the proximity of community areas. • Mobilization activities shall be limited in daytime. • Conduct maintenance and regular inspection on the vehicle will be used. • Develop an effective grievance mechanism to record and respond to noise and vibration complaints.	**Minor**
EIA08: Solid Waste/Non-Hazardous Waste due to Land and Vegetation Clearance During Construction	Project area Local community	**Negligible**	• Develop and implement a Waste Management Plan, including wastewater management component to ensure proper segregation, collection, temporary storage, transportation, and disposal of waste in accordance with the requirements aligned with the Project's safeguards. • Provision of waste temporary storage according to the waste types. • Provision soil disposal area and soil will be reused as foundation for all manner of groundworks. • Develop Contractor and Supplier Management Plan to ensure permitted local supplier for civil and structural material comply with the government requirements, including batching plants and temporary construction facilities within Project area; and conduct due diligence to ensure that its operations have proper E&S management practice and supported with the necessary quarry operation permits. • Third party waste collector will then be permitted to take the wastes. Determine the location for final	**N/A**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			waste disposal in coordination with the local government and coordinate with the Environmental Agency of Banyuwangi Regency.	
EIA09: Solid Waste/Non-Hazardous Waste from Workers Activity During Construction and Operation	Project area Local community	**Minor**	• Develop and implement a Waste Management Plan, including wastewater management component to ensure proper segregation, collection, temporary storage, transportation, and disposal of waste in accordance with the Project's safeguards requirements. • Provision of rubbish bins according to the waste types. • Maintain the performance of septic tank to ensure that the septic tank works well and coordination with third party to periodically empty the septic tank. • Third party waste collector will then be permitted to take the wastes. Determine the location for final waste disposal in coordination with the local government and coordinate with the Environmental Agency of Banyuwangi Regency.	**Negligible**
EIA10: Hazardous Waste During Construction and Operation	Project area Local community	**Moderate**	• Develop and implement a Waste Management Plan, including wastewater management component to ensure proper segregation, collection, temporary storage, transportation, and disposal of waste in accordance with the Project's safeguards requirements. • The selected solar PV modules will use monocrystalline panels that do not contain hazardous materials. The project intentionally avoids the use of PV technologies that contain cadmium or other highly toxic substances.	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			• Damage solar panels will be inspected and assessed for repair or disposal. Damaged panels classified as B3 waste will be temporarily stored in the project owned TPS B3 facility. • Provision of hazardous waste temporary (TPS B3) accordance with Indonesia's hazardous waste guidelines. • Trained personnel will handle damaged panels using appropriate PPE. • Loading and unloading activities will minimize physical stress to avoid further damage or material leakage. • Coordination with licensed hazardous waste agency (for transport and disposal facility), and perform hazardous waste management in accordance with the operational technical document for hazardous waste management owned; and • Develop and implement emergency prepadness and response plan. • Develop and implement an Asbestos Management Plan (AMP) as refer to the Regulation Ministry of Manpower No. 3 of 1985 regarding Occupational Health and Safety the Use of Asbestos, Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management Appendix IX for List of Hazardous Wastes from Unspecific Sources and the Asian Infrastructure Investment Bank (AIIB) Environmental and Social Codes of Practice (ESCOPs), including procedures for safe handling, storage, transportation, and disposal which covering:	

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			- Asbestos identification in the workplace; - An outline on how the risks for each Asbestos Containing Material (ACM) are controlled; - Control measures on the management of asbestos and ACM in the workplace; - Procedures for accidents, incidents and emergencies involving asbestos in the workplace; - Responsibilities in implementation of the plan; - Worker requirements for conducting asbestos work; - Air monitoring requirement during each type of asbestos work; and - Requirement of communication of the plan to workers and other relevant stakeholders.	
EIA11: Impact on Existing Local Public Road Condition due to Increment of Traffic Volume Associated with Mobilization Activity During Construction Phase (Project Construction Equipment and Material and Construction Workers)	Local community	**Moderate**	• The ANDALALIN or Traffic Management Plan is part of AMDAL and prepared during the planning stage of a project, including coordination Transportation Agency of Banyuwangi Regency, and coordination with community surrounding Project area (scheduling and mobilisation). Develop and implement Traffic Management Plan in alignment with The ANDALALIN document in accordance with the Project's safeguards, including stakeholder coordination, vehicle movement scheduling, and control of vehicle volumes to minimize emissions. • Engage and inform the community around Project area about the construction activity, including project schedule and mobilisation route of heavy vehicles.	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			• Scheduling the mobilisation of heavy equipment and material outside the peak hour of traffic volume and consider after school and weekly market schedule and it expected to inform relevant governance agency (Transportation Agency/Dinas Perhubungan) of the project schedule/activity and for escorting if the vehicle convoy is needed. • Install the Project traffic sign and road markings for safety reason. • Provide road officer who responsible to manage traffic flow at the gate of project area and install the post security. • Provide the laydown area to store the heavy equipment and material, as well as the parking area for light and heavy vehicles to avoid parking on the public roadside. • Ensure the vehicles and drivers in good condition and have valid licence to operate according to standard operation procedure. • Conduct regular orientation sessions for Project and/or EPC drivers focusing on the ANDALALIN requirements and road safety protocols. The sessions should cover topics such as speed limits, the meaning of traffic signs and road markings, and other relevant traffic regulations. • Ensure the heavy vehicle weight loading accordance with the road load capacity standard. • Ensure the heavy vehicle loading handling accordance with applied standard operation procedure.	

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			• Vehicle speed limit shall apply standard road speed limit (i.e. for collector road inter-city is 40 km/hour and settlement area at local road is 15 - 20 km/hour). • Improved the road paving with poor condition at local road segment that expected cannot accommodate heavy vehicle load and repair the damaged road cause by the Project's heavy vehicle mobilisation activity after Project construction activity. • Provide grievance mechanism platform to accommodate community perception related to transportation.	
EIA12: Impact of Greenhouse Gas (GHG) Emission due to of Fuel Combustions during mobilization of Equipment, Materials and Workers	Global climate Local community	**Negligible**	While the impact is negligible, best practices are expected to be implemented by the Project as follow: • Exhaust emissions from off-road and on-road equipment operating within the site will be controlled by the contractor by ensuring that emissions are minimized through regular servicing of machinery to meet the relevant emission standards; and • Ensure that the engines of all vehicles and machinery on site are not left running unnecessarily.	**N/A**
EIA13: Impact of Greenhouse Gas (GHG) due to Land Clearing, Civil Works and Construction of Solar PV	Global climate Local community	**Negligible**	While the impact is negligible, best practices are expected to be implemented by the Project as follow: • Exhaust emissions from off-road and on-road equipment operating within the site will be controlled by the contractor by ensuring that emissions are minimized through regular servicing	**N/A**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
and Supporting Facilities Impact Discussion			of machinery to meet the relevant emission standards. • Ensure that the engines of all vehicles and machinery on site are not left running unnecessarily. • Disturbed areas that will no longer be developed can be revegetated with local vegetation to serve as buffer for future activities and operation and to increase local sequestering capacity for greenhouse gases.	
EIA14: Positive Impact due to Greenhouse Gas Emission Reduction from Solar PV Operations	Global climate Local community	**Positive**	-	**N/A**
EIA15: Habitat Loss due to Construction	Terrestrial Flora and Fauna	**Minor**	• Project to provide clear Land Preparation and Civil Work Plan including relevant site layout map to allow all construction personnel have clear understanding on their working area boundary. • Under the supervisory of Project Owner and/or Consultant Supervisor, construction personnel shall conduct join inspection to determine the designated project footprint boundary prior to the commencement of land clearing. • Biodiversity Site Induction shall be conducted together with HSE Site Induction prior to the site joint inspection. • Using the approved site layout map, construction personnel shall conduct the land clearing within designated project footprint boundary. Land	**Negligible**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			clearing outside the boundary is out of conduct and remedial action shall be conducted. • Implement "3 R" procedure (Report, Rescue and Release) to trapped wildlife within Project site. Consultation with professional Ecologist or Veterinarian may be required if serious or emergency situation occurred (i.e. handling injured wildlife).	
EIA16: Habitat Modification or Fragmentation	Terrestrial Fauna	**Negligible**	No mitigation measures are required since the impact significance is considerably negligible.	**N/A**
EIA17: Avian Fauna Mortality due to Collision and/or Electrocution	Avian Fauna	**Moderate**	• The proposed transmission-line route and corridor shall not be changed without further assessment of bird collision and electrocution risk. • If any significant change to the OHTL route, corridor, tower locations, span lengths or conductor/earth wire configuration occurs during detailed engineering design (DED), the avian collision and electrocution risk assessment shall be updated by a qualified ornithologist/ecologist. • During DED, the final OHTL alignment, tower schedule, span configuration and earth wire/OPGW arrangement shall be reviewed against the VP survey results to identify priority higher-risk collision spans. These shall include, but not be limited to, spans near VP2, mature tree vegetation, mixed plantation edges, agricultural foraging areas and locations where Band 2 bird activity was recorded. • Prior to energization, effective bird flight diverters shall be installed on identified higher-risk OHTL spans. Diverters shall be installed preferentially on	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			the earth wire/OPGW, and where required on conductors, in accordance with manufacturer recommendations and good international practice. • The final OHTL design shall be reviewed to confirm bird-safe clearances at tension towers, jumper arrangements, gantry structures, terminal structures and substation-interface areas. Where any configuration presents a potential electrocution risk to medium- or large-bodied birds, appropriate redesign, insulation or shielding shall be implemented. • Post-construction fatality/mortality monitoring shall be undertaken for a minimum of one year after energization. Monitoring shall include systematic carcass searches beneath representative and higher-risk spans, with correction for searcher efficiency, carcass persistence/scavenger removal, habitat visibility and survey interval. Monitoring shall cover relevant seasonal periods and peak bird movement periods. • If monitoring identifies bird mortality above agreed trigger levels, adaptive management shall be implemented. This may include installation of additional bird flight diverters, increased diverter density, extension of diverters to additional spans, review of tower/perching management, and extension of monitoring beyond one year. • Routine operational inspections shall include checks for bird nesting or frequent perching on towers, particularly by raptors such as Crested Honey Buzzard, Chinese Sparrowhawk, Peregrine Falcon	

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			and other birds of prey. Any nest management or perch deterrent measures shall be developed and implemented by qualified specialists.	
EIA18: Disturbance Displacement	Terrestrial Fauna	**Minor**	No specific mitigation measures. Refer to mitigation measures of habitat lost.	**Negligible**
EIA19: Barrier Effects due to Soar PV Arrays Installation	Terrestrial Fauna	**Moderate**	• With the involvement of a biodiversity specialist, the Project shall conduct a joint pre-land clearing inspection to ensure that the site does not overlap with existing wildlife corridors as part of their natural home range. • The Project shall ensure that they will not close the existing wildlife corridor if it was identified during the joint pre-land clearing inspection activity. • The Project shall provide space within the Project footprint for conserving the existing wildlife corridor if the case of item #2 is occurred.	**Minor**
EIA20 : Aquatic Fauna Habitat Degradation	Aquatic Fauna	**Negligible**	No specific mitigation measures. Refer to mitigation measures of erosion, sedimentation and surface water quality degradation.	**N/A**
EIA21: Loss of important provisioning services	Sugar cane farmers	**Moderate**	No specific mitigation measures. Refer to mitigation measures of disturbance or impact on socio-economy and livelihood of landowner and land user as a result of project land acquisition (SIA03).	**N/A**

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6.1.2 Erosion, Sedimentation, Soil Disturbance and Surface Water Quality

6.1.2.1 EIA01 – Impact on Surface Water Quality due to Erosion, Sedimentation and Soil Disturbance during Land Preparation and Civil Works (including access road, drainage, TL tower footing and right of way; Construction of Ground-mounted PV and Supporting Facilities)

Impact Discussion

The Project is a ground-mounted PV, where the solar modules and facilities such as switchyard, extension bay, gantry and TL will be placed on land (the project area). Land preparation and civil works for those facilities including construction of ground-mounted PV and its supporting facilities will increase surface runoff and erosions during the rainfall period, which potentially carries sediments into the nearby surface water and potentially decrease the quality of surface water.

Impact Evaluation and Significance

The area that needs to be cleared for this Project is as follow:

- Ground-mounted PV (Boundary), Switchyard, PV Module, Transmission Line RoW (RoW 1, 2 partially RoW 3) and Transmission Tower (1-3) – 155.39 ha
- Gantry – 0.06 ha
- Extension bay – 0.54 ha
- RoW Transmission Line – 8.24 ha
- Transmission Tower – 0.55 ha

Therefore, the total area that will be cleared is approximately 164.78 ha, which is considered large.

According to the meteorological data of 2013 to 2022, the Project area is predicted to have a longer wet season throughout the year. In average, the Project area has approximately 160 days of rainy days in a year. The rainfall intensity above 100 mm usually occur from November to June. During the average rainfall varied between 43.27 – 268.86 mm/month with a number of rainy days up to 14 days in a month.

Based on the landslide hazard index, the Solar ground-mounted PV project site is located in the area with no landslide hazard. In addition, topographic survey conducted in the Project area which covers 164.78 ha during the feasibility study showed that the Project area is relatively slopy and classified as undulating-rolling (slope in ranges 20-35% and difference elevation 150-80 m). The river within the project area is an intermittent river, which is water-filled only during rainy season. The surface water was taken at approximately 1.6 km downstream from the project site. Total Suspended Solid (TSS) concentration of the Paleran River is still well within the standard.

The transmission line corridor passes through predominantly agricultural land, primarily rice fields cultivated by local communities. The closest section of the transmission line (TL06) is situated approximately 80-100 m from the DAM Tugu River (approximately 1 km from project site).

The PV module, switchyard, extension bay, and substation areas are primarily covered by sugar cane plants, and it was observed other wood-producing plants and shrubs. Land preparation activities, including site clearing, vegetation removal, and surface leveling may disturb the existing soil profile and lead to topsoil redistribution. Meanwhile, the transmission line areas are predominantly agricultural fields (commonly rice fields)

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cultivated by local communities, typically planted with a single species of seasonal crop, either through dryland or wetland farming.

Disturbances during the construction of both the Solar PV and transmission line may increase the risk of soil erosion, reduce soil fertility, and alter surface runoff patterns, potentially impacting nearby agricultural land, drainage systems, and surrounding areas. The overall construction phase from NTP to COD of the plant is estimated to be 12 (twelve) months, with land clearing and preparation anticipated to be completed within the first three months

It is expected that the earthwork activities for the 164.78 ha area will be performed within the wet season period. Therefore, it is anticipated that the magnitude/severity of the erosion and sedimentation impact is **Medium**.

Based on the landslide hazard index, slope category, sedimentation, soil disturbance and the surface water quality at both the project and TL areas, the sensitivity of impact is classified as **Medium**, characterised by sandy silt and & topsoil medium stiff with low plasticity and low steepness of slope.

With severity/magnitude classified as **Medium** and sensitivity of impact as **Medium**, consequently the impact significance falls under **Moderate**.

Table 6-2 *Impact on Surface Water Quality due to Erosion, Sedimentation and Soil Distribution during Land Preparation and Civil Works (including access road, drainage, TL tower footing and right of way; Construction of Ground-mounted PV and Supporting Facilities)*

Impact Description	*Risk and Impact from Surface Water Quality due to Erosion, Sedimentation and Soil Disturbance during Land Preparation and Civil Works (including access road, drainage, TL tower footing and right of way; Construction of Ground-mounted PV and Supporting Facilities)*								
Impact Nature		Positive			✔	Negative			
Impact Type	✔	Direct				Indirect			
Severity/ Magnitude		Negligible		Low	✔	Medium		Large	
Sensitivity/Vulnerability		Low	✔	Medium		High			
Significance		Negligible		Minor	✔	Moderate		Major	

Source: AFRY, 2024

Proposed Mitigation Measures

It is expected that the following mitigation measures will be embedded to the earthwork's method statement by the Project:

- The Project shall install construction boundary to avoid unnecessary clearing beyond the boundary.
- Erosion management plan shall be prepared before the construction phase commenced; it includes but not limited to the construction of temporary drainage temporary selected sediment ponds and soil & vegetation disposal prior to commencement of any earthwork activities and designated disposal sites.
- Ensure cleared debris is promptly removed from the site to prevent obstruction of drainage, reduce pest risk, and minimize potential impacts on soil quality.
- Minimize vegetation clearing by restricting land disturbance to only areas essential for construction and preserve natural vegetation buffers, particularly near slopes and water bodies.

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- Conduct an inventory of other wood-producing plants before clearing. Where feasible, retain mature or healthy trees at buffer zones or transplant them to suitable nearby areas. Minimize run of water carrying soil from the tree uprooting for replanting that might result sedimentation in the nearby river.
- Strip and store topsoil separately for future site rehabilitation or landscaping and protect topsoil stockpiles with tarpaulin or grass cover to avoid erosion.
- Establishing temporary or permanent vegetation on disturbed areas to stabilize the soil and minimize erosion.
- A Material Handling Plan shall be developed to ensure the safe, efficient, and environmentally responsible handling, storage, transport, and installation of materials required for the ground-mounted solar PV and transmission line project.
- Establish an effective grievance mechanism to document and address complaints related to spoil spillage, transmission line tower footing access, and right-of-way issues affecting nearby agricultural properties.

Residual Impact Significance

If the mitigation measures are implemented well with regular monitoring of the mitigation measures above, the residual impact is deemed to be **Minor** significance.

6.1.2.2 EIA02 - Impact on Surface Water Quality due to Wastewater Discharge during Construction Phase including Operation of Basecamp

Impact Discussion

Runoff and sedimentation may occur during land preparation activities, particularly from vegetation clearing and soil disturbance associated with construction. These impacts can be further intensified by wastewater discharges generated during both the construction and operational phases, especially from worker-related activities such as sanitation and domestic use. The wastewater discharge from the Project is expected to come from:

- Wastewater from workers domestic activity at site including basecamp (toilets, bathroom) and canteen with characteristic high in BOD, TDS, pH, faecal coli, grease and turbidity; and
- Wastewater from vehicles washings, which typically contains oil and sediments.

Septic tanks will be designed and installed complying with applicable standards to receive domestic wastewater from toilets. A third-party will then be engaged for periodical collection and disposal of waste from the septic tanks. Wastewater from the canteen will be channelled into the onsite drainage that will be equipped with a grease trap. Periodical cleaning/collection of grease/oil from the grease trap will be conducted and managed as hazardous waste.

Both wastewater from the construction site and operation phase, temporary drainage, settling pond and STP will be constructed to manage/treat runoff water before discharge to environment.

Impact Evaluation and Significance

The receptor of the wastewater discharge is Paleran River, and according to baseline study, its surface water quality is overall good. The water from Paleran River is used to supply for public water resource such as irrigation and fishing activities, while for clean water, the community mostly rely on The PDAM Banyuwangi. Meanwhile, the transmission line areas are predominantly dry agricultural (commonly) by local communities, who rely on the Paleran and Dam Tugu River for irrigation.

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The land clearing and levelling have potential impact of spoil spillage the nearby farm or properties during construction. Construction period will take approximately 12 months, while land clearing activities until the land is ready for construction is expected to take less than 3 months. Thereby, the sensitivity of the impact receptor is considered as **low**.

The wastewater will be discharged continuously during the construction activity which will take place approximately 12 months. Therefore, the impact duration categorized as **short term**. As mentioned above that the surface water's parameter meets the regulatory standards. However, considering measures for treating the wastewater, the scale is considered as **Low**. Overall, the magnitude of the impact is categorized as **Low**.

With severity/magnitude classified as **Low** and sensitivity of impact as **Low**, consequently the impact significance falls under **Negligible**.

Table 6-3 *Impact on Surface Water Quality due to Wastewater Discharge during Construction Phase including Operation of Basecamp*

Impact Description	*Risks and Impact from Surface Water Quality due to Wastewater Discharge during Construction Phase including Operation of Basecamp*								
Impact Nature		Positive			✔	Negative			
Impact Type	✔	Direct				Indirect			
Severity/ Magnitude		Negligible	✔	Low		Medium		Large	
Sensitivity/Vulnerability	✔	Low		Medium		High			
Significance	✔	Negligible		Minor		Moderate		Major	

Source: AFRY, 2024

Proposed Mitigation Measures

While the impact is negligible, best practices are expected to be implemented by the Project as follows:

- Erosion and drainage management plan shall be prepared before the construction phase commenced. Design and implement temporary surface drainage systems to control runoff, prevent ponding and uncontrolled flow across exposed soil surfaces. Sediment pond design with adequate volume to accommodate peak flow during rain events and allow sufficient detention time for sediment to settle.
- Conduct land clearing and earthworks in phases to reduce exposed soil area.
- Designated spoil disposal area to Identify and use clearly designated spoil disposal sites with appropriate containment.
- Proper design of the wastewater treatment plant complies with applicable standards where the septic tank process and size align with the expected volume and characteristic of wastewater, and installed at a safe distance from water sources.
- Vehicle washing will be covered in the wastewater management plan, which will specify the treatment methods and discharge procedures to ensure that wastewater from vehicle and equipment washing areas is directed to the sediment pond.
- Wastewater management plan, shall be developed to ensure all wastewater is properly treated before being discharged into water bodies, including an emergency response procedure if any case the wastewater treatment is not working.
- Secondary containment shall be ready at working area where oil or chemicals are handled to effectively manage any potential spills, leaks and others unplanned incident.

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6.1.2.3 EIA03 - Impact on Surface Water Quality due to Wastewater Discharge from Solar Modules Cleaning

Impact Discussion

After reaching operational phase and the ground mounted PV has been running for some time, the solar modules need to be cleaned periodically mainly from dust, dirt and /or bird droppings. Typically, water treatment is not required for cleaning, unless it is really required, water will be treated by filtration using active carbon prior to use. The cleaning will be carried out manually by worker. The water from the cleaning will be directly discharged to a drainage that is equipped with grease trap and into a settling pond prior to release into the environment. No chemical will be used in the cleaning process and only water with a total hardness of less than 75 ppm will be used. The water generated from the cleaning will be directly discharged to a drainage that is equipped with grease trap and into a settling pond and treated in the Sewage Treatment Plant (STP) prior to release into the environment. It will then be treated through the STP and subsequently discharged to the environment in accordance with applicable standards. Since no harmful chemicals are involved, the solar panel washing water is generally considered safe for discharge.

Impact Evaluation and Significance

The water to clean the modules will be sourced from the PDAM Banyuwangi. A third-party cleaning service will be engaged on quarterly basis to clean the solar modules when dirt or stains that are difficult to remove. However, the third party usually clean the solar PV panel with water only without any additive. The total volume of water needed is 1,568 m^3/year if the cleaning is done in quarterly basis to clean all the solar modules. The solar modules cleaning activity will be carried out throughout the operational phase, which will take place for 25 years. The impact duration is considered **Long Term**; however, the scale is low as the water discharged will not contain chemicals/pollutants and will use water with a total hardness of less than 75ppm. Therefore, the impact magnitude is categorized as **Low**.

In the Project area, creek is only flow during rainy season, thus during dry season, the wastewater from cleaning solar module will just flow to the ground and let it dry. Since the water source used by the community mainly from PDAM water, followed by packaged drinking water and only small amount of people use groundwater with depth up 100 m, thus the sensitivity of the receptor is **Low**.

Since the magnitude of impact is **Low** and the sensitivity of receptor also **Low,** therefore the impact significance is **Negligible**.

Table 6-4 *Impact on Surface Water Quality due to Wastewater Discharge from Solar Modules Cleaning*

Impact Description	*Impact on Surface Water Quality due to Wastewater Discharge from Solar Modules Cleaning*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible	✔	Low		Medium		Large
Sensitivity/Vulnerability	✔	Low		Medium		High		
Significance	✔	Negligible		Minor		Moderate		Major

Source: AFRY, 2024

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After evaluating the impact, its significance is **Negligible**, however, best practices are expected to be implemented by the Project as follow:

- De-ionized water with a total hardness of less than 75 ppm, as recommended by the manufacturer and required by the Company, shall be used by the third party for cleaning ground-mounted PV module.
- If de-ionized water is not available, rainwater or tap water shall be used as an alternative.
- No chemical detergents or cleaning agents will be used, especially since the runoff is discharging directly into the surrounding soil/drainage.

6.1.3 Ambient Air Quality

The project area is surrounded by undulating terrain of hills and valley that have a very good environmental quality, particularly for ambient air quality. Other activities in the area of study are limited, as well as activity on the road/highway. Therefore, the sources of pollution from human activities can be assumed to be very little. The baseline results advise that the ambient air quality at three sampling locations complies with the National Ambient Air Quality Standards and WHO Air Quality Guidelines. There is no indication of significant air pollution at these locations.

6.1.3.1 EIA04 – Impact to Ambient Air Quality due to Mobilization of Equipment, Materials and Workers during Construction and Operation

Impact Discussion

During the land clearing and construction of the groundmounted PV, air emissions will be generated from the mobilization of equipment, material, and workers. The equipment to be used includes a crawler crane, truck crane, excavator, drilling machine, dump truck, road roller, internal combustion water pump, and diesel generator. The combustion of diesel fuel in this equipment will produce exhaust emissions in the form of NO_2, SO_2, TSP, PM_{10}, and $PM_{2.5}$.

In addition to exhaust emissions, fugitive dust emissions in the form of PM_{10} and $PM_{2.5}$ will result from vehicle movement activities associated with the mobilization.

For transporting the equipment, container trucks, flat trucks, or three-axle trailers (7A) are designated, and the AASHTO HS20 Standard is adopted for transportation.

During the operational phase, no significant impact on ambient air quality is expected from worker mobilization or transmission line maintenance activities, particularly due to the preservation of the protection zone beneath the overhead transmission line. The operation and maintenance procedures are described in Section 3.6.3.

Impact Evaluation and Significance

The site mobilization process involves the transportation or movement of materials, soil, machinery, wastes, and workers during the construction phases. Dust is generated due to the pulverization of soil particles when vehicles move on unpaved surfaces. The turbulence created during vehicular movement causes particulates to be entrained in the wake of moving vehicles. It is important to note that dust from unpaved surfaces generally consists of larger particle sizes compared to particulates generated by combustion processes. According to baseline study, its air quality is overall good and is still within the national and international standards.

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The mobilisation equipment and material will be unloaded at Banyuwangi seaport and trans-shipped using trailer trucks and transported to the Banyuwangi site by road transport. The existing road Raya Banyuwangi – Situbondo Road, Argopuro Road, Raden Wijaya Road and Joyoboyo Road has good road pavement (asphalt pavement). The impact will be experienced by the community nearby the mobilization route with limited road width and paving condition to accommodate heavy vehicle. Thus, the sensitivity of the impact receptor is considered **Medium**.

The villages that will be passed by the mobilization are Kalipuro and Giri subdistricts (Kalipuro, Kelir and Giri Villages). Thus, the extent of the impact is **Local**. The duration of the impact will be limited (temporary) during mobilization activity will take place less than 12 months, then the impact duration is categorized short term. Taking into account considerations above, it is concluded that severity of air quality impact is **Medium** which in line with the traffic impact assessment magnitude (Section 6.1.7 on Traffic). The sensitivity is considered as **Medium** due to the construction equipment and material mobilization route on Raya Banyuwangi – Situbondo Road, Argopuro Road, Raden Wijaya Road and Joyoboyo Road nearest settlement (Kalipuro, Kelir and Giri Villages). With severity/magnitude **Medium** and sensitivity of impact also **Medium**, consequently the impact significance falls under **Moderate.**

Table 6-5 *Impact to Ambient Air Quality due to Mobilization of Equipment, Materials and Workers during Construction and Operation*

Impact Description	*Risks and Impacts from Ambient Air Quality due to Mobilization of Equipment, Materials and Workers during Construction and Operation*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Small	✔	Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible		Minor	✔	Moderate		Major

Source: AFRY, 2024

Proposed Mitigation Measures

It is expected that the following mitigation measures will be embedded to all activity such as construction and installation of ground-mounted PV facilities, switchyard, construction of transmission line and extension bay.

- Develop Air Quality Management Plan which include providing a tire washing facility for trucks/heavy vehicles that leave construction site, conduct dust/particulate matter suppression and maintenance and regular inspection on construction machinery;
- Conduct maintenance and regular inspection on construction machinery;
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits;
- Ensure all vehicles and equipment switch off their engines when stationary;
- Avoid long queueing of vehicles outside the site for long duration by proper planning of receipt or dispatch of materials. If materials are delivered in bulk in several shipments, then prepare a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Carry out emission test for genset during commissioning stage although the genset is used as power back up to collect baseline data on the emission quality of the

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genset. Maintenance of genset and data record on the genset running hours to follow Minister of Environment and Forestry regulation No. 11 of 2021.

Residual Impact Significance

If the mitigation measures are implemented well with regular monitoring of the mitigation measures above, the residual impact is deemed to be **Minor** significance.

6.1.3.2 EIA05 – Impact on Ambient Air Quality due to Land Clearing, Civil Works and Construction of Transmission Line, Ground-mounted PV and Supporting Facilities

Impact Discussion

The Project is a ground-mounted PV, where the solar modules will be place on land, for all facilities such as module area, switchyard, extension bay, and transmission line. Dust will be generated from land clearing, civil works as well as the construction of ground-mounted PV and its supporting facilities.

Impact Evaluation and Significance

- Ground-mounted PV (Boundary), Switchyard, PV Module, Transmission Line RoW (RoW 1, 2 partially RoW 3) and Transmission Tower (1-3) – 155.39 ha
- Gantry – 0.06 ha
- Extension bay – 0.54 ha
- RoW Transmission Line – 8.24 ha
- Transmission Tower – 0.55 ha

Therefore, the total area that will be cleared is approximately 164.78 ha, which is considered large.

Baseline ambient air quality around the project location showed that the ambient air quality is good and is still within the national and international standards. The potential for the project to cause decrease in ambient air quality due to land preparation and on-ground construction is assessed as minor. Impact severity of dust and exhaust emission are assessed **Medium** for PV module area, switchyard, extension bay, transmission line, gantry and a number of equipment will be used.

However, the soil will not be moved outside since it will reuse for embankment and backfill. In addition, the land preparation and construction time will be conducted temporary for 3-6 months. The sensitivity is considered as **Low** due to adjacent settlement, both from from the project site and Transmission Line (T01-T04, T07-T10 and T14). Guidance on the Assessment of Dust from Demolition and Construction, Version 2.2 developed by the Institute of Air Quality Management (IAQM, 2024) has been used for impact assessment. According to this Guidance, site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed.

It is expected during construction activity will anticipate the ambient air and the sensitivity of impact is **Medium** and sensitivity of impact also **Low**, consequently the impact significance falls under **Minor.**

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Table 6-6 *Impact on Ambient Air Quality due to Land Clearing, Civil Works and Construction of Transmission Line, Ground-mounted PV and Supporting Facilities*

Impact Description	*Risks and Impacts from Ambient Air Quality due Land Clearing, Civil Works and Construction of Transmission Line, Ground-mounted PV and Supporting Facilities*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Low	✔	Medium		Large
Sensitivity/Vulnerability	✔	Low		Medium		High		
Significance		Negligible	✔	Minor		Moderate		Major

Source: AFRY, 2024

Proposed Mitigation Measures

- Develop Air Quality Management Plan which include providing a tire washing facility for trucks/heavy vehicles that leave construction site, conduct dust/particulate matter suppression (water spraying on road) and maintenance and regular inspection on construction machinery.
- The Project shall install construction boundary to avoid unnecessary clearing beyond the boundary.
- Speed of vehicles on site will be limited to 10-15 km/hr which will help in minimising fugitive dust emissions due to vehicular movement.
- Exhaust emissions from equipment operating within the site will be controlled by the contractor by ensuring that emissions are minimized through regular servicing of machinery to meet the relevant emission standards.
- Manage material transfer activities to minimize the fugitive dust arising from unloading/loading.
- Ensure covering of soil stockpile on site (if any) with tarpaulins.
- Conduct maintenance and regular inspection on construction machinery.
- Re-vegetate earthworks and exposed areas/soil stockpiles shall be carried out as soon as practicable to stabilise surfaces. Once work in a specific area is completed, the soil shall be reinstated immediately before moving on to other areas. This approach will help to reduce dust emission.

Residual Impact Significance

If the mitigation measures are implemented well with regular monitoring of the mitigation measures above, the residual impact is deemed to be **Negligible** significance.

6.1.4 Noise and Vibration Level

Noise and Vibration level will be generated during construction phase from heavy equipment operations during land preparation activities, land excavation and land levelling such as equipment such as during construction activities would involve the use of off-road construction equipment such as crawler crane, truck crane, excavator, drilling machine, dump truck, road roller, internal combustion water pump, diesel generator and jack drill. Based on the baseline results noise quality showed exceedance against the WBG EHS Guidelines for night-time (Ln) at all of the two locations (NS01 and NS02) were identified at Kalipuro Village, except for the day 2 measurement at NS03 (Bulusan Village).

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6.1.4.1 EIA06 – Impact from Noise and Vibration due to Land Clearing, Civil Works and Construction of Transmission Line, Ground-mounted PV and Supporting Facilities

Impact Discussion

The Project is a ground-mounted PV, where the solar modules and facilities such as switchyard, extension bay, gantry and TL will be placed on designated area will be placed on land (the project area).

Noise may be also generated from large vehicle movements in the project and TL areas such as dump trucks and material trucks. Excessive noise may be generated from the operations of equipment used during ground-mounted PV instalment such as hoister etc. During operation of ground-mounted PV system, it will not generate any noisy from the module or panel operation.

Impact Evaluation and Significance

The baseline result of noise measurement (Ldn) is still below the standard of Ministry of Environmental (MoE) Decree Number 48 of 1996 and WBG EHS Guidelines. Noise quality showed exceedance against the WBG EHS Guidelines for night-time (Ln). The measurement result of vibration is also no indication of exceedance to the MoE Decree Number 49 of 1996. The noise and vibration scale are considered **Medium** as the construction will involve equipment that will generate noise and vibration, both on-ground facilities. The extent will be limited to the Project area of influence; thus, it is considered as **Local**. The duration of construction will be **Temporary** for 12 months. Based on the discussion, it can be concluded that the magnitude of the impact is **Medium**.

The settlement considered a sensitive receptor is located adjacent to the on-ground facilities. The designated transmission line route primarily traverses dry agricultural areas and generally runs in close proximity to settlements (T01-T04, T07-T10 and T14). Other potential sensitive receptors, as outlined in **Table 3-5 (**Project components by administrative location), may also be affected by noise generated during the installation of PV facilities and transmission line project area. Therefore, the sensitivity is considered **Medium**.

With severity/magnitude **Medium** and sensitivity of receptor also **Medium** consequently the impact significance falls under **Moderate**.

Table 6-7 *Impact from Noise and Vibration due to Land Clearing, Civil Works and Construction of Transmission Line, Ground-mounted PV and Supporting Facilities*

Impact Description	*Risks and Impacts from Noise and Vibration due to Land Clearing, Civil Works and Construction of Transmission Line, Ground-mounted PV and Supporting Facilities*								
Impact Nature		Positive			✔	Negative			
Impact Type	✔	Direct				Indirect			
Severity/ Magnitude		Negligible		Low	✔	Medium		Large	
Sensitivity/Vulnerability		Low	✔	Medium		High			
Significance		Negligible		Minor	✔	Moderate		Major	

Source: AFRY, 2024

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Proposed Mitigation Measures

- Development and implementation of Noise and Vibration Management Plan;
- Limit exposure of workers handling noisy and vibrating equipment;
- Construction activities shall be limited to daylight hours although scheduling will require overnight operations on occasion;
- Plan the layout of the site by considering using materials and other large structural equipment or even stockpile to act as noise barriers;
- Use of hoarding/temporary noise barriers or permanent noise barriers where noisy activities are to be installed close to sensitive receivers; and
- Develop an effective grievance mechanism to record and respond to noise and vibration complaints.

Residual Impact Significance

If the mitigation measures are implemented well with regular monitoring of the mitigation measures above, the residual impact is deemed to be **Minor** significance.

6.1.4.2 EIA07 – Impact from Noise and Vibration due to Mobilization of Equipment, Materials and Workers

Impact Discussion

The baseline result of noise quality measurement (Ldn) is still below the standard of Ministry of Environmental and Forestry (MoEF) Decree Number 48 of 1996 and WBG EHS Guidelines. Noise quality showed exceedance against the WBG EHS Guidelines for night-time (Ln) for NS01 and NS02. The measurement result of vibration is also no indication of exceedance to the MoEF Decree Number 49 of 1996. Noise and Vibration may be also generated from large vehicle transportation to the project area. Excessive Noise and Vibration may be generated from the operations of vehicle used during construction. The vehicle will be used for transporting the equipment are container truck flat trucks/three axles trailer (7A) or AASHTO HS20 Standard. Site mobilization will involve transportation or movement of materials, soil, machinery, wastes and workers during the construction phases.

Mobilization of equipment and material will generate Noise and Vibration. The potential for the project to cause increase on Noise and Vibration level due to mobilization activities is assessed at minor significance. The severity is considered low as the mobilization time will be conducted temporary for 12 months and will using container truck. The sensitivity is considered medium since the equipment mobilization route will use main road as there are some of receptors live nearby the main road.

Impact Evaluation and Significance

Noise and Vibration around and within the project area mainly generated from vehicles passing through the area. It was also identified that some noises were generated from the weekly market activities (from crowds) on road during the weekends, and prayer calls/recitation from the mosques, which are short term only. Results of Noise and Vibration measurement shows that Noise and Vibration level in the area is still below the national and international Noise and Vibration level threshold.

Both the project site and TL areas (commonly) are located in close proximity to settlements therefore, sensitivity can be considered as **Medium**. Severity/magnitude would be categorized as **Medium** since construction activities will be temporary (approximately 12 months) and impact will be limited within the project area as settlements are quite far. In addition, noise and vibration generated would not be

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continuous (only during the operations of heavy vehicle and equipment, and construction work) and could be effectively mitigated through an environmental management plan.

With severity/magnitude **Medium** and sensitivity of impact also **Medium** consequently the impact significance falls under **Moderate**.

Table 6-8 *Impact from Noise and Vibration due to Mobilization of Equipment, Materials and Workers*

Impact Description	*Risks and Impacts from Noise and Vibration due to Mobilization of Equipment, Materials and Workers*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Low	✔	Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible		Minor	✔	Moderate		Major

Source: AFRY, 2024

Proposed Mitigation Measures

- Development and implementation of Noise and Vibration Management Plan.
- Limit the hours of operation for specific loud pieces of equipment or operations. Attention will be paid to operations in the proximity of community areas.
- Mobilization activities shall be limited in daytime.
- Conduct maintenance and regular inspection on the vehicle will be used.
- Develop an effective grievance mechanism to record and respond to noise and vibration complaints.

Residual Impact Significance

If the mitigation measures are implemented well with regular monitoring of the mitigation measures above, the residual impact is deemed to be **Minor** significance.

6.1.5 Solid Waste / Non-hazardous Waste

6.1.5.1 EIA08 – Solid Waste/Non-Hazardous Waste due to Land and Vegetation Clearance During Construction

Non-hazardous waste will be generated from land and vegetation clearance during construction for module area, switchyard, extension bay, and transmission line area.

Impact Discussion

The area that needs to be cleared for this Project is as follow:

- Ground-mounted PV (Boundary), Switchyard, PV Module, Transmission Line RoW (RoW 1, 2 partially RoW 3) and Transmission Tower (1-3) – 155.39 ha
- Gantry – 0.06 ha
- Extension bay – 0.54 ha
- RoW Transmission Line – 8.24 ha
- Transmission Tower – 0.55 ha

Therefore, the total area that will be cleared is approximately 164.78 ha, which is considered large.

The Project area is located at sugarcane plantation, while the TL is located mostly in rice field. Waste will be generated during following activities throughout the Project phases:

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- During construction activities including land clearing activities, it will require general conditioning of the terrain, including grubbing, cutting trees, and removal of topsoil, when necessary, as part of land preparation. Waste generation during these activities consists of sugarcane waste (bagasse), grass, excess soil and shrubs. The estimated land that will be cleared is approximately 164.78 ha covering PV modules area, switchyard, extension bay, gantry and transmission line area.
- Waste generation during these activities consists of wooden logs, grass, excess soil and shrubs. The estimated land that will be cleared is approximately 164.78 ha covering module area, switchyard, extension bay, gantry and transmission line area.
- While during the construction of solar PV power plants including transmission line, the construction waste temporary storage will be provided at project site and transmission line areas. The waste will be in the form of woods, material leftovers, concrete scrap, metal scraps, wire scraps and workers' domestic waste. Third party waste collector will then be permitted to take the waste.

Impact Evaluation and Significance

Wastes are likely to increase resulting from the construction wastes (sugarcane bagasse, material leftovers, concrete scrap, metal scraps, wire scraps etc.), which is considered non-hazardous.

Permitted local suppliers for civil and structural material will be complying with the government requirement as applicable for batching plant and the area for structure material will be provided as temporary construction facilities (section 3.6.2).

Construction waste temporary storage will be provided two separate blocks with total 20 m^2 to sort the waste based on category, organic and inorganic wastes and will collect construction waste (ie. woods, metal scraps, wire scraps etc.). The storage will be covered with a roof but without walls. Third party waste collector will then be permitted to take the waste. The project will establish separate waste temporary storage between construction waste which will collect metal scraps, wire scraps etc; and general waste which will collect office waste and workers' waste from domestic activities including shrubs, other wood-producing plants and sugarcane bagasse. While sugarcane stalk will be sold to third party (if require).

Soil disposal area will be provided due the area is relatively flat. The soil will be reused as the foundation for all manner of groundworks. Site levelling will only be conducted for the buildings, warehouse, switchyard area, electrical cluster, gantry, TL and its access road, assembly yard of PV modules and area of temporary construction facilities. Other area will only be subjected to slight trimming other than large-scale site levelling to minimize hauling activities. The earth excavation works mainly include surface clearing, site levelling, on-site road excavation, transformer foundation, collector line/ cable trenches, on-site drainage ditch. Third party for soil transport will be engaged by the Project to be able to soil transport to soil disposal (if require).

Most of civil and structural material, such as ready mix, batching plant, crushed stone /quarry, will be available from local suppliers in the nearest city or approximately within one hour of land transportation to the Project area. Permitted local suppliers for civil and structural material will be complying with the government requirement as applicable for batching plant and the area for structure material will be provided as temporary construction facilities (Section 3.6.2).

According to National Waste Management Information System or *Sistem Informasi Pengelolahan Sampah Nasional (*SIPSN) in 2023. Banyuwangi regency has 19 locations

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for temporary domestic waste disposal facilities or *Tempat Pembuangan Sementara* (TPS) with total waste managed is 16,117.01 ton/year and 2 locations of final domestic waste landfill or *Tempat Pembuangan Akhir* (TPA) Gintangan and Karangbendo with total waste managed 47,804.05 ton/year. The capacity of TPS will accommodate the solid/non-hazardous waste during construction.

It is expected that period during construction for almost 6-7 months, the impact duration categorized as **Short Term**. Ground-mounted PV (Boundary), Switchyard, PV Module, Transmission Line RoW (Row 1, 2 partially RoW 3) and Transmission Tower (1-3) with total 155.39 ha and Gantry (0.06 ha) are dominated by open vegetation, other wood-producing plants, shrubs and sugar cane plantation. While RoW TL (8.24) and Transmission Tower (0.55 ha) are dominated by dry agricultural and rice fields. Due to the vegetation on clearing area is mostly sugar cane, grass and shrubs, no significant construction waste will be exposed. It is anticipated that the magnitude/severity of the construction waste impact is **Low.**

The third party will be collecting the construction waste; therefore, the sensitivity of impact is classified as **Low**, consequently the impact significance falls under **Negligible**.

Table 6-9 *Solid Waste/Non-Hazardous Waste due to Land and Vegetation Clearance During Construction*

Impact Description	*Risks and Impacts from Solid Waste/Non-Hazardous Waste due to Land and Vegetation Clearance During Construction*								
Impact Nature		Positive			✔	Negative			
Impact Type	✔	Direct				Indirect			
Severity/ Magnitude		Negligible	✔	Low		Medium		Large	
Sensitivity/Vulnerability	✔	Low		Medium		High			
Significance	✔	Negligible		Minor		Moderate		Major	

Source: AFRY, 2024

Proposed Mitigation Measures

- Develop and implement a Waste Management Plan, including solid waste management component to ensure proper segregation, collection, temporary storage, transportation, and disposal of waste in accordance with the requirements aligned with the Project's safeguards.
- Provision of waste temporary storage according to the waste types.
- Provision soil disposal area and soil will be reused as foundation for all manner of groundworks.
- Develop Contractor and Supplier Management Plan to ensure licensed local supplier for civil and structural material comply with the government requirements, including batching plants and temporary construction facilities within the Project area; and conduct due diligence to ensure that its operations have proper E&S management practice and supported with the necessary quarry operation permits.
- Third party waste collector will then be permitted to take the wastes. Determine the location for final waste disposal in coordination with the local government and coordinate with the Environmental Agency of Banyuwangi Regency.

Residual Impact Significance

If the mitigation measures are implemented well with regular monitoring of the mitigation measures above, the residual impact is deemed to be **Negligible** significance.

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6.1.5.2 EIA09 – Solid Waste/Non-Hazardous Waste from Workers Activity During Construction and Operation

Impact Discussion

The solid waste generation from workers estimated 0,68 m^3/day. With the approximately number of construction workforce is 431 workers (local and non-local), operation workforce of 54 workers, and post operation with 23 workers (local). Approximately 0,65 m^3/day of domestic solid waste will be generated during construction and 0,07 m^3/day during operation (this has been assessed in section 3.9).

The other solid non-hazardous waste such concrete and brick walls, steel, glass mirrors, electrical cables, pipes, pumps) and other types of waste that can be recycled or still have economic value will be separated to be sold.

Meanwhile, the panel cleaning activity and other PV structures will generate wastewater. However, clean water will be used for cleaning without any use of chemicals or corrosive solvents, thus impact from cleaning of PV panels will not be significant.

Impact Evaluation and Significance

Worker activities during construction period will take approximately 12 months include Land preparation and civil works (including access road, drainage, TL tower footing and right of way; construction of groundmounted PV and supporting facilities).

Domestic solid waste from workers will concentrate at accommodation camp, office and canteen. The rubbish bin will be used to sort waste into two categories: organic and inorganic. Two rubbish bins, each with a capacity of 50 liters, will be provided. The rubbish bins will be provided to accommodate solid waste from the workers and all phases of activities (construction and operational). Meanwhile, septic tanks also will be constructed to treat domestic waste from the workers which has been has explained in section 3.10.

Domestic solid waste from workers will concentrate at Basecamp location designated adjacent with the switchyard area at Kalipuro Village due easiest worker mobilization from and to project area. All domestic waste will be transport to the temporary waste storage (TPS) that are located adjacent the Site (Banyuwangi subdistrict).

It is-expected that period of the workers activities during construction for almost 12 months and operation stage (25 years). Therefore, it is anticipated that the magnitude/severity of the domestic waste from workers impact is **Medium.**

Basecamp is located switchyard and not to far with the residential area (Kalipuro Village). The sensitivity of impact is classified as **Low**, consequently the impact significance falls under **Minor**.

Table 6-10 *Solid Waste / Non-hazardous Waste Impact from Workers Activities During Construction and Operation*

Impact Description	*Risks and Impacts from Solid Waste / Non-hazardous Waste Impact from Workers Activities During Construction and Operation Phases*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Low	✔	Medium		Large
Sensitivity/Vulnerability	✔	Low		Medium		High		
Significance		Negligible	✔	Minor		Moderate		Major

Source: AFRY, 2024

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Proposed Mitigation Measures

- Develop and implement a Waste Management Plan, including solid waste management component to ensure proper segregation, collection, temporary storage, transportation, and disposal of waste in accordance with the Project's safeguards requirements.
- Provision of rubbish bins according to the waste types.
- Maintain the performance of septic tank to ensure that the septic tank works well and coordination with third party to periodically empty the septic tank.
- Third party waste collector will then be permitted to take the wastes. Determine the location for final waste disposal in coordination with the local government and coordinate with the Environmental Agency of Banyuwangi Regency.

Residual Impact Significance

If the mitigation measures are implemented well with regular monitoring of the mitigation measures above, the residual impact is deemed to be **Negligible** significance.

6.1.6 Hazardous Waste

6.1.6.1 EIA10 Hazardous Waste During Construction, Operation and Post Operation

Hazardous waste is defined as any waste containing dangerous and/or toxic material and will damage or pollute the environment or endanger the human health. Hazardous waste includes combustible, inflammable, reactive, toxic, infectious, and corrosive materials.

Impact Discussion

Hazardous waste generation is expected from the Project activities during construction phase, operation phase as well as decommissioning phase. If not managed properly it could contaminate the environment.

Various types of hazardous waste have the potential to be generated from construction activities, including electronic equipment, contaminated packaging/containers, used/damaged hoses, used/expired chemicals and additives, lubricants, and hydraulic fluids. These wastes may also be generated due to accidental spills and leaks. Any structures within the designated areas for the Solar PV system and supporting facilities will need to be removed including asbestos-containing materials found in the roofing components of existing Wungkal Afdelling Office and employee's housing.

During operational, no significant amount of process wastewater produced from panel cleaning due there will be no chemical during the cleaning. The solid hazardous wastes comprise domestic waste, used oil or solvent from operational vehicles, and broken or replaced components (e.g., PV modules, battery cells) upon decommissioning.

Impact Evaluation and Significance

The hazardous waste such as lubricants and fuel could be delivered to the authorized facilities for further processing. The used PV panels could be collected and recycled as a raw material to produce new components for other PV modules, or if not recycled, these components need to be processed by an authorized facility since they contain hazardous materials (e.g., heavy metals).

Hazardous waste generated during construction will be collected at the Temporary Hazardous Waste Storage (TPS B3) and located at adjacent with the switchyard area.

A temporary hazardous waste storage facility will be constructed adjacent to the switchyard area during both the construction and operation phases. For transporting hazardous waste, the Project will engage a licensed hazardous waste transporter such

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as PT. Prasadha Pamunah Limbah Industri (PPLI). The Project will ensure that hazardous waste is properly managed and processed by a licensed hazardous waste service provider.

PPLI will also manage asbestos treatment using advanced waste treatment methods for asbestos-containing material (roofing) in existing structures at the project site.

For overall hazardous waste management, the Project refer with Government Regulation No. 22 of 2021 on Environmental Protection, Organisation and Management. Waste will be transported to the hazardous waste treatment facility, such as PT. Prasadha Pamunah Limbah Industri (PPLI) through a licensed hazardous waste transport service.

Hazardous waste will be generated during construction with period 12 months and operation stage (25 years). During construction and operation not all the activities phases will produce the hazardous waste (B3). It is expected with severity/magnitude **Medium**.

The Temporary Hazardous Waste Storage (TPS B3) is located at adjacent switchyard and not too far from residential (Kalipuro Village). The sensitivity of impact is classified as **Medium**, consequently the impact significance falls under **Moderate**.

Table 6-11 *Hazardous Waste During Construction and Operation*

Impact Description	*Risks and Impacts from Hazardous Waste During Construction and Operation*							
Impact Nature	✔	Positive				Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Small	✔	Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible		Minor	✔	Moderate		Major

Source: AFRY, 2024

Proposed Mitigation Measures

- Develop and implement a Waste Management Plan, including hazardous waste management component to ensure proper segregation, collection, temporary storage, transportation, and disposal of waste in accordance with the Project's safeguards requirements.
- The selected solar PV modules will use monocrystalline panels that do not contain hazardous materials. The project intentionally avoids the use of PV technologies that contain cadmium or other highly toxic substances.
- Damage solar panels including end-or-life disposal will be inspected and assessed for repair or disposal. Damaged panels classified as B3 waste will be temporarily stored in the project owned TPS B3 facility.
- Provision of hazardous waste temporary (TPS B3) accordance with Indonesia's hazardous waste guidelines.
- Trained personnel will handle damaged panels using appropriate PPE.
- Loading and unloading activities will minimize physical stress to avoid further damage or material leakage.
- Coordination with licensed hazardous waste agency (for transport and disposal facility), and perform hazardous waste management in accordance with the operational technical document for hazardous waste management owned; and
- Develop and implement emergency preparedness and response plan.
- Develop and implement an Asbestos Management Plan (AMP) as refer to Regulation Ministry of Manpower No. 3 of 1985 on Occupational Health and Safety the Use of

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Asbestos, Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management Appendix IX for List of Hazardous Wastes from Unspecific Sources and the Asian Infrastructure Investment Bank (AIIB) Environmental and Social Codes of Practice (ESCOPs), including procedures for safe handling, storage, transportation, and disposal which will encompass:

- Asbestos identification in the workplace;
- An outline on how the risks for each Asbestos Containing Material (ACM) are controlled;
- Control measures on the management of asbestos and ACM in the workplace;
- Procedures for accidents, incidents and emergencies involving asbestos in the workplace;
- Responsibilities in implementation of the plan;
- Worker requirements for conducting asbestos work;
- Air monitoring requirement during each type of asbestos work; and
- Requirement of communication of the plan to workers and other relevant stakeholders

Residual Impact Significance

If the mitigation measures are implemented well with regular monitoring of the mitigation measures above, the residual impact is deemed to be **Minor** significance.

6.1.7 Traffic

6.1.7.1 EIA11 – Impact on Existing Local Public Road Condition due to Increment of Traffic Volume Associated with Mobilization Activity During Construction Phase (Project Construction Equipment and Material and Construction Workers)

Discussion of Impact

The Project construction will be required to deliver the heavy equipment and material through existing public road to the project site. As mentioned in Section 3.6.2.3, they will be unloaded at Tanjung Perak seaport and Bayuwangi seaport for main equipment unloading. The trans-shipped using trailer trucks and transported to the Banyuwangi site by road transport. Access road to the Banyuwangi site will be used for equipment and material mobilization during construction. The road transport will use existing national collector road, Situbondo – Banyuwangi Road, then connect to collector road Argopuro Road and Joyoboyo Road.

The peak estimation of construction worker requirement for banyuwangi Solar PV Project is approximately 431 workers. It is expected that 80% of construction workers or about 341 people are from locals with the required specification and 90 expert people. The construction workers basecamp expected will be provided by the EPC for worker accommodation during construction phase.

Based on Baseline condition, the existing road Joyoboyo Road and Argopuro Road are categorized as collector road, with the road width between 4 - 5 meters at Joyoboyo Road and 7 – 8 meters at Argopuro Road. The road pavement of bot road has good pavement. While the national road (Situbondo – Banyuwangi Road) has road width about 6 meters/lane with good pavement road. In relation with traffic volume condition, the road performance LoS level at Joyoboyo Road and Argopuro Road categorized as LoS level A (negligible delay or congestion). While, at Situbondo – Banyuwangi Road LoS level is on category C which delay or congestion likely to occurred. The LoS at Situbondo – Banyuwangi Road is understandable because this road is national collector

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road and become the main road access that connect Ketapang Port and Banyuwangi Regency. The mobilization material and heavy equipment and construction workers will likely have an impact on traffic volume increment during the construction phase but unlikely in operation phase.

Impact Evaluation and Significance

As the EPC contractor has not been assigned yet, no details are available at this stage on the number of vehicles requires to deliver the equipment and material. Therefore, for impact evaluation purposes assumption for 100 MW Solar PV development based on Traffic Management Plan (ANDALALIN) of Ground mounted Solar PV 100 MW Banyuwangi sites. The ANDALALIN has been prepared based of Ministry of Transportation No. 17/2021 regarding Traffic Impact Management and must obtain approval from The Minister of Transportation. The ANDALALIN is prepared during the planning stage of a project or activity that is expected to have a significant impact on traffic around the project site. The ANDALALIN is followed on Regent Decree of Banyuwangi No.188/258/429.0011/2016 regarding Determining the Status of District Roads of Banyuwangi Regency. PT PLN Indonesia Power has submitted the ANDALALIN document to Minister of Transportation and currently waiting for approval. The approval is essential to ensure that proposed developments comply with local traffic management regulations and minimize impact on traffic flow and safety.

The ANDALALIN document estimated the maximum heavy vehicle during mobilisation of equipment and material is 17 (seventeen) trucks per hour[64] or 31 pcu/hour. For the construction workers, assuming the scenario that EPC will provide workers accommodation to accommodate 20% of construction workers (90 people) and for the local workers (341 people) will using motorcycle (2 person/motorcycle) traffic generation from construction workers is 102 pcu/hour and concentrated on the project main facilities. The period of construction is expected will be 12 months, it is expected the mobilisation equipment and material likely occurred throughout the construction period.

The level of service on the existing road due to the traffic generation from mobilisation equipment and material, and construction workers mobilisation at Argopuro Road remained unchanged. However, at Joyoboyo Road and Situbondo - Banyuwangi Road there are slight increment of traffic volume that change the LoS level. Considering the increase of traffic volume, road width and project construction period the severity considered as **medium**.

Table 6-12 *Road Performance at Traffic Sampling Location with Project Influence*

Traffic ID	Road Segment	Baseline (Without Project)		With Project	
		Volume (pcu/hour)	LoS	Volume (pcu/hour)	LoS
TR 1	Joyoboyo Road	1160	A	1293	B
	Argopuro Road	707	A	840	A
TR 2	Situbondo - Banyuwangi Road	2547	C	2680	D

The road friction or land use type along the road access is identified as mixed use between settlement, commercial, industry, public market, public facilities, and

[64] Traffic Management Plan or *Analisis Dampak Lalu Lintas* (ANDALALIN) of 100 MW Solar Power Plant Bayuwangi Site

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cultivation/paddy field. The traffic flow needs to be managed at the bridges at Joyoboyo Road considering the bridge width is limited for one way light/heavy vehicles. In addition, the schedule of heavy equipment and material mobilisation shall consider the weekly market schedule (at Joyoboyo Road) to avoid road closure/detouring road, as well as afterschool time. Therefore, the sensitivity of the risk expected in **medium** level.

With severity/magnitude classified as **medium** and sensitivity of impact as **medium**, consequently the impact significance falls under **moderate**.

Table 6-13 *Increment of road traffic volume related risks and impacts*

Impact Description	*Risk and impact on Existing Local Public Road Condition due to Increment of Traffic Volume Associated with Project Construction Equipment and Material Mobilization, and Construction Workers Activities*								
Impact Nature		Positive			✔	Negative			
Impact Type	✔	Direct				Indirect			
Severity/ Magnitude		Negligible		Small	✔	Medium		Large	
Sensitivity/Vulnerability		Low	✔	Medium		High			
Significance		Negligible		Minor	✔	Moderate		Major	

Source: AFRY, 2024

Proposed Mitigation Measures

- The ANDALALIN or Traffic Management Plan is part of AMDAL and prepared during the planning stage of a project, including coordination Transportation Agency of Banyuwangi Regency, and coordination with community surrounding Project area (scheduling and mobilisation). Develop and implement Traffic Management Plan in alignment with The ANDALALIN document and Good Practice Note for Road Safety (WB, 2019) in accordance with the Project's safeguards, including stakeholder coordination, vehicle movement scheduling, and control of vehicle volumes to minimize emissions.
- Engage and inform the community around Project area about the construction activity, including project schedule and mobilisation route of heavy vehicles.
- Scheduling the mobilisation of heavy equipment and material outside the peak hour of traffic volume and consider after school and weekly market schedule and it expected to inform relevant governance agency (*Transportation Agency/Dinas Perhubungan*) of the project schedule/activity and for escorting if the vehicle convoy is needed.
- Install the Project traffic sign and road markings for safety reason.
- Provide road officer who responsible to manage traffic flow at the gate of project area and install the post security.
- Provide the laydown area to store the heavy equipment and material, as well as the parking area for light and heavy vehicles to avoid parking on the public roadside.
- Ensure the vehicles and drivers in good condition and have valid licence to operate according to standard operation procedure.
- Conduct regular orientation sessions for Project and/or EPC drivers focusing on the ANDALALIN requirements and road safety protocols. The sessions should cover topics such as speed limits, the meaning of traffic signs and road markings, and other relevant traffic regulations.
- Ensure the heavy vehicle weight loading accordance with the road load capacity standard.

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- Ensure the heavy vehicle loading handling accordance with applied standard operation procedure.
- Vehicle speed limit shall apply standard road speed limit (i.e. for collector road inter-city is 40 km/hour and settlement area at local road is 15 – 20 km/hour).
- Improved the road paving with poor condition at local road segment that expected cannot accommodate heavy vehicle load and repair the damaged road cause by the Project's heavy vehicle mobilisation activity after Project construction activity.
- Provide grievance mechanism platform to accommodate community perception related to transportation.

Residual Impact

If the mitigation measures are implemented well with regular monitoring of the mitigation measures above, the residual impact is deemed to be **Minor** significance.

6.1.8 Greenhouse Gas Emission

6.1.8.1 EIA12 – Impact of Greenhouse Gas (GHG) Emission due to of Fuel Combustions during mobilization of Equipment, Materials and Workers

Greenhouse gas (GHG) emissions for this project are associated with diesel fuel combustion from off-road and on-road equipment as well as worker vehicle trips. Cumulative increase in GHG concentrations in the atmosphere globally can be attributed to various sources such as burning of fossil fuel, agricultural by-products, land clearing and others. During operation, the Solar PV will not use any fossil fuel. It thereby reduces the greenhouse gas emissions associated with fossil fuel-based electricity generation system.

According to the IFC Performance Standard 3 for a project that is expected to produce more than 25,000 MT CO_{2e}/year, while EP 4 is expected to be more than 100,000 tonnes of CO_{2e}/year, the project proponent is required to report their annual Scope 1 and 2 GHG emissions. Scope 1 emissions are direct emissions from the facilities owned or controlled within the physical project boundary as for Scope 2 emissions are indirect emissions associated with the off-site. However, the wide range of greenhouse gas emission from Photovoltaic approximately 30-300 g CO_{2e}/kWh (N.H. Reich, 2007) which will not reach the standard from both IFC and EP 4.

Impact Discussion

Construction of off-road and on-road equipment will generate GHG emissions due to the burning of fuels. During the land clearing and construction of the solar PV, GHG emissions will be generated from fuel combustions during the mobilization of equipment, material, and workers. The equipment with fuel combustion engines will include a crawler crane, truck crane, excavator, drilling machine, dump truck, road roller, internal combustion water pump, and diesel generator. The combustion of fuel in these equipment will produce GHG emissions mainly in the form of CO_2 with relatively small amounts of methane (CH_4) and nitrous oxide (N_2O).

Impact Evaluation and Significance

The duration of the impact will be limited during mobilization activity will take place less than 12 months, then the impact duration is **Short Term**. Based on the GHG estimations, the magnitude of the impact was translated to **Low** Severity. The sensitivity of receptor to the GHG impact is assessed **Low**. Combining **Low** Severity and **Low**

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Sensitivity results **Negligible** Significance of the impact from the Ground mounted PV construction.

Table 6-14 *Greenhouse Gas (GHG) Emission Impact due to of Fuel Combustions during mobilization of Equipment, Materials and Workers*

Impact Description	*Greenhouse Gas (GHG) Emission Impact due to of Fuel Combustions during mobilization of Equipment, Materials and Workers*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible	✔	Low		Medium		Large
Sensitivity/Vulnerability	✔	Low		Medium		High		
Significance	✔	Negligible		Minor		Moderate		Major

Source: AFRY, 2024

Proposed Mitigation Measures

While the impact is negligible, best practices are expected to be implemented by the Project as follow:

- Exhaust emissions from off-road and on-road equipment operating within the site will be controlled by the contractor by ensuring that emissions are minimized through regular servicing of machinery to meet the relevant emission standards; and
- Ensure that the engines of all vehicles and machinery on site are not left running unnecessarily.

6.1.8.2 EIA13 – Impact of Greenhouse Gas (GHG) due to Land Clearing, Civil Works and Construction of Solar PV and Supporting Facilities

Impact Discussion

During the land clearing, civil works and construction of the solar PV, GHG emissions will be generated during the operations of equipment with fuel combustion engines such as crawler crane, truck crane, excavator, drilling machine, dump truck, road roller, internal combustion water pump, and diesel generator. The combustion of fuel in these equipment will produce GHG emissions mainly in the form of CO_2 with relatively small amounts of methane (CH_4) and nitrous oxide (N_2O). Total area that will be cleared is approximately 103,20 ha, including PV Modul, Switchyard, Extension Bay, Transmission line an access road, which is considered large area.

Impact Evaluation and Significance

The duration of the impact will be limited, as land clearing, civil work and construction activities will take place less than 12 months, then the impact duration is **Short Term**. Based on the GHG estimations, the magnitude of the impact was translated to **Low** Severity. The sensitivity of receptor to the GHG impact is assessed **Low**. Combining **Low** Severity and **Low** Sensitivity results in **Negligible** Significance of the impact from the Solar PV construction.

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Table 6-15 *Greenhouse Gas (GHG) Emission Impact due to of Fuel Combustions during mobilization of Equipment, Materials and Workers*

Impact Description	*Greenhouse Gas (GHG) Emission Impact due to of Fuel Combustions during mobilization of Equipment, Materials and Workers*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible	✔	Low		Medium		Large
Sensitivity/Vulnerability	✔	Low		Medium		High		
Significance	✔	Negligible		Minor		Moderate		Major

Source: AFRY, 2024

Proposed Mitigation Measures

While the impact is negligible, best practices are expected to be implemented by the Project as follow:

- Exhaust emissions from equipment operating within the site will be controlled by the contractor by ensuring that emissions are minimized through regular servicing of machinery to meet the relevant emission standards;
- Ensure that the engines of all machinery on site are not left running unnecessarily; and
- Disturbed areas that will no longer be developed can be revegetated with local vegetation to serve as buffer for future activities and operation and to increase local sequestering capacity for greenhouse gases.

6.1.8.3 EIA14 – Positive Impact due to Greenhouse Gas Emission Reduction from Solar PV Operations

Impact Discussion

Indonesia is committed to fulfil the energy mix target in the Country (minimum 23% renewables by 2025 and 31% by 2050), where a Green Energy Project (*Hijaunesia*) has been established with the aim to reduce the GHG emission (29% GHG emission reduction by 2030). The development of Solar PV Power Plant (PP) becomes one of the considerations on the GHG emission reduction program, which would be able to substitute the fuel sourced power plants.

Impact Evaluation and Significance

Solar PV Power Plant (PP) is considered as a renewable, clean source of electricity. Solar PV PP will not emit any greenhouse gases, instead it could substitute fuel sourced power plant that emit greenhouse gas as a result of fuel burning. The operation phase will last for about 25 years as in accordance with the design lifetime of the PV module, which is long term. Thus, the impact significant is assessed **Positive**.

Table 6-16 *Positive Impact from Solar PV Operations*

Impact Description	*Positive Impact related to Greenhouse Gas Emission from Solar PV Operations*			
Impact Nature	✔	Positive		Negative
Impact Type	✔	Direct		Indirect

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6.1.9 Biodiversity

The significance of the impacts has been assessed using the approach and methodology described in the pre-ESIA report. The criteria for sensitivity and magnitude of the impact on Biodiversity (Habitat & Species) are defined in tables below.

Table 6-17 *Sensitivity Criteria for Biodiversity*

Sensitivity	Definition
Negligible	**Habitat** No wildlife habitat is impacted, or only an area with extensive human activity that does not support the wildlife habitat (i.e., intensive agriculture area, settlement area, exiting industrial complex, etc.). **Species** No species impacted by the project or only limited species that have a wide distribution in the world and/or common species that do not have any conservation interest and not include as low conservation interest based on expert opinion.
Low	**Habitat,** Only a local designation/recognition, habitats of significance for species listed as Least Concern (LC) on the IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion. **Species** Species and/or sub-species of LC or DD on the IUCN Red List or not meeting medium or high-value conservation criteria.
Moderate	**Habitat** Habitats within nationally designated or recognized areas, habitats of significant importance to globally Vulnerable (VU), Near Threatened (NT), or Data Deficient (DD) species, habitats of significant importance for nationally restricted range species, habitats supporting nationally significant concentrations of migratory species and/or congregatory species, and low-value habitats used by species of medium value. **Species** Species on the IUCN Red List as VU, or NT, species protected under national legislation, nationally restricted range species, nationally important numbers of migratory or congregatory species, species not meeting criteria for high value, and species vital to the survival of a medium value species.
High	**Habitat** Habitats within internationally designated or recognized areas, habitats of significant importance to globally Critically Endangered (CR) or Endangered (EN) species, habitats of significant importance to endemic and/or globally restricted-range species, habitats supporting globally significant concentrations of migratory species and/or congregatory species, highly threatened and/or unique ecosystems, areas associated with key evolutionary species, and low or medium value habitats used by high-value species. **Species** Species listed as CR or EN on the IUCN Red List. Species having a globally restricted range (i.e., plants endemic to a site or found globally at fewer than ten sites, fauna having a distribution range (or global breeding range for bird species) of less than 50,000 km^2), internationally important numbers of migratory, congregatory species, key evolutionary species, and species vital to the survival of a high-value species.

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Table 6-18 *Magnitude Criteria for Biodiversity*

Magnitude	Definition
Negligible	**Habitat** No existing habitat is affected except within the normal range of variation. **Species** No species is affected except in the normal range of variation.
Low	**Habitat** Affects only a small area of habitat, such that there is no loss of viability/ function of the habitat. **Species** Effect does not cause a substantial change in the species' population or other species dependent on it.
Moderate	**Habitat** Affects part of the habitat but does not threaten the long-term viability/ function of the habitat. **Species** Effect causes a substantial change in abundance and/or reduction in the distribution of a population over one or more generations but does not threaten the long-term viability/ function of that population or any population dependent on it.
High	**Habitat** Affects the entire habitat, or a significant proportion of it, and the long-term viability/ function of the habitat is threatened. **Species** Affects the entire population, or a significant part of it, causing a substantial decline in abundance and/or change in and recovery of the population (or another dependent on it) is not possible either at all or within several generations due to natural recruitment (reproduction, immigration from unaffected areas).

The significance of impact will be evaluated refer to **Table 5-4**.

6.1.9.1 Terrestrial Biodiversity

Based on existing literature—58 studies related to birds, 20 related to bats, and 339 concerning general ecology—there are four potential risks that ground-mounted solar PV development poses to biodiversity: collision risk, disturbance and displacement, barrier effects, and changes in habitat function, as well as habitat loss and fragmentation. These risks are likely to occur on a large scale due to the extensive land area required for solar PV installations and the surface area needed to effectively harvest sunlight (Chris Harrison, Huw Lloyd and Chris Field, 2016). In the context of Ground-mounted Solar PV in Banyuwangi, those potential impacts are discussed below.

6.1.9.1.1 EIA15: Habitat Loss due to Construction

Discussion of Impact

Construction of PV modules and their associated facilities typically requires removal of vegetation and surface grading across large areas of land. This may cause habitat loss, degradation and fragmentation, leading to a reduction in species richness and density.

Impact Evaluation and Significance

Referring to the land area breakdown as detailed in Project Description (Section 3.1.2), the area would be required for land clearing is 157.46 Ha including:

- 156.26 ha: PVPP and Switchyard Boundary including 136 ha FPV area and 20.26 ha SUTT internal site, excluding TL; and

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- 1.2 ha: Extention Bay.

Given those proposed area required for land clearing is sugarcane field (agricultural land habitat) where the species of birds, mammals, and insects is less diverse compared to the mix plantation habitat, so the magnitude of impact is considerably **low**. It would not cause a substantial change in the species' population or other species dependent on it. The sensitivity of impact is considerably **low** since no species is qualified for CHA at TB2 (representing area for project footprint). Therefore, overall assessment of risk and impact for habitat loss due to construction activity advised that the significant of this impact is **minor**.

Table 6-19 *Habitat Loss due to Construction*

Impact Description	*Habitat Loss due to Construction*								
Impact Nature		Positive			✔	Negative			
Impact Type	✔	Direct				Indirect			
Severity/ Magnitude		Negligible	✔	Low		Medium		High	
Sensitivity/Vulnerability		Negligible		Low	✔	Medium		High	
Significance		Negligible	✔	Minor		Moderate		Major	

Proposed mitigation measures

It was understood that land clearing, and habitat disturbance will be occurred at the area for main project component including PVPP and switchyard, extension bay, associated facilities including power transmission line tower pad and substation.

The proposed mitigation measures are as follow:

- Project to provide clear Land Preparation and Civil Work Plan including relevant site layout map to allow all construction personnel have clear understanding on their working area boundary.
- Under the supervisory of Project Owner and/or Consultant Supervisor, construction personnel shall conduct join inspection to determine the designated project footprint boundary prior to the commencement of land clearing.
- Biodiversity Site Induction shall be conducted together with HSE Site Induction prior to site join inspection.
- Using the approved site layout map, construction personnel shall conduct the land clearing within designated project footprint boundary. Land clearing outside the boundary is out of conduct and remedial action shall be conducted.
- Implement "3 R" procedure (Report, Rescue and Release) to trapped wildlife within Project site. Consultation with professional Ecologist or Veterinarian may be required if serious or emergency situation occurred (i.e. handling injured wildlife).

Residual Impact

As a result of implementation of the proposed measures, the residual risk and negative impact on habitat loss due to land clearing is expected negligible.

6.1.9.1.2 EIA16: Habitat Modification or Fragmentation

Discussion of Impact

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The potential for solar PV developments to result in habitat modification and fragmentation with potential significant negative impacts on biodiversity in areas of high ecological value (Birdlife, 2011).

Referring to baseline survey, the Ecologically Appropriate Area of Analysis (EAAA) of the project are predominantly modified habitat including 68% agricultural land (TB4) consists of agricultural (monoculture) field and mixed plantation (TB3 and TB4), 14% plantation forest (TB1 and TB2), 13% built-up area and only 1% shrubland.

Impact Evaluation and Significance

Using the guideline for identifying High Ecological Value Aquatic Ecosystems (HEVAE)[65], the criteria for identifying High Ecological Value Terrestrial Ecosystems is defined as follow:

- Diversity: Diversity of species, habitats, and/or geomorphological features and processes;
- Distinctiveness: The terrestrial ecosystem is, or features rare, threatened or unusual, and/or it features rare or significant species and/or geomorphological features;
- Vital habitat: The terrestrial ecosystem provides vital habitat for unusually large numbers of native or migratory species and/or maintenance of populations of specific species critical life cycle stages and/or provides key or significant refugia for terrestrial species that depend on that habitat, particularly during times of stress;
- Naturalness: The ecological character of the ecosystem is not adversely affected by modern anthropogenic activity; and
- Representativeness: The terrestrial ecosystem is an outstanding example of its class within EAAA.

Table 6-20 *Ecological Value of Study Area*

Type of Habitat	Ecological Value				
	Diversity	Distinctive-ness	Vital Habitat	Natural-ness	Representative-ness
Agricultural Land (TB1 and TB2)	Birds: 23-30 species Mammals: 7 species (none at TB2) Flora: 8-25 species	No	No	No	No
Mixed Plantation (TB1, TB3 and TB4)	Birds: 14-16 species Mammals: 3-4 species Flora: 14-16 species	No	No	No	No
Water Body (Panawa River)	Ichtyofauna Diversity Index: 1.5 (9 taxa)	No	No	No	No

[65] Guidelines for Identifying High Ecological Value Aquatic Ecosystems (HEVAE): Aquatic Ecosystems Toolkit Module 3 (Department of Environment, Science and Innovation) (des.qld.gov.au)

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Given, the most EAAA is modified habitat, the ecological value of those habitat type is considerably low. Referring to this analysis, the significance impact of Project to biodiversity due to habitat modification and fragmentation is considerably **negligible** due to small impact magnitude and low sensitivity of habitat fragmentation to biodiversity which found in each habitat.

Table 6-21 *Habitat Modification or Fragmentation*

Impact Description	*Habitat Modification or Fragmentation*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible	✔	Low		Medium		High
Sensitivity/Vulnerability			✔	Low		Medium		High
Significance	✔	Negligible		Minor		Moderate		Major

Proposed mitigation measures

No specific mitigation measures are required to undertaken as long as all proposed mitigation measures on habitat loss is properly undertaken.

Residual Impact

The residual risk and negative impact on habitat modification and fragmentation due to land clearing are not expected since the significance impact is negligible.

6.1.9.1.3 EIA17: Avian Fauna Mortality due to Collision and/or Electrocution

Discussion of Impact

The Project may result in avian mortality through collision with solar PV infrastructure and/or collision and electrocution associated with the proposed 150 kV OHTL. For ground-mounted solar PV facilities, available literature indicates that direct collision risk with PV panels is generally low, although birds may occasionally be attracted to PV sites depending on habitat context, availability of foraging resources and surrounding land uses. The more relevant avian mortality risk for the Project is therefore associated with the proposed OHTL and related infrastructure, particularly where birds fly within the same height band as the conductors or earth wire/OPGW.

Bird collision with overhead lines can occur when flying birds fail to detect conductors or earth wires, particularly thinner and less visible wires such as earth wires/OPGW. Collision risk is influenced by biological, environmental and engineering factors, including bird size, flight behavior, maneuverability, line visibility, weather and light conditions, habitat context, and whether the line intersects regular bird movement routes. Collision risk is typically higher where overhead lines cross wetlands, roosting or foraging routes, migration corridors, or areas with frequent flight activity by large-bodied or less maneuverable species.

Electrocution risk occurs when a bird simultaneously contacts two energized components, or an energized component and a grounded component. This risk is generally higher on medium-voltage distribution lines, where the spacing between energized and grounded components may be small enough for birds to bridge. For high-voltage transmission lines such as the proposed 150 kV lattice OHTL, phase-to-phase and phase-to-ground clearances are generally larger, and therefore electrocution risk is

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expected to be lower. However, localized electrocution or injury risks may still occur at complex structures such as tension towers, jumper arrangements, gantry structures, terminal structures and substation-interface areas if bird-safe design is not confirmed.

The Banyuwangi 150 kV OHTL will be approximately 4.3 km long and supported by 16 lattice towers. The distance between the ground and the lowest conductor on a standard tower is approximately 19 m, while the height from ground level to the lowest crossarm is approximately 22 m. The second baseline bird survey defined Band 2 as 10–35 m above ground level, which corresponds to the approximate height range of the proposed transmission infrastructure. Therefore, bird use of Band 2 is the key factor in assessing potential collision risk.

The first baseline vantage point survey recorded limited flight activity within the higher flight-height bands. Crested Serpent-eagle was the only species recorded in Band 2 and Band 3 during the first baseline survey, while other species such as Cave Swiftlet, Javan Pond Heron, White-breasted Woodswallow and Javan Kingfisher were observed primarily in Band 1. However, the second baseline survey provided more detailed information on bird use of the proposed OHTL corridor and specifically focused on bird activity within Band 2.

The second baseline survey recorded 40 bird species crossing or inhabiting habitats along the proposed transmission-line corridor. Of these, 17 species were recorded using Band 2, including House Swift, Cave Swiftlet, Black-nest Swiftlet, Scaly-breasted Munia, White-breasted Woodswallow, Javan Kingfisher, Blue-tailed Bee-eater, Javan Pond Heron, Crested Honey Buzzard and Peregrine Falcon. Band 1 was the most frequently used flight zone at both VP1 and VP2, indicating that most bird flight activity occurred below the main OHTL collision-risk zone. Nevertheless, Band 2 activity was confirmed, particularly at VP2, where 16 species, 38 flight movements and 122 individuals were recorded within the Band 2 height range. At VP1, 4 species, 11 flight movements and 81 individuals were recorded in Band 2.

The most frequently recorded Band 2 species were small to medium-sized and generally maneuverable species, including House Swift, Cave Swiftlet, Black-nest Swiftlet and Scaly-breasted Munia. These species are expected to have lower collision susceptibility than large-bodied, less maneuverable birds such as storks, cranes or large waterbirds. However, their confirmed use of the OHTL height band indicates that some collision exposure exists. In addition, protected and/or migratory raptors, including Crested Honey Buzzard, Chinese Sparrowhawk and Peregrine Falcon, were recorded during the second baseline survey. Crested Honey Buzzard and Peregrine Falcon were recorded within Band 2, although at low frequencies and low individual numbers. These species remain relevant receptors due to their protected and migratory status, although their low recorded exposure reduces the likely magnitude of impact.

The baseline results do not indicate the presence of a major directional flight corridor for large-bodied waterbirds or raptors within the proposed OHTL corridor. Most Band 2 movements were described as random, short-distance or associated with movements between trees and canopy-level habitat features within modified agricultural and plantation landscapes. This suggests that the OHTL collision risk is lower than would be expected in a wetland, reservoir-edge or major migratory flight-corridor setting. However, localized risk remains relevant, particularly around VP2 and other spans that pass close to mature tree vegetation, mixed plantation edges, agricultural foraging areas or locations where Band 2 bird activity is concentrated.

Impact Evaluation and Significance

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Potential avian mortality associated with the Project may occur through two main pathways: (i) collision with ground-mounted PV infrastructure, and (ii) collision and/or electrocution associated with the proposed 150 kV OHTL. These impact pathways have different likelihoods and risk mechanisms and are therefore evaluated separately below.

- Collision Risk Associated with Ground-Mounted PV Panels

The potential for bird collision with ground-mounted PV panels is considered to be low. Available studies do not indicate that bird collision with PV panels is typically a significant source of avian mortality, and the Banyuwangi Project is located within a modified agricultural and plantation landscape rather than an open waterbody. Although birds may use vegetation and habitats surrounding the PV site for foraging, shelter and movement, direct collision with the PV arrays is not expected to be a major mortality pathway.

The magnitude of direct collision risk with the ground-mounted PV panels is therefore assessed as Low. The sensitivity of avian receptors is assessed as Medium due to the presence of protected, migratory, endemic and Vulnerable species within the wider study area. The resulting significance of direct collision with PV panels is assessed as Minor.

- Collision Risk Associated with the 150 kV OHTL

The proposed 150 kV OHTL presents a more relevant avian collision-risk pathway than the ground-mounted PV panels. The lowest conductor height of the proposed OHTL is approximately 19 m, and the lowest crossarm is approximately 22 m above ground level. This overlaps with Band 2, defined during the second baseline survey as 10–35 m above ground level.

The second baseline survey confirmed that birds use Band 2 within the proposed OHTL corridor. A total of 17 species were recorded in this height band. Bird use of Band 2 was relatively limited at VP1 but more pronounced at VP2. The higher number of species, flight movements and individuals recorded at VP2 suggests that this area may provide more suitable habitat conditions for birds using mid-altitude flight paths, likely associated with mature vegetation, plantation edges and agricultural foraging resources.

The species recorded most frequently in Band 2 were generally small to medium-sized and relatively maneuverable. This reduces the overall collision susceptibility compared with sites where high numbers of large-bodied waterbirds or soaring birds regularly cross transmission-line corridors. However, collision risk cannot be considered negligible because confirmed Band 2 use overlaps with the proposed OHTL height range. The thinner earth wire/OPGW is expected to present a greater collision risk than the larger phase conductors because it is less visible to flying birds.

Protected and migratory raptors, including Crested Honey Buzzard and Peregrine Falcon, were recorded within Band 2, although at low frequencies and low individual numbers. Chinese Sparrowhawk was also recorded during the second baseline survey but was not recorded within the Band 2 flight-height table. These species are considered secondary receptors for OHTL collision risk due to their conservation status, but their low recorded exposure indicates that the magnitude of impact on these species is likely to be limited.

Based on the above, the unmitigated collision risk associated with the Banyuwangi 150 kV OHTL is assessed as Low to Medium overall, with locally Medium risk at higher-risk spans, particularly near VP2 and any spans passing close to mature tree vegetation, mixed plantation edges, agricultural foraging areas or locations where Band 2 bird

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activity is concentrated. The sensitivity of avian receptors is assessed as Medium due to the confirmed presence of protected, migratory, endemic and Vulnerable species. The resulting unmitigated significance of OHTL collision risk is assessed as Minor to Moderate overall, with locally Moderate significance at higher-risk spans.

- Electrocution Risk Associated with the 150 kV OHTL

Electrocution risk for the main 150 kV lattice OHTL is expected to be low because the phase-to-phase and phase-to-ground clearances are generally larger than the wingspans of the bird species recorded during the baseline surveys. Therefore, the likelihood of a bird simultaneously contacting two energized components, or an energized component and a grounded component, is expected to be low under normal design conditions.

However, localized electrocution or injury risks may still occur at specific structures where conductor geometry is more complex, including tension towers, jumper arrangements, gantry structures, terminal structures and substation-interface areas. Towers may also be used by raptors or other birds for perching. Therefore, the final engineering design should be reviewed to confirm bird-safe clearances and appropriate insulation or shielding where necessary.

The magnitude of electrocution risk is assessed as Low, while receptor sensitivity is assessed as Medium due to the presence of protected and migratory species. The resulting significance of electrocution risk is assessed as Minor, subject to confirmation of bird-safe design during detailed engineering.

- Overall Impact Significance

Overall, avian mortality risk associated with the Banyuwangi Project is driven primarily by potential collision with the proposed 150 kV OHTL, rather than by direct collision with ground-mounted PV panels or electrocution on the OHTL. The unmitigated OHTL collision risk is assessed as Low to Medium overall, with locally Medium risk at higher-risk spans, especially near VP2 and areas where Band 2 bird activity is concentrated. Electrocution risk is assessed as Low. Hence, in general, assuming a precautionary approach, overall severity/magnitude is classified as **Medium**.

Given the presence of protected, migratory, endemic and Vulnerable species in the study area, avian receptor sensitivity is assessed as **Medium**. The overall unmitigated significance of avian mortality due to collision and/or electrocution is therefore assessed as **Minor to Moderate**, with localized Moderate significance for higher-risk OHTL spans.

Table 6-22 *Avian Fauna Mortality due to Collision and/or Electrocution*

Impact Description	*Disturbance Displacement due to Construction*							
Impact Nature		Positive		✔	Negative			
Impact Type	✔	Direct			Indirect			
Severity/ Magnitude		Negligible		Low	✔	Medium		High
Sensitivity/Vulnerability		Negligible		Low	✔	Medium		High
Significance		Negligible		Minor	✔	Moderate		Major

Proposed mitigation measures

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The following mitigation measures shall be implemented to reduce avian mortality risk associated with collision and/or electrocution:

- The proposed transmission-line route and corridor shall not be changed without further assessment of bird collision and electrocution risk.
- If any significant change to the OHTL route, corridor, tower locations, span lengths or conductor/earth wire configuration occurs during detailed engineering design (DED), the avian collision and electrocution risk assessment shall be updated by a qualified ornithologist/ecologist.
- During DED, the final OHTL alignment, tower schedule, span configuration and earth wire/OPGW arrangement shall be reviewed against the VP survey results to identify priority higher-risk collision spans. These shall include, but not be limited to, spans near VP2, mature tree vegetation, mixed plantation edges, agricultural foraging areas and locations where Band 2 bird activity was recorded.
- Prior to energization, effective bird flight diverters shall be installed on identified higher-risk OHTL spans. Diverters shall be installed preferentially on the earth wire/OPGW, and where required on conductors, in accordance with manufacturer recommendations and good international practice.
- The final OHTL design shall be reviewed to confirm bird-safe clearances at tension towers, jumper arrangements, gantry structures, terminal structures and substation-interface areas. Where any configuration presents a potential electrocution risk to medium- or large-bodied birds, appropriate redesign, insulation or shielding shall be implemented.
- Post-construction fatality/mortality monitoring shall be undertaken for a minimum of one year after energization. Monitoring shall include systematic carcass searches beneath representative and higher-risk spans, with correction for searcher efficiency, carcass persistence/scavenger removal, habitat visibility and survey interval. Monitoring shall cover relevant seasonal periods and peak bird movement periods.
- If monitoring identifies bird mortality above agreed trigger levels, adaptive management shall be implemented. This may include installation of additional bird flight diverters, increased diverter density, extension of diverters to additional spans, review of tower/perching management, and extension of monitoring beyond one year.
- Routine operational inspections shall include checks for bird nesting or frequent perching on towers, particularly by raptors such as Crested Honey Buzzard, Chinese Sparrowhawk, Peregrine Falcon and other birds of prey. Any nest management or perch deterrent measures shall be developed and implemented by qualified specialists.

Residual Impact

With implementation of the proposed mitigation measures, including targeted installation of bird flight diverters on higher-risk OHTL spans, confirmation of bird-safe design at complex structures, and post-construction fatality monitoring with adaptive management, the residual risk of avian mortality due to collision and/or electrocution is expected to be reduced to **Minor**.

Residual risk is not expected to be fully eliminated because birds were confirmed to use the Band 2 height range that overlaps with the proposed OHTL. However, residual

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impacts are expected to be manageable and not significant, provided that mitigation is implemented prior to energization and monitoring confirms low or negligible mortality. If monitoring identifies significant bird mortality, additional adaptive management measures shall be implemented.

6.1.9.1.4 EIA18: Disturbance Displacement

Discussion of Impact

Construction of solar PV plants and their associated facilities typically require removal of vegetation and surface grading across large areas of land. Beside habitat loss, this may cause disturbance on biodiversity due to displacement during the construction activity.

Impact Evaluation and Significance

The significance of biodiversity impacts will vary depending on the level of degradation of the previous habitat and the geographic location, and in some circumstances may be positive. Given the Banyuwangi ground-mounted solar PV is on land, which is mostly dominated by sugar cane plantation, so the significance of impact of disturbance displacement due to change of land use from plantation forest to solar PV arrays is **minor**. This conclusion is driven by consideration that magnitude of negative impact on affected terrestrial biodiversity habitat at the location where the proposed solar PV arrays will be sited is **low** compared to the entire area in the vicinity of this project footprint. In addition, the sensitivity of existing biodiversity leaving in habitat at the location where the proposed solar PV footprint is considerably **low** due to no conservation significance species.

Table 6-23 *Disturbance Displacement due to Construction*

Impact Description	*Disturbance Displacement due to Construction*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible	✔	Low		Medium		High
Sensitivity/Vulnerability		Negligible	✔	Low		Medium		High
Significance		Negligible	✔	Minor		Moderate		Major

Proposed mitigation measures

There are no specific mitigation measures is required to undertaken as long as all proposed mitigation measures on habitat loss is properly undertaken.

Residual Impact

As a result of implementation of the proposed measures, the residual risk and negative impact on habitat modification and fragmentation due to land clearing is expected minor.

6.1.9.1.5 EIA19: Barrier Effects due to Soar PV Arrays Installation

Discussion of Impact

Large areas of PV panels and their associated facilities can disrupt wildlife movement and/or migrations by acting as a barrier. For example, important stopover sites for

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migratory birds may be lost due to cumulative impacts from several large PV plants along their flyway[66].

Solar plants typically have security perimeter fencing installed. In some cases, existing ground clearance under fences, gaps in the fence weave, and gates allow small to medium sized mammals to pass. However, such fencing could still pose a barrier to large mammal movement and/or migrations.

Impact Evaluation and Significance

Referring to baseline survey of mammal, endangered long-tailed macaque (*Macaca fascicularis*) was found at TB1 outside area proposed for the PV arrays. Given the distribution of this species in this area is unknown, no evidence or information regarding presence of the long-tailed macaque in TB2. Although direct evidence of the barrier effect of solar facilities is largely unquantified, the barrier effects related to large scale developments and infrastructure components, such as fencing, has been demonstrated to impact species movement, and reduction of range size[67]. It more likely occurred in Banyuwangi ground-mounted solar PV site in particularly TB2. Concerning to the **medium** sensitivity and **low** impact magnitude of barrier effect due to fencing during the future operation of this solar PV plant, the significance of impact is considerably **moderate**.

Table 6-24 *Barrier Effects due to Soar PV Arrays Installation*

Impact Description	*Barrier Effects due to Soar PV Arrays Installation*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible	✔	Low		Medium		High
Sensitivity/Vulnerability		Negligible		Low	✔	Medium		High
Significance		Negligible		Minor	✔	Moderate		Major

Proposed mitigation measures

- By the involvement of biodiversity specialist, the Project shall conduct a joint pre-land clearing inspection to ensure that the Project site is not overlapping with the existing wildlife corridor as part of their home range.
- The Project shall ensure that they will not close the existing wildlife corridor if it was identified during the joint pre-land clearing inspection activity.
- The Project shall provide space within the Project footprint for conserving the existing wildlife corridor if the case of item #2 is occurred.

Residual Impact

As a result of implementation of the proposed measures, the residual risk and negative impact on barrier effect due to Project site fencing is expected minor.

[66] BirdLife International (n.d.).
[67] Numerous studies have documented the barrier effects of infrastructure developments. For example, see Wingard et al. (2014); Wyckoff et al. (2018).

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6.1.9.2 Aquatic Biodiversity

6.1.9.2.1 EIA20: Aquatic Habitat Degradation

Discussion of Impact

The habitat quality of aquatic biota will be depending on the water quality at the location where the biota is living. The changes in hydrology and water quality and/or quantity will lead to aquatic habitat degradation. Referring to the impact assessment of solar PV construction and operation (see Section 6.1.2) to the surface water quality, it was understood that the impact is negligible. During operation, water will be mainly used for maintenance activity (cleaning of Solar PV mirrors) and daily activities of employee (toilets, canteen, and garden watering). Cleaning solar PV arrays typically require significant amount of water, which has been detailed in Section 3.6.3.1. Water will be mainly sourced from PDAM and planned to be stored in a $20m^3$ water storage tank. Rainwater retention ponds and a groundwater deep well could be alternatives and integrated into the design to constitute water reserves for cleaning.

Impact Evaluation and Significance

It was also understood that there is no significant amount of process wastewater is expected to be produced and discharged to the existing water body. The water used for the solar PV mirrors cleaning is generally demineralized and clean. It does not indicate any harm after cleaning the panel surface.

Based on the above description, the impact of solar PV construction and operation on aquatic biodiversity is considerably **negligible.**

Table 6-25 *Aquatic Habitat Degradation*

Impact Description	*Aquatic Habitat Degradation*								
Impact Nature		Positive			✔	Negative			
Impact Type		Direct			✔	Indirect			
Severity/ Magnitude		Negligible	✔	Low		Medium		High	
Sensitivity/Vulnerability			✔	Low		Medium		High	
Significance	✔	Negligible		Minor		Moderate		Major	

Proposed mitigation measures

There is no specific proposed mitigation measure for impact on aquatic biodiversity habitat since the mitigation measures for negative impact on surface water quality is properly undertaken.

Residual Impact

As a result of implementation of the proposed measures, the residual risk and negative impact on surface water quality due to Project construction and operation is expected not any impact.

6.1.10 Ecosystem Services

6.1.10.1 EIA21: Loss of important provisioning services

Although land take for solar developments and their associated facilities could lead to reduced access to, and the loss of important provisioning services such as areas

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important for agriculture or provision of natural resources, ecosystem service impacts in relation to solar developments are not well understood[68] and require particular attention in early planning.

Referring to the baseline study, there is an existing activity of sugar cane plantation in the agricultural land area where the Banyuwangi Solar PV panels will be installed. The discussion of this potential issue is provided in Social Impact Assessment (Sub Section 6.2.3.1 SIA02 and 6.2.4.1 SIA03).

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[68] De Marco et al. (2014); Terrapon-Pfaff et al. (2019

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6.2 Social Impact Assessment

6.2.1 Overview

This Social Impact Assessment chapter has been developed to assess project related impacts against the expectations of the AIIB ESF and IFC Performance Standards Framework. The following sections identify and discuss the predicted positive and significant negative social and community health impacts associated with the pre-construction, construction, and operation of the Banyuwangi Ground Mounted Solar PV Power Plant Project. Key impact areas included in this section are:

- Land Acquisition Impacts
- Local Economy and Community Livelihood
- Local Economy and Employment
- Impact on Community Amenity / Public Facilities
- Landscape and Visual Impacts
- Socio-Culture
- Cultural Heritage
- Community Health
- Community Safety and Security
- Occupational Health and Safety
- Human Rights Impact
- Community Perception

6.2.2 Summary of Social Impact Assessment of Banyuwangi Ground-Mounted Solar PV Power Plant Project

A summary of the social impact assessment results during the pre-construction, construction, operation and post-operation phases of the Banyuwangi Ground-Mounted Solar PV Power Plant Project is presented in **Table 6-26.**

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Table 6-26 *Summary of Social Impact Assessment*

Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
SIA01: Disturbance or Impact on Socio-Economy and Livelihood of Landowner and Land User as a Result of Project Land Acquisition	Project affected landowners and land users due to land acquisition	**Moderate**	• Conduct a land acquisition and resettlement study to outline the land acquisition policy principles, procedures, and institutional arrangements to mitigate risks and offer livelihood and development opportunities to the affected people affected by the land acquisition of the Project. This will include the plantation workers and vulnerable people (women and people below poverty rate) who potentially affected by the land use change of the plantation area. • Monitor the number of workers losing their regular daily work in PTPN XII sugar cane operation especially from 3 affected villages. • Consider establishing a Community Development or a CSR program coordinating with relevant local government, PTPN XII and stakeholders to support local economic and social development. • Establish and implement a Project grievance mechanism that is understood by and accessible for the affected communities. The mechanism will be simple, efficient, and timely and fully consultative.	**Minor**
SIA02: Disturbance or Impact on the Economy and Livelihood due to Project Construction and Operation	Livestock breeder around the Afdeling Wangkal Plantation and the owner of Omah Telu Homestay and Cafe	**Negligible**	• Engage the community leaders, local community, business party and especially farmers who also as breeder to socialize the development of Banyuwangi Ground-mounted Solar PV Project, the benefits from the Project as new attraction in the area, and the restriction area for community to access the site, as well as how to mitigating the restriction access; • Grievance mechanism to be established by the Project to allow individuals or community groups the opportunity to	**N/A**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			raise issues in regard to the disturbance of community economy and livelihood due to the Project construction and operation; • Consider establishing a Community Development or a CSR program coordinating with relevant local government, PTPN XII and stakeholders to support local economic and social development; and • Project/PT PLN Indonesia Power to ensure the Project's grievance mechanism is well socialized, and when grievances are submitted, the PT PLN IP and EPC will investigate and address the issue in a timely manner.	
SIA03: Employment and Business Opportunity during Project Land Preparation and Civil Works	Local workers and business/vendors during land preparation and civil work	**Positive**	• Prioritizing local workers in accordance with the Project qualification. • Develop a transparent, clear and neutral procedure of local worker recruitment which is appropriately disclosed to the local community; coordinate with the local Labour Agency, sub-district or village government and leaders (e.g., posters of recruitment process to be installed at sub-district and village government office); • Ensuring wages for the local workers are in accordance with each expertise or skill level and implementing applicable labour regulation including compliance with the Provincial/Regional Minimum Wage; and • Inclusion of the Project commitment to optimise local employment and local business opportunities from the Project and its EPC contractors and sub-contractors in written contract.	**N/A**
SIA04: Employment and Business Opportunities during the Project Workforce	Local communities especially local workforce (unskilled and non-technical labour) and local businesses / vendors	**Positive**	A number of measures to optimise the Project's positive impact to employment and business opportunities suggesting to continues from the Positive impact in the Section 6.2.5.1 **SIA03**.	**N/A**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
Recruitment during Construction and Operation of the Project			Additional mitigation efforts in accordance with the AIIB ESF are as follows: • Measures related to workforce management to be included in a Labour Management Plan (LMP) which is developed by the Project in accordance with the applicable national and regional regulations, as well as the AIIB ESF on Labour and Working Conditions. • As part of the Project social responsibility, to optimize positive impacts on business opportunities for locals, to develop and implement community development/ empowerment plan for potential local business partners through (a) Consultation with the local business to identify need and potencies for development; and (b) Id needed, implement a series of training sessions targeted at improving community capacity to provide materials and services required by the Project. • Follow Indonesia Labour law and regulation as well as International Labour Organization (ILO) requirements related to the worker recruitment with attention given to appropriate contracting and the establishment of clear terms and conditions to address issues related to child and forced labour as well as human trafficking; and • Grievance redress mechanism (GRM) to be established to allow all groups of affected people to share their concerns and complaints regarding the Project worker recruitment process.	
SIA04A: Risks Related to the Recruitment and the Presence of Project Security Personnel during	Local community near the Project site	**Moderate**	• Conduct a security risk assessment for the Banyuwangi Solar PV Project • Security personnel for the Project need to be trained not only in general security protocols but also in the specifics	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
Construction and Operation of the Project			of solar PV systems. This includes understanding the equipment, layout, and potential hazards. • Providing the security personnel with training in conflict de-escalation techniques to minimize the risk of confrontations with workers, local communities, or visitors • Provide training for the security personnel on local customs and norms, traditions, and values of the local community. The training should include aspects such as local etiquette, religious practices, appropriate dress code, and communication styles. • Maintain transparent communication with local communities and stakeholders regarding the role of security personnel and the project's overall goals. This helps mitigate any concerns or misunderstandings about the project. • Develop comprehensive ERP that include procedures for security-related incidents, ensuring security personnel are well-prepared to respond to any potential issues, including unauthorized access or sabotage.	
SIA05: Disturbance or impact on road damage, community amenity and public facilities due to project construction and operation.	Mobilization of heavy equipment and vehicles during construction.	**Moderate**	• The Contractor will establish a Traffic Management Plan (TMP) to manage potential congestion to ensure community safety and project mobilisation. • Community Liaison Office (CLO) or Community relations to be appointed to do stakeholder engagement with community, and consult regularly with communities on the Project traffic routes and peak traffic times; • Keep communicating and coordinating with the village government, village leaders, local institutions and PTPNXII regarding the progress of the panel installation project phase in PTPNXII land area;	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			• Regular maintenance during construction and rehabilitation after construction – restore roads to equal or better condition; and • Grievance mechanism to be established by the project to allow individuals or community groups the opportunity to raise any issues regarding project activity.	
SIA06: Impact on Landscape and Visual Associated to Project Construction and Operation (Transmission Line and Ground Mounted Solar PV)	Landscape and visual interference due to Project construction for construction workers and nearby community	**Minor**	• Minimise the site clearing and maintain the vegetation cover around construction boundary area. • Install the temporary fence during construction around Project area which adjacent with settlement with limited vegetation cover to prevent visual intrusion. • Ensure proper housekeeping and instruct the workforce accordingly (i.e., ensure that all machines, vehicles, and tools used during construction to be removed after construction works finished as earliest as possible and waste, including tree cutting waste from site preparation shall be handling in a timely manner).	**Negligible**
	Landscape and visual interference due to Project operation	**Positive**	Engaged the local community tourism/educational association and/or regional stakeholder to expound the visual impact perspective as future green energy awareness and potential educational attraction.	**N/A**
SIA07: Impact on socio-culture & social behaviour of local community as a result of Project construction.	Increase in the number of workers during construction. Interaction of migrant workers with local communities.	**Minor**	• Consult with the local leaders (village government, community leaders and local institution), before the construction activities begin. Especially discussing the socio-cultural habits of the community, acceptance of immigrants, and the need for local workers according to the project phase. • The project consulted with the Banyuwangi district Manpower Office regarding data on job seeker capacity and definitions of the scope of local employment.	**Negligible**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			• PT PLN Indonesia Power ensures that all contractors (EPCs) provide Labour Management Plan (LMP) and induction to all workers, especially immigrants, regarding behaviour and adaptation to local customs and culture. • Consultation approach and empowerment program for village institutions. • Projects to be able to adapt and continue to support local culture by participating in its implementation. • The project will continue to carry out further consultations involving various stakeholders related to customary issues and consider involving the Osing community in Kemiren in the project's social investment program, which may be structured as part of the Corporate Social Responsibility (CSR) initiative. • The project provides a Stakeholder Engagement Plan (SEP) document as a reference for coordinating with stakeholders related to the project and anticipating issues developing in the community. • Project/PT PLN Indonesia Power to ensure the Project's grievance mechanism is well socialized, and when grievances are submitted regarding socio cultural, PT PLN Indonesia Power and EPC will investigate and address the issue in a timely manner.	
SIA08: Disturbance to Cultural Heritage as a result of Project construction and potential access restriction of the local community to the CH sites.	Old Burial of Plantation (PTPN) Workers located within the boundary of the area intended for the construction of the Solar PV panels area	**Minor**	• Project to consult with the community leaders in Wangkal Hamlet to ensure that there is no family or close relative of the local village residents buried in the old burial site. This to anticipate any further measure required such as claim for compensation, etc. • Consult with the local relevant village leaders before construction activities to discuss/inform the areas of construction works and schedule and measure required to	**Negligible**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			be taken should the burial site be disturbed or impacted. This can be in the form of providing sign or boundary marks around the burial complex thus the construction activities can avoid potential relocation of the site. • PT PLN Indonesia Power to ensure the Project's grievance mechanism is well socialized, and when grievances are submitted regarding cultural heritage, the PT PLN IP and EPC will investigate and address the issue in a timely manner.	
SIA09: Community Health Impact Associated with Dust and Air Quality as a Result of Project Construction, Material Mobilization and Land Preparation	Local community in the vicinity of the project construction area and along the route of project mobilization.	**Moderate**	• Consultation with communities of Project's traffic routes, peak traffic, and access road construction times (especially to agriculture/plantation workers) to manage/inform the number of vehicles, road construction time and wetting the road schedule, especially road section from Kalipuro (Wangkal hamlet) to Ketapang area. • Regular check on ARI data records from the nearby health facilities at least once every 6 months • Consider establishing community health assistance through a CSR Program coordinating with public health centres and focusing on managing ARIs and other similar health issues. • Establish and implement a Project grievance mechanism to report dust and pollution concerns that are understood by and accessible for the affected communities in every affected village.	**Minor**
SIA10: Health Impact Associated with the Presence of Non-Local Workforce during	Community in the key affected villages in general and those in the vicinity of Project construction area.	**Moderate**	• Compulsory medical examinations for Project workers, contractors and sub-contractors working during construction and operation stage to ensure they are fit for work and to monitor the prevalence of communicable	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
Project Construction and Operation			disease and STD detected through annual medical check-ups. • Conduct a monitoring of disease prevalence in community surrounding the project location by doing regular coordination with public health centre • Conduct and induction and training on the community engagement code of conducts regarding interaction with locals, especially about communicable disease and STD. • Engagement with local authorities relevant to crime (local police), health (local health service/hospital) and social problems (village leaders) for prevention of any community and workers health. • Establish and implement a Project grievance mechanism to report crime, health, and social problems related to workers that is understood by and accessible for the affected communities in every affected village.	
SIA11: Impact on Community Safety Associated with Road Safety due to Increase of Traffic Volume on Existing Road due to Project Construction Equipment and Material Mobilization	Local community and road user along the existing road of heavy equipment and material mobilisation	**Moderate**	• Develop and implement Traffic Management Plan associated with The ANDALALIN document. • Conduct or inform the community around Project area about the construction activity, including project schedule and mobilisation route of heavy vehicles. • Scheduling the mobilization of heavy equipment and material outside the peak hour of traffic volume and consider after school and weekly market schedule; and it expected to inform relevant governance agency (Transportation Agency/Dinas Perhubungan) of the project schedule/activity and for escorting if the vehicle convoy is needed. • Install the Project traffic sign and road markings for safety reason.	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			• Provide road officer who is responsible for managing traffic flow at the gate of project area and install the post security. • Provide the laydown area to store heavy equipment and material, as well as the parking area for light and heavy vehicles to avoid parking on the public roadside. • Ensure the vehicles and drivers are in good condition and have a valid licence to operate according to standard operation procedure. • Ensure the heavy vehicle weight loading accordance with the road load capacity standard. • Ensure the heavy vehicle loading handling accordance with applied standard operation procedure. • The vehicle speed limit shall apply the standard road speed limit (i.e. for collector road inter-city is 40 km/hour and settlement area at local road is 15 - 20 km/hour) • Improved the road paving with poor condition at local road segment that expected cannot accommodate heavy vehicle load and repair the road damage caused by the Project's heavy vehicle mobilisation activity after Project construction activity. • Provide a grievance mechanism platform to accommodate community perception related to transportation.	
SIA12: Impact Associated with Workers/Occupational Health and Safety during Construction and Operation	Project construction workers, particularly the local and unskilled workers.	**Moderate**	It is anticipated that the EPC will develop an Occupational Health and Safety Plan to safeguard the health and safety of the local workers who are likely to be less experienced in this area. The following are the additional proposed measures to mitigate the risk/impact related to OHS: • Construction worker standards to be aligned with minimum national requirements for health and safety	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			during construction and operation, along with inductions, training, refreshers, and inspections. • The Project will prioritise worker health and safety standards such as preparing SOPs for each type of construction activity, conducting regular health and safety training and briefings (in the local languages as required) before the implementation of the activities (toolbox meeting) and compulsory use of personal protective equipment (PPE) • Strict Occupational Health and Safety requirements will be embedded in the EPC contract to ensure occupational injuries, worker rights, deaths, disability, and diseases are managed as per the Project's commitments. • Should non-compliance repeatedly occur, a zero-tolerance approach to be adopted. • Establish and implement a Worker Grievance Mechanism that will be accessible for all workers and contractors to report issues (a confidential option to be provided). When complaint is submitted, the project will undertake an immediate investigation.	
SIA13: Risks and Impact Associated with Labour Rights and Working Condition during Workforce Recruitment, Project Construction and Operation	Project workforce, particularly the unskilled local workforce during the construction phase.	**Moderate**	• Development of a Labour Management Plan (LMP) to ensure that the labour rights and working conditions for the Project and its Contractor's workers are protected, with consideration of both national regulation and international best practice adopted by the Banyuwangi Solar PV Power Plant Project. • Require contractors to adhere to the PT PLN Indonesia Power/Project labour management plan through contract requirements to ensure the same standards are applied to all contractors and the supply chain.	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			• Project to work with the contractors to ensure adequate resources and technical knowledge to cover issues relating to labour rights and working conditions, non-discrimination, and grievances; and • Establish and implement worker grievance mechanisms for workers and to be adequately communicated to workers at the time of recruitment, as part of the labour management plan.	
SIA14: Gender-Based Discrimination and Violence during Construction	Construction workforce particularly female workforce.	**Moderate**	• Development of a Labour Management Plan (LMP) to ensure that the labour rights and working conditions for the Project and its Contractor's workers are protected, with consideration of both national regulation and international best practice adopted by the Banyuwangi Solar PV Power Plant Project. The Labour Management Plan will incorporate policies and procedure to address risk of SEAH/GBVH particularly for female workers and implemented throughout the life cycle of the Project. • Ensure that the Project follows gender inclusion policies, reporting on recruitment targets, processes and hiring numbers, as well as suitable provisions for female personnel. This is not limited to equal pay and conditions, but also to facilities for lactating mothers, flexible working arrangements and access to female supervisors and mentors. • Promote the Project GBV policies and ensure socialization of the policies and procedures to contractors and workers. • Provide separate, secure, and safe worker accommodation for men and women working in construction, particularly for the non-local workforce. • In the GRM implementation, ensure that a female officer is involved as a team member and that there is a private	**Minor**

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Identified Impact	Impact Receptor	Impact Significance	Proposed Mitigation	Residual Impact
			grievance reporting process, referral channels, and systems of support for employees and the community to help encourage the reporting of any GBV or discrimination-related grievances and protect the complainant.	
SIA15: Change in Community Perception Throughout the Project Phases (Pre-Construction, Construction, and Operation)	Land acquisition process for transmission towers, public consultations, labour recruitment, equipment mobilization during construction and project operation.	**Moderate**	• The project (PT PLN Indonesia Power) discloses information regarding the project description, activity phases, duration, and potential impacts as well as mitigation that will be carried out, to the closest communities who will be affected; • Conduct regular approaches and involvement of stakeholders (SEP), both from government and community leaders, village institutions, non-governmental organizations (NGOs); • Carrying out the land acquisition process in accordance with LARAP document, applicable regulations and appropriate compensation for affected land and other assets. • Implement safety and environmental management measures to minimize adverse impacts on society; and • Project/PT PLN Indonesia Power has built a complaints mechanism that provides opportunities for communities and groups to easily submit complaints regarding project activities, as well as ensuring that the Project complaints mechanism is well socialized.	**Minor**

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6.2.3 Land Acquisition Impact

6.2.3.1 SIA01 – Disturbance or Impact on Socio-Economy and Livelihood of Landowner and Land User as a Result of Project Land Acquisition

Discussion of Impact

There is no indication of any land owned by individuals of the local community will be affected by the Project's solar PV area. Ground mounted solar power plant Banyuwangi site is expected to acquire 164.78 hectares. Only the economic displacement impact (loss of income/livelihood) is identified as the result of the land acquisition process. No physical displacement or relocation is expected as the project owner commits to avoid the impact of physical displacement. Land parcels for solar PV and switchyard area is acquired from PTPN XII. PT PLN Indonesia Power will be purchasing the land which is currently sugarcane plantation from PTPN XII. However, land acquisition and compensation will apply for Transmission Line routes including 16 footprints for 150 kV transmission tower and right-of-way (RoW), gantry and extension bay. The land required for tower footprints, gantry and extension bay is expected to be acquired through purchase from PTPN XII and individual landowners in accordance with the results of an inventory of assets and land values by the Public Appraisal Services Office (KJPP) and direct negotiations with landowners. Meanwhile, for the RoW area, compensation will be provided to affected landowners due to restrictions on land use — specifically, the establishment of a safety clearance zone that limits structures within 13.5 meters of vertical clearance from ground level, with a maximum allowable building height of 8 meters. This also means that the affected land under ROW can still be cultivated as long as the crops on this land do not go to the free space zone. Currently, the land-use of the proposed transmission line routes is agricultural land. All acquisition and compensation processes will be conducted in accordance with the standards and requirements outlined in the international Land Acquisition and Livelihood Restoration Plan (LALRP).

There are several local communities who have been working for PTPN XII doing regular maintenance to the crop cultivated during the harvesting period. The conversion of some parts of plantation area into Project area potentially poses negative impact on the daily worker's livelihood through potential decrease of their household income. Based on social baseline data, the wages received by male and female workers are the same, IDR 45,000 per day for 6 hours of work. Wage payments are made every two weeks, totalling IDR 500,000-600,000. During harvest, wages are calculated on a piece rate basis, IDR 50,000 per ton worked by three people. Three workers can harvest 13 tons of sugar cane in three days, equivalent to 1 rit. There are 75 daily sugarcane workers (plantation maintenance and harvest) who routinely work in the PTPN XII Kaliselogiri Afdeling Wangkal area with some additional harvesting workers from outside Banyuwangi when needed, dominated by female workers. Daily workers work in groups, each group totalling 20-25 people with each group coordinated by a supervisor. It is understood that the casual work in plantation is not the only income for most of the community members, as there are some agricultures related works available in their own land such as animal husbandry, coconut plantation, and business activities. This information is especially for Kalipuro and Kelir villages that many of the plantation workers come from. Their livelihood as daily laborers on the Wangkal sugarcane plantation have been disrupted by the acquisition of the land for the PVPP. PTPN I offered to relocate these laborers to a coffee plantation in Kaliselogiri, approximately 30 kilometers away. However, due to the increased travel time and costs, and a shift from regular daily work

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to more seasonal employment, some laborers found this option unviable and declined the offer.

Some harvest residue from sugarcane plantation harvests is used by the community for cattle feed might reduce in quantity because some parts of plantation are converted into ground mounted solar PV area. Besides the concern of losing income from daily labour, the community also expressed their concern of losing the harvest residue for their cattle feed. However, based on the total size of PTPN XII plantation in this area, the project is expected to only use 1.75% of total land holding in PTPN XII Banyuwangi. Therefore, there will be available alternative locations for harvesters to work on and for the community to gather harvest residue for their cattle feed.

Based on the current and existing project design, some sections of the transmission line of the Banyuwangi Site will pass through areas currently utilized for agricultural purposes. Sixteen (16) transmission towers are established as the continuation of the existing Banyuwangi-Ketapang transmission line in this area (located in sugarcane plantation). The project identified there will be landowners and land users to be impacted along the transmission line area (tower and ROW). It is likely that most of the agriculture land belongs individually to the local community. Therefore, there will be potential economic displacement particularly due to land acquisition for the Project (area for the TL tower footing). Loss of land due to land acquisition has the potential to create disturbance to community income and livelihoods, those reliant upon agriculture and plantation activities (landowners and land users). There will be no physical displacement along the transmission line, as the project owner is committed to not using the community settlement area as tower footprint. Along ROW location (4.3 KM) can still be used by the community after the cable erection process as long as the structures or trees do not disturb the 150 kV free space zone. The location of ROW section transmission T-07 is expected to be close (about 17 meters) to the surrounding community house, however there is no relocation expected as the house is still in a safe space area and the landowner does not show any objection toward the project. Tower footing area is expected to be purchased and location under ROW is expected to be compensated based on the number of trees or any other asset impacted on site as well as any other calculated loss.

All the land acquisition process is based on land acquisition for public interest. As such, it is in compliance to national regulations and calculated by certified national land appraiser. It is expected that the compensation value is equivalent to full replacement value.

Impact Evaluation and Significance

A total of 158 households (391 APs) will be affected, either through the permanent acquisition of a portion of their land or through permanent use restrictions within the transmission line RoW. A smaller group of 20 households (60 APs) who do not own land but cultivate plots as sharecroppers, renters or tenants, and landuser will also be economically displaced. 75 plantation workers will have their livelihood source affected. 92 households (58% of total affected households) are considered vulnerable. In addition, 36 households (91 Aps) are classified as significantly affected. Based on the identified affected households that will be impacted by transmission line and ROW, economic displacement may occur due to access restrictions under the tower footings and ROW; however, most landowners in these areas are reported to have multiple sources of income, such as construction labor, transportation services, or seasonal work on nearby plantations. Cattle farming is also a common side activity for about 20% of households, with sales often timed to coincide with religious holidays or to meet emergency cash

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needs. The full replacement value for land is expected to help the affected people to expand/ replace land by buying or renting land in another area with a minimum area and similar quality. As land acquisition only happened in Kalipuro, Kelir and Giri Villages, where these areas have agricultural economy basis, there are still available areas for land cultivation that give affected landowners chance to replace/ expand their land after some portions of their land being acquired. Nevertheless, there is no guarantee yet that landowners and land users will find alternative income or alternative land directly. Therefore, the magnitude can be said as **Medium**.

As mentioned in the baseline, there are respondents in Kelir village that still mentioned their income level is under poverty line (11 AHs), and their only income is from working in PTPN plantation. They are worried that they may lose their income due to PTPN selling some parts of their plantation. Even though it is not the first-time community in 3 villages experiences land acquisition and disruption of economic activities due to transmission line, some community members who own coconut trees are still opposed to transmission line as their trees have been impacted by transmission line before and they have not received compensation. The vulnerability level with current available information is rated **Medium**. The impact of the project land acquisition on the loss of access and income for the landowners and land users is evaluated as being **Moderate** significance as presented in **Table 6-27**.

Table 6-27 *Impact on Socio-Economy and Livelihood of Landowner and Land users as a result of Project Land Acquisition*

Impact Description	*Disturbance or Impact on Socio Economy and Livelihood of Landowner and Land users as a Result of Project Land Acquisition*								
Impact Nature		Positive			✔	Negative			
Impact Type	✔	Direct				Indirect			
Severity/ Magnitude		Negligible		Small	✔	Medium		Large	
Sensitivity/Vulnerability		Low	✔	Medium		High			
Significance		Negligible		Minor	✔	Moderate		Major	

Proposed Mitigation Measures

- Conduct a land acquisition and resettlement study to outline the land acquisition policy principles, procedures, and institutional arrangements to mitigate risks, implement livelihood restoration program, and offer development opportunities to the affected people affected by the land acquisition of the Project. This will include the plantation workers and vulnerable people (women and people below poverty rate) who potentially affected by the land use change of the plantation area.
- Monitor the number of workers losing their regular daily work in PTPN XII sugar cane operation especially from 3 affected villages.
- Consider establishing a Community Development or a CSR program coordinating with relevant local government, PTPN XII and stakeholders to support local economic and social development.
- Establish and implement a Project grievance mechanism that is understood by and accessible for the affected communities. The mechanism will be simple, efficient, timely, and fully consultative.

Residual impact

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The impact result after implementing the above proposed measures will be designated as **Minor**.

6.2.4 Local Economy and Community Livelihood

6.2.4.1 SIA02 – Disturbance or Impact on the Economy and Livelihood due to Project Construction and Operation

Discussion of Impact

The Project will develop ground-mounted solar PV module and switchyard on the Wangkal Plantation (PTPN XII) in Kalipuro Village, while the transmission line route will cross the agriculture area of community mostly in Kalipuro Village (9 towers), Kelir Village (3 towers), and Giri Village (3 towers).

In Kalipuro, Kelir, and Giri Villages, agriculture, horticulture, and plantation were identified as one of main livelihoods of community. The Wangkal Plantation area is planted with sugar cane and some few parts planted with teak and Sengon wood. While on the outside of Wangkal Plantation area, the most productive agriculture and plantation crops identified are coconut, corn, and rice. Many coconut plantations in the Project area absorb high number of people working as casual labourer, because coconut cultivation has quite a lot of product output to be utilized.

The construction and operation of the Project could potentially have an indirect impact on the economy and livelihood of community who use the plantation area as their source of their livelihood. Apart from the affected people by the land acquisition process.

Impact Evaluation and Significance

There is potential impact or disturbance to community economy and livelihood during project construction and operation, primarily for farmers and cultivators whose land areas are directly affected by the project. The derivative impacts are such as livestock breeders around the Afdeling Wangkal Plantation area who usually take sugar cane leaves and forage grass from the plantation area to feed their livestock. Based on the baseline survey, the intensity of taking livestock food sources increases in the rainy season and vice versa. However, apart from sugar cane leaves and forage grass, there are also corn leaves which can be used as a source of feed for their livestock. So, if the Wangkal Plantation is used as a ground-mounted solar PV area, and the source of livestock food that is usually taken in the plantation area disappears, it can be replaced with a source of feed from corn plantations and grass that comes from outside the Wangkal plantation area. The livestock breeder is identified as secondary livelihood, where the livestock is one of the forms of saving by the community (usually farmers). These saving can be exchanged for money if there is an urgent need due to economic condition.

In addition, there was a negative perception from owner of Omah Telu Homestay and Café which is the business adjacent on the western of the Wangkal Plantation area. He was not aware on the Project development and reject the project since he perceives the Project will disturb the view of his homestay so that it will stop his business. However, he is renting the land for 2 years and just opened the business in December 2023, so the impact is not permanent.

From the things mentioned above, then the severity of impact on disturbance to community economy and livelihood during construction and operation is assessed **low**. Even, according to the landscape and visual impact presented in Section 6.2.7.1 SIA07, the existence of ground-mounted solar PV will be as new attraction for the area.

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The negative perception to the Project development comes from the owner of homestay, where the impact on it is not permanent, so that the sensitivity is also **low**. The impact significance to the disturbance of community economy and livelihood during Project construction and operation is assessed as **Negligible**.

Table 6-28 *Disturbance or Impact on the Economy and Livelihood due to Project Construction and Operation*

Impact Description	*Disturbance or Impact on the Economy and Livelihood due to Project Construction and Operation*								
Impact Nature		Positive			✔	Negative			
Impact Type		Direct			✔	Indirect			
Severity/ Magnitude		Negligible	✔	Low		Medium		Large	
Sensitivity/Vulnerability	✔	Low		Medium		High			
Significance	✔	Negligible		Minor		Moderate		Major	

Proposed Mitigation Measures

The proposed mitigation measures are as follows:

- Engage the community leaders, local community, business party, and especially farmers who also as breeder to socialize the development of Banyuwangi Ground-mounted Solar PV Project, the benefits from the Project, and the restriction area for community to access the site, as well as how to mitigating the restriction access;
- Grievance mechanism to be established by the Project to allow individuals or community groups the opportunity to raise issues in regard to the disturbance of community economy and livelihood due to the Project construction and operation;
- Consider establishing a Community Development or a CSR program coordinating with relevant local government, PTPN XII and stakeholders to support local economic and social development; and
- Project/PT PLN Indonesia Power to ensure the Project's grievance mechanism is well socialized, and when grievances are submitted, the PT PLN IP and EPC will investigate and address the issue in a timely manner.

Residual Impact

As a result of implementing the proposed measures, the remaining negative impact of the disturbance to community economy and livelihood will not be occurred.

6.2.5 Local Economy and Employment

6.2.5.1 SIA03 – Employment and Business Opportunity during Project Land Preparation and Civil Work

Discussion of Impact

Land preparation and civil work activities will be required a number of workers, where the work activities included land clearing, site levelling, earth excavation, new access road development. These workers will be engaged after the land acquisition is completed.

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The Project is expected to have positive impacts as the Project has committed to apply its international sustainability policy to ensure benefits for locals from its project development, as well as adhering to AIIB ESF which emphasis the alignment of project's social development program with the management of impacts on the affected people. This will allow more benefits to be enjoyed by local communities as the directly impacted people.

Impact Evaluation and Significance

Even though the land preparation and civil work activities will be carried out in short-term (around 1-2 month), hiring local workers for the Project's land preparation and civil work activities will become a positive effect on the local economy. Especially if the workers in this land preparation and civil work activities can be continued in the next project construction activities, so that it is sustainable and has a positive impact for longer.

In addition, benefits also come from non-local workers of needed accommodation, and workers' purchase foods and groceries from local vendors. Thus, the impact significant is assessed **Positive**.

Table 6-29 *Employment and Business Opportunity during Project Land Preparation and Civil Work*

Impact Description	*Employment and Business Opportunity during Project Land Preparation and Civil Work*			
Impact Nature	✔	Positive		Negative
Impact Type	✔	Direct		Indirect

Proposed Mitigation Measures

A number of measures to be implemented for optimising positive impacts on local employment and business opportunities including:

- Prioritizing project affected people and local workers in accordance with the Project qualification.
- Develop a transparent, clear and neutral procedure of local worker recruitment which is appropriately disclosed to the local community; coordinate with the local Labour Agency, sub-district or village government and leaders (e.g., posters of recruitment process to be installed at sub-district and village government office);
- Ensuring wages for the local workers are in accordance with each expertise or skill level and implementing applicable labour regulation including compliance with the Provincial/Regional Minimum Wage; and
- Inclusion of the Project commitment to optimise local employment and local business opportunities from the Project and its EPC contractors and sub-contractors in written contract.

Residual Impact

No residual impact applied. The positive significance impact will be maintained if the mitigation measures are implemented.

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6.2.5.2 SIA04 – Employment and Business Opportunities during the Project Workforce Recruitment during Construction and Operation of the Project

Discussion of Impact

The Project may adversely affect the sources of income for some local community members; however, it may also offer employment opportunities and/or increased revenue to local business. For example, the project will impose construction activities (e.g., construction of base camp, solar PV and supporting facilities, and transmission line) and will therefore increase the local population in the short-term, bringing more visitors to the area. Such a population increase provides an opportunity for new ventures and may create employment opportunities for unskilled and non-technical labour. This would have a positive economic impact to the local community.

The economic impacts on local communities are likely more significant during construction phase when worker numbers and project on-site activities will be at peak, while at operation phase direct economic benefits for locals are likely to decrease following construction demobilisation, which would lead to lower demand for goods and services. Positive impact at operation phase will still be present, however they will be experienced at the wider level, for example the generation of electricity, implementation of a more advanced community development program, as part of corporate social responsibility (CSR) regulated by the Indonesian government.

Impact Evaluation and Significance

Engagement with the community during the ESIA baseline study identified a high interest in working for the Project. Employment opportunities is one of the main expectations from community to the Project proponent. The baseline identified the main occupations of respondents are business/entrepreneurship (mostly found in Kalipuro and Giri Villages), daily labourers (mostly found in Kelir Village), and farmers or planters found in all affected villages. The remaining occupations found based on baseline survey are farm workers and private sector workers, services sector, factory workers and others.

Project estimate a peak number of workers during construction phase at approximately 431 workers, where 80% or 341 workers sourced from local workforce both skilled and non-skilled. In addition, the Project will require approximately 54 staffs during operation, where helper and security position will be prioritized from the local workforce. A detailed breakdown of the workforce and project duration is described in **Table 3-14** Workers Estimation for Banyuwangi PV Construction and **Table 3-16** Workers Estimation for Banyuwangi Ground Mounted PV Operation, of this document. To optimise the Project benefits on local employment, the Project to ensure that the local community will be informed and given equal opportunity to apply for and be employed by the Project, this may be achieved through an overarching local hiring policy, placing employment advertisements in prominent public places and community spaces, and delivering training.

There will be a positive effect to the local economy from hiring local workers for construction and operation activities. It is expected that these skilled and non-skilled positions will be sourced from local and/or within Banyuwangi Regency.

The presence of the Project workforce will require a number of goods and services which are expected to be sourced from local enterprises and small businesses, e.g., in-migrant workers will require basic needs of food and services during their stay around the Project area, while some contractors are also likely to stay in the community. In addition, the

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Project has committed to, wherever possible, sourcing construction materials and resources from the local community/area, including quarry materials, transportation, hardware, and other general materials supply. These are opportunities for locals to obtain a benefit from direct and indirect business partnership with the Project.

The indirect effects from the Project activities and the presence of non-local workers would be expected to generate business and enterprise in the accommodation, food, and entertainment sectors, and provide a multiplier effect on the local economy. Further, effect implementation of the ESMP would render the mitigated significant **Positive**.

Table 6-30 *Employment and Business Opportunity during Project Construction and Operation*

Impact Description	*Employment and Business Opportunity during Project Construction and Operation*			
Impact Nature	✔	Positive		Negative
Impact Type	✔	Direct		Indirect

Proposed Mitigation Measures

A number of measures to optimise the Project's positive impact to employment and business opportunities suggesting to continues from the Positive impact in the Section 6.2.5.1 **SIA03**.

Additional mitigation efforts in accordance with the AIIB ESF are as follows:

- Measures related to workforce management to be included in a Labour Management Plan (LMP) which is developed by the Project in accordance with the applicable national and regional regulations, as well as the AIIB ESF on Labour and Working Conditions.
- As part of the Project social responsibility, to optimize positive impacts on business opportunities for locals, to develop and implement community development/ empowerment plan for potential local business partners through (a) Consultation with the local business to identify need and potential for development; and (b) If needed, implement a series of training sessions targeted at improving community capacity to provide materials and services required by the Project.
- Follow Indonesia Labour law and regulation as well as International Labour Organization (ILO) requirements related to the worker recruitment with attention given to appropriate contracting and the establishment of clear terms and conditions to address issues related to child and forced labour as well as human trafficking; and
- Grievance redress mechanism (GRM) to be established to allow all groups of affected people to share their concerns and complaints regarding the Project worker recruitment process.

Residual Impact

No residual impact applied. The positive significance impact will be maintained if the mitigation measures are implemented.

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6.2.5.3 SIA04A – Risks Related to the Recruitment and the Presence of Project Security Personnel during Construction and Operation of the Project

Discussion of Impact

The presence of security personnel at a project site can pose several risks to the surrounding local community. These risks primarily relate to interactions between security personnel and community members, and may include:

- The presence of security personnel may create tension between the local community and the project, especially if the security personnel are seen as an external force or if their behaviour is perceived as aggressive or overbearing.
- If security personnel are armed or involved in conflict-related incidents, it may raise concerns within the community about potential violence or unintended confrontations.
- Security personnel from outside the local area may not be familiar with the local culture or norms, which could lead to misunderstandings or actions that are seen as disrespectful by the community.

Impact Evaluation and Significance

The severity of impact/risk related to the recruitment and the presence of project security personnel is assessed as **Medium** by considering several aspects such as potential direct interaction between security personnel and local community in the context local community members may visit the site for various reasons (e.g., to see the project, for employment-related inquiries, or due to curiosity). Security personnel often act as the first point of contact, verifying who is entering the site and ensuring that only authorized individuals gain access. As described in the baseline chapter, It is expected that 80% of construction workers or about 341 people are from locals with the required specification and the project construction schedule is aimed for 12 months. Hence, potential interaction between the local communities with various reason with the project security personnel is expected to be high, particularly during the construction phase. There may also a case where local residents might unintentionally or deliberately enter the site without authorization. Security personnel may need to explain site restrictions, handle trespassing situations diplomatically, and ensure that people understand why access is restricted (e.g., safety or security concerns).

The sensitivity of the potential risk/impact due to the recruitment/presence of security personnel is assessed as being **Medium** considering at the time of this impact assessment was prepared, AFRY have not received any information regarding the security personnel arrangement for the Banyuwangi Solar Project during the construction phase as well as the operational of the Banyuwangi Solar PV Project. If the security personnel are hired locally, this could be seen as a positive aspect, with minimal disruption to the community. However, if the hired security personnel are poorly trained in managing situations without being confrontational, their approach might come across as unnecessarily aggressive or intimidating. In addition, if the security staff will be recruited aren't trained in de-escalation techniques may worsen the situations, especially in instances where community members have grievances with the project.

The impact significance related to the recruitment and presence of security personnel during Project construction and operation is assessed as **Moderate** as presented in **Table 6-31**.

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Table 6-31 *Recruitment and the Presence of Project Security Personnel during Construction and Operation of the Project*

Impact Description	Risks Related to the Recruitment and the Presence of Project Security Personnel during Construction and Operation of the Project							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Small	✔	Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible		Minor	✔	Moderate		Major

Proposed Mitigation Measures

A number of measures will be implemented to optimize the management of the project security personnel, including:

- Conduct a security risk assessment for the Banyuwangi Solar PV Project
- Security personnel for the Project to be trained not only in general security protocols but also in the specifics of solar PV systems. This includes understanding the equipment, layout, and potential hazards.
- Providing the security personnel with training in conflict de-escalation techniques to minimize the risk of confrontations with workers, local communities, or visitors
- Provide training for the security personnel on local customs and norms, traditions, and values of the local community. The training should include aspect such as local etiquette, religious practices, appropriate dress code, and communication styles.
- Maintain transparent communication with local communities and stakeholders regarding the role of security personnel and the project's overall goals. This helps mitigate any concerns or misunderstandings about the project.
- Develop comprehensive ERP that include procedures for security-related incidents, ensuring security personnel are well-prepared to respond to any potential issues, including unauthorized access or sabotage.

Residual Impact

As a result of implementation of the proposed measures, the residual negative impact of the presence of project security personnel will be **Minor**.

6.2.6 Impact on Community Amenity / Public Facilities

6.2.6.1 SIA05 – Disturbance of Local Public Road and Public Facilities due to Increased Vehicle Movement during Mobilization of Construction Material and Heavy Equipment

Discussion of Impact

Mobilization of large equipment and vehicles will start from Tanjung Perak Port, Surabaya or Banyuwangi buffer port to the project location.

The road network proposed with National Road (Class of Road III). The design of on-site roads shall include both permanent and temporary roads. The Banyuwangi Solar Panel PV PP site can be accessed from the nearest city via a two lane 3-meter-wide asphalt road. This road is mainly used by the public and trucks rarely pass this route. Access

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along the perimeter of the site and within the site itself are via a 3-meterwide local road made of soil. This access road is wavy and might turn into muddy during rainy season. This road is mainly used by the plantation workers to mobilize crops and for their daily commuting or the factory workers / labourers to reach their work location at Ketapang Port.

Mobilization of project vehicles can cause inconvenience to road users and can also cause damage to road conditions. Nearby residential areas may also experience increased dust, noise, and vibration. Also, the impact of vehicle noise passing through places of worship, schools, Islamic boarding school, etc, which can disrupt comfort and security in community activities.

Impact Evaluation and Significance

The main equipment for the Solar PV power plant will be transported from Tanjung Perak seaport in Surabaya using trailer trucks to the Project site by road transport, with 302 km and estimated travel time of 6 hours. Or if the equipment is transported by sea, the equipment will be unloaded at the Tanjung Wangi Banyuwangi logistics port as a buffer from the Tanjung Perak Port in Surabaya. The distance from Banyuwangi port to the project location is around 6.4 km and takes 18 minutes with local road.

Meanwhile, most civil and structural materials, such as ready mix, batching plant, crushed stone/quarry, will be available from local suppliers in nearby cities as required by the project.

The village road leading to the panel installation location, this access road is wavy and might turn into muddy during rainy season. This road is mainly used by the plantation worker to mobilize crops and for their daily commuting. Pressure and vibration from large vehicle traffic can cause road damage. However, this impact is likely to be temporary, especially when transporting equipment before the panel installation process. Therefore, the severity impact on community amenity due to the access road mobilization is assessed as **Medium**.

The road that will be used is also a public road that is in good condition, and is usually used for inter-city mobilization, so that people are relatively used to the noise and traffic of motorized vehicles. Vibrations caused by the increased use of trailer trucks, dump trucks carrying construction materials and equipment can have a direct negative impact that has the potential to disrupt public facilities along the road access routes and community activities elementary schools, mosques, residential areas and Islamic boarding schools.

Therefore, the impact sensitivity is considered as **Medium** (See **Table 6-32**).

Table 6-32 *Disturbance to Local Road, Community Amenities and Public Facility*

Impact Description	*Disturbance to Local Road, Community Amenities and Public Facility during mobilization of heavy equipment and vehicles*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Small	✔	Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible		Minor	✔	Moderate		Major

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Proposed Mitigation Measures

The proposed mitigation measures are as follow:

- The Contractor will establish a Traffic Management Plan (TMP) to manage potential congestion to ensure community safety and project mobilisation.
- Community Liaison Office (CLO) or Community relation to be appointed to do stakeholder engagement with community, and consult regularly with communities on the Project traffic routes and peak traffic times;
- Keep communicate and coordinate with the village government, village leaders, local institutions and PTPNXII regarding the progress of the panel installation project phase in PTPNXII land area;
- Regular maintenance during construction and rehabilitation after construction – restore roads to equal or better condition; and
- Grievance mechanism to be established by the project to allow individuals or community groups the opportunity to raise any issues regarding project activity.

Residual Impact

As a result of implementation of the proposed measures, the residual negative impact of the disruption of community amenities and public facilities will be **Minor**.

6.2.7 Landscape and Visual Impacts

6.2.7.1 SIA06 – Impact on Landscape and Visual Associated to Project Construction and Operation (Transmission Line and Ground Mounted Solar PV)

Discussion of Impact

It is important to note that the impacts discussed throughout this section are not necessarily considered negative. The aesthetic perception by viewers is quite different for development of Solar PV; it can be positive or negative, depending on the individual's attitude to the principle and presence of renewable energy generation. Aesthetic issues are by their nature highly subjective. For some viewers, especially such Solar PV power plant development and its supporting facilities could be regarded as manmade structures with visual burdens while to others it represents a positive impact in the sense that they introduce to new view man-made object presence.

Impact Evaluation and Significance

The construction activities that are likely to create landscape and visual interference to aesthetics include: materials lay down, excavation, backfilling, and spoil. The project site land use identified as sugarcane plantation that have vegetative covers; hence the sugarcane plant needs to be removed on land preparation activity as part of construction phase. The mounting of ground mounted PV module installed in about 2 meters above the ground with the total area of PV module is about 88 ha. The vegetation cover removal expected only occurred at the inside of PV module area it is expected the vegetation around project boundary still can blocked the visibility of PV module installation. In addition, there are identified other PLN's switchyard and transmission lines (other project) will be develop at the sugarcane plantation area as well. While the land preparation for transmission tower area is about 0.04 ha of each tower footing. The construction period is expected 12 (twelve) months, the severity impact on landscape and visual interference assessed as **low**.

The nearby settlement is located adjacent with the project area and has vegetation cover surrounding the settlement area and public road, this resulting the visual towards the

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PV module is slightly visible. As mentioned in section 4.2.2.7, the perception from the owner of homestay nearby the project area (Omah Telu homestay) was identified object to the solar PV development because the Project expected will limited the view from the homestay to the Ketapang harbour (sea view). The Omah Telu homestay is quite new homestay, started to operation in mid-December 2023 with an initial 2-years lease from the landowner. In addition, refer to Banyuwangi spatial planning map (**Figure 3-13**), surrounding of the Banyuwangi PV development is categorized as settlement area and plantation area. The visual intrusions are anticipated to be limited to the construction employees and several settlements at the West side of PV boundary that have direct view to the Project area only. Hence, the visual effects sensitivity to the receptors during the construction phase will be **medium** within the project area.

The main impact during operation is the visual of PV module installation and the transmission tower (high object). The transmission tower (15 towers) will clearly stand out from the surrounding natural landscape, while the visibility of PV module operation is slightly visible from the settlement (human eye height about 2 meters) due the installation of PV module will be about 2 meters and the vegetation cover around the settlement and PV boundary area are blocked the visibility of PV module. In addition, the existing transmission line was identified parallel with project transmission line segment. Therefore, the community or public road user has been familiar with the view of transmission line. The solar PV development might become an educational attraction for green energy and creating future green energy perspective. This visual impact during the operation phase may be perceived as **positive**.

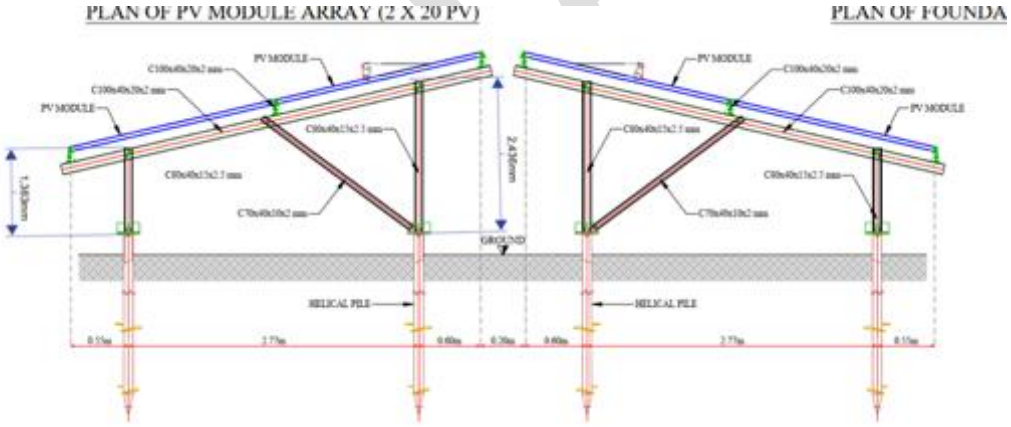


Figure 6-1 *Typical Ground Mounted PV Foundation and Module Array*

Table 6-33 *Landscape and visual related risks and impacts during construction phase*

Impact Description	*Risk and Impact on Landscape and Visual Associate to Project Construction*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible	✔	Low		Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible	✔	Minor		Moderate		Major

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Table 6-34 *Landscape and visual related risks and impacts during operation phase*

Impact Description	*Risk and Impact on Landscape and Visual Associate to Project Operation*			
Impact Nature	✔	Positive		Negative
Impact Type	✔	Direct		Indirect

Proposed Mitigation Measures

The proposed mitigation measure for construction phase as follows:

- Minimise the site clearing and maintained the vegetation cover around construction boundary area.
- Install the temporary fence during construction around Project area which adjacent with settlement with limited vegetation cover to prevent visual intrusion.
- Ensure proper housekeeping and instruct the workforce accordingly (i.e., ensure that all machines, vehicles, and tools used during construction to be removed from after construction works finished as earliest as possible and waste, including tree cutting waste from site preparation shall be handling in a timely manner).

The proposed mitigation measure for operation phase as follows:

- Engaged the local community tourism/educational association and/or regional stakeholder to expound the visual impact perspective as future green energy awareness and potential educational attraction.

Residual Impact

As noted throughout the assessment, generally the visual intrusion are considered minor. The mitigation during construction can be implemented to reduce the residual impact to negligible. There are no mitigation measures per se that can be implemented to eliminate the visual instrusion from transmission line operation. Otherwise, the solar PV development and its supporting facilities might become an educational attraction for green energy and creating future green energy perspective.

6.2.8 Socio-Culture

6.2.8.1 SIA07 – Impact on Socio-Culture and Social Behaviour of Local Community as a Result of Project Construction and Operation Activities

Discussion of Impact

Banyuwangi is located at the eastern tip of the island of Java, which borders the island of Bali and to the north close to the island of Madura. The region is surrounded by straits and oceans, making it possible for residents to migrate in and out easily. For this reason, several ethnic groups, including the Osing (indigenous tribe of Banyuwangi), Javanese, Balinese, Madurese and Mandar live in Banyuwangi and contribute to the development of the region. Although there are Osing communities in Kemiren village that meet the criteria of Indigenous Peoples as set by AIIB, IFC, and WB. However, there will be no direct impact on these communities due to the development of the project. The daily language of the Banyuwangi people is also mixed, between Osing, Madurese and Javanese. This diversity creates an atmosphere in Banyuwangi society that is rich in culture, making it a heterogeneous city. In the context of diversity, community meetings become a forum for community communication to build understanding and get to know

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each other in strengthening ties between Banyuwangi community groups. The largest religious group is Muslims, but other religions can also practice their religion comfortably. Religious-based institutions are also of great interest to the public, including Christian religious institutions.

Community participation in village activities is also quite high, including participation in social institutions or organizations. Good relations between communities and between institutions can minimize conflict in society. According to respondents, as many as 80% of conflicts occurred between fellow residents, 13% between the incoming residents, and 8% between residents and the incoming residents. Usually, these conflicts originate from land disputes between families, labour issues or debts.

During the construction period, the project will recruit many workers, both local and migrant. The construction duration is 12 months, with the need for workers starting to increase from the 3rd month to a peak in the 7th month reaching 431 workers (local 341; immigrants 90). Even though barracks will be built for migrant workers, interaction with local workers and the local community cannot be limited, so it can affect the socio-cultural habits of the community.

Impact Evaluation and Significance

For community who are accustomed to diversity, the presence of non-local workers and their interactions with local workers and local communities has the potential to give rise to new influences and habits regarding culture, however, this influence can be assumed to be insignificant.

Nevertheless, there is the potential for unhealthy competition and jealousy to emerge between workers, thereby reducing the social ties of local communities. This happens especially at the stage of recruiting local workers. The majority of workers needed during construction are those who have abilities according to their field of work, making it a challenge for local residents to compete.

Meanwhile, the magnitude/severity of the impact is estimated to be **Medium** because the construction process is short term, and migrant workers will live in temporary base camps, so interaction is limited.

Even though it has an impact, but the strong social and cultural ties of the local community, as expressed in the baseline, mean that the influence of project activities and migrant workers can be well anticipated. Changes in socio-cultural and social order have the potential to occur but the sensitivity is considered **Low**.

Therefore, the impact/disturbance to socio cultural and social behaviour is assessed as **Minor** significance as presented in **Table 6-35**.

Table 6-35 *Disturbance to Socio cultural and social behaviour due to migrant workers during construction and operations*

Impact Description	*Risk of social and cultural disruption due to migrant workers during construction and operations*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Small	✔	Medium		Large
Sensitivity/Vulnerability	✔	Low		Medium		High		
Significance		Negligible	✔	Minor		Moderate		Major

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Proposed Mitigation Measures

The following actions will be implemented by the Project to manage the impact to cultural heritage disturbance during the construction phase:

- Consult with the local leaders (village government, community leaders and local institution) before the construction activities begin. Especially discussing the socio-cultural habits of the community, acceptance of immigrants, and the need for local workers according to the project phase.
- The project consulted with the Banyuwangi district Manpower Office regarding data on job seeker capacity and definitions of the scope of local employment.
- PT PLN Indonesia Power ensures that all contractors (EPCs) provide Labour Management Plan (LMP) and induction to all workers, especially immigrants, regarding behavior and adaptation to local customs and culture.
- Consultation approach and empowerment program for village institutions.
- Projects to be able to adapt and continue to support local culture by participating in its implementation.
- The project will continue to carry out further consultations involving various stakeholders related to customary issues and considering involving the Osing community in Kemiren in the project's social investment program, which may be structured as part of the Corporate Social Responsibility (CSR) initiative.
- The project provides a Stakeholder Engagement Plan (SEP) document as a reference for coordinating with stakeholders related to the project and anticipating issues developing in the community.
- Project/PT PLN Indonesia Power to ensure the Project's grievance mechanism is well socialized, and when grievances are submitted regarding socio cultural, the PT PLN Indonesia Power and EPC will investigate and address the issue in a timely manner.

Residual Impact

As a result of implementation of the proposed additional measures, the residual negative impact of the disruption of socio cultural will be **Negligible**.

6.2.9 Cultural Heritage

6.2.9.1 SIA08 – Disturbance to Cultural Heritage during the Project Construction and Operation

Discussion of Impact

Result of the baseline study which also involve a cultural heritage screening process has indicated there is a physical cultural heritage in the form of Old Burial of Plantation (PTPN) Workers located within the boundary of the area intended for the construction of the Solar PV panels area (See **Figure 6-2**). The identified cultural heritage site is an old, abandoned burial of the past plantation workers, administratively located within the Wangkal Sub-Village. Based on consultations to the local community during the baseline study, there seems to be less cultural attachment of the present local village residents to this identified burial site. Potential impact will likely be a minor disturbance or minor damage to the existing tombs during land clearing and construction process of the Solar PV main component.

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Figure 6-2 *Old Burial of Plantation Workers*

Impact Evaluation and Significance

The location of the Old Burial site is precisely on the edge of the Solar PV area boundary which may potentially be affected by the land preparation process which can takes several weeks up to one month, and mobilization of construction material and equipment which approximately may last for months. Based on the consultation with the local community, within the burial complex filled with several tombs made of stone with one tomb with roof structure. Given the burial is currently abandoned, therefore there is possibility of relocation of the tomb to avoid disturbance or damaged caused by the Project construction activities. As such, the Severity of impact related to cultural heritage is assessed as **Moderate.**

As previously described, the Old Burial site is currently no longer use by the local community and based on the consultations, most of the family or close relative of those buried in the burial site no longer live in the villages near the project area. There seems to be no close cultural attachment of the current village residents to this cultural heritage site. This was evidenced by the site has not been visited by anyone for years for pilgrimage purpose. As such, the sensitivity of the impact receptor is assessed as **Low.**

Therefore, the Significance of impact related to cultural heritage during construction and operation is assessed as **Minor** significance as presented in **Table 6-36**.

Table 6-36 *Impact Significance of Disturbance to cultural heritage*

Impact Description	*Disturbance to cultural heritage during project construction and operation.*								
Impact Nature		Positive			✔	Negative			
Impact Type	✔	Direct				Indirect			
Severity/ Magnitude		Negligible		Low	✔	Medium		Large	
Sensitivity/Vulnerability	✔	Low		Medium		High			
Significance		Negligible	✔	Minor		Moderate		Major	

Proposed Mitigation Measures

Indonesia Power has recognized the potential impacts on cultural heritage located within the project area and has confirmed that such impacts will be avoided. This commitment has been reflected in the latest Banyuwangi Solar PV Power Plant project design

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In addition to the above, the following actions will be implemented by the Project to manage the impact to cultural heritage disturbance during the construction phase:

- Project to consult with the community leaders in Wangkal Hamlet to ensure that there is no family or close relative of the local village residents buried in the old burial site. This to anticipate any further measure required such as claim for compensation, etc.
- Consult with the local relevant village leaders before construction activities to discuss/inform the areas of construction works and schedule and measure require to be taken should the burial site be disturbed or impacted. This can be in the form of providing sign or boundary mark around the burial complex thus the construction activities can avoid or potential relocation of the site.
- PT PLN Indonesia Power to ensure the Project's grievance mechanism is well socialized, and when grievances are submitted regarding cultural heritage, the PT PLN Indonesia Power and EPC will investigate and address the issue in a timely manner.

Residual Impact

As a result of implementation of the proposed additional measures, the residual negative impact of the disruption of cultural heritage is assessed as **Negligible.**

6.2.10 Community Health

6.2.10.1 SIA09 – Community Health Impact Associated with Dust and Air Quality as a Result of Project Construction, Material Mobilization and Land Preparation

Discussion of Impact

The construction of all project components is estimated to be 12 months construction period. The construction activities beside equipment mobilization that might produce dust and reduce air quality are surface clearing, site levelling, on-site road excavation, transformer foundation, collector line/ cable trenches, and on-site drainage ditch. The construction activities are located 100 – 300 meters from the closest community settlement in Kalipuro village. The construction of Ground-mounted solar module and Switchyard in Kalipuro Village. The construction of solar module and switchyard will be located within the sugarcane plantation area. Community mentioned, during harvest period, the PTPN XII incinerates harvest residue that cannot be used, which causes reduce air quality and flying black ash. The construction of 150 kV TL line is expected to affect 3 villages: Kelir, Kalipuro, and Giri Village.

The Banyuwangi Solar Panel PV PP site can be accessed from the nearest city via a two lane 3-meter-wide asphalt road. This road is mainly used by the public and trucks rarely pass this route. The road network proposed with National Road (Class of Road III). Access along the perimeter of the site and within the site itself are via a 3-meterwide local road made of soil. This access road is wavy and might turn muddy during rainy season. This road is mainly used by the plantation workers to mobilize crops and for their daily commuting. The design of on-site roads should include both permanent and temporary roads. The roads should be designed for a life of a minimum of 25 years.

The main equipment for the Solar PV power plant construction will be unloaded at the respective seaport or nearby container terminal and trans-shipped using trailer trucks and transported to the Project site by road transport. The largest and nearest seaport for Ground-mounted solar PV PP Banyuwangi site would be Tanjung Perak Seaport located in Surabaya with secondary seaport is also available in Banyuwangi (Banyuwangi

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Seaport). Meanwhile, the local materials will be transported using the existing road network in the area including public and village routes. The EPC contractor is expected to source the construction material locally. The project location is located 290 km from Tanjung Perak port depends on the option of road and 40.4 km to Banyuwangi seaport. Other construction materials will be transported from the surrounding area.

Impact Evaluation and Significance

The equipment and material mobilization will be conducted intermittently for 12 months. The increase of traffic during this time might happen in public/village road utilized by Wangkal hamlet resident from Kalipuro to Ketapang area. While construction of Ground-mounted solar module and Switchyard site, access road and transmission line are expected to only happen in the agricultural area where no settlement observed. Based on this discussion, the magnitude of impact is assessed as **Medium.**

The dust and decreased air quality may irritate the respiratory tract, making it more susceptible to infection. These specifics impacts cannot directly cause ISPA/ARI (acute respiratory infection) but these impacts can create conditions that make people more susceptible to it. Further, the community health baseline shows that the affected communities in the project location have respiratory disease prevalence. The public health centre of Kelir records 1401 cases of ISPA, Giri does not record any cases of ISPA, Klatak records 2093 cases of ISPA in 2023. Based on community feedback during stakeholder engagement and baseline survey, they perceived the project construction may increase the dust from sites construction and traffic from mobilization of equipment / construction material to their community. This discussion shows bring the sensitivity/ vulnerability of community to **Medium.**

Based on the above discussion, the significance of community health impact associated with Dust and Air quality is assessed as **Moderate** significance as presented in **Table 6-37**.

Table 6-37 *Community Health Impact Associated with Dust and Air Quality*

Impact Description	*Community Health Impact Associated with Dust and Air Quality*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Small	✔	Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible		Minor	✔	Moderate		Major

Proposed mitigation measures.

In addition to existing management measures for dust and pollution controls. Project will implement the following additional measure:

- Consultation with communities of Project's traffic routes, peak traffic, and access road construction times (especially to agriculture/plantation workers) to manage/inform the number of vehicles, road construction time and wetting the road schedule, especially road section from Kalipuro (Wangkal hamlet) to Ketapang area.
- Regular check on ARI data record from the nearby health facilities at least once every 6 months

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- Consider establishing community health assistance through a CSR Program coordinating with public health centres and focusing on managing ARIs and other similar health issues.
- Establish and implement a Project grievance mechanism to report dust and pollution concerns that are understood by and accessible for the affected communities in every affected village.

Residual impact

As a result of implementation of the proposed additional measures, the residual negative impact of Community health impact associated with dust and air quality will be **Minor** significance.

6.2.10.2 SIA10 – Health Impact Associated with the Presence of Non-Local Workforce during Project Construction and Operation

Discussion of Impact

The peak estimation of construction worker requirement for Banyuwangi Ground mounted Solar PV Project is approximately 431 workers. It is divided for project management, engineering department, procurement, QA/QC, general, finance and construction team. It is expected that 80% of construction workers or about 341 people are from locals with the required specification. This means, the locals with required specification will have a priority to apply especially from meaning Kalipuro Sub-district and surrounding area for Banyuwangi site. The estimated timeline of construction is 12 months and operation are 25 years with significantly less workers compared to construction period. Estimated non-local workers are about 90 workers (20%) which require skilled workers from outside the project location. It is assumed that 100 people recruited per 2 months, then the recruitment of workforce is carried out 5 times and adjusted with the need for workforce in the field. During the operation stage, the number of workers is reduced to 54 workers.

Given the number of non-local workers, daily interactions with locals are expected to occur e.g., there is potential interaction during workers purchase of goods and services or when they are out at night or the weekend as well as traffic to and from the site. The presence of some additional workers in the local community may create negative impacts such as transferring of communicable disease (Covid-19 or ARI) from and to non-local workers. Most of the time, it is unlikely for non-local workers to cause the prevalence of new disease to local community or social problems however as the interaction with non-local workers will not be limited, mitigation measures to be adopted to manage social illness, conflict and the spread of communicable disease.

Impact Evaluation and Significance

Consultation with affected community in 3 villages (Kalipuro, Klatak and Bulusan village) surrounding the Banyuwangi site have mainly in favor of the project due to workforce recruitment opportunity. It is expected that majority of workforce would come from affected area as such only 20% of workforce that can be categorised as non-local workforce. The project site is located in Kalipuro Village which has many non-locals staying these due to the existence of companies or factories, namely PTPN XII, PT Semen Bosowa, PT INKA (train company). Apart from that, Kalipuro has also become a crossing center connecting the islands of Java and Bali which is connected by Ketapang and Gilimanuk Port, so many workers make Kalipuro Village their place of residence.

The social baseline shows, there are 3 community health facilities serving these affected villages. 2 public health centres (Kelir and Klatak) have been mentioned to have

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ISPA/ARI as highest disease prevalence in 2023. The communicable disease cases might be exacerbated due non-local workers with communicable disease. There is record on reported sexual transmissible disease (545 HIV case) in Klatak public health centre. The closest prostitution area is reported in Banyuwangi, 25.9 km (30 to 40 minutes, Lokalisasi Padang Bulan Singojuruh[69]) from project location.

Even though the community has experience with high number of non-local workers due to other business activities in the project area, it seems the prevalence of ARI and STD are found. The number of non-local workers from other business and the Banyuwangi Solar PV site can increase the vulnerability of the affected people, as such the vulnerability of affected people is assessed as **Medium,** and the impact magnitude is assessed as **Medium** because of the project may exacerbate the impact from other business activity.

The significance of impact to community health as a result of non-local workers area assessed as being **Moderate** significance as presented in **Table 6-38.**

Table 6-38 *Health Impact Associated with The Presence of Non-Local Worker*

Impact Description	*Community Health Impact Associated with the presence of non-local worker*								
Impact Nature		Positive			✔	Negative			
Impact Type	✔	Direct				Indirect			
Severity/ Magnitude		Negligible		Small		Medium		Large	
Sensitivity/Vulnerability		Low	✔	Medium		High			
Significance		Negligible		Minor	✔	Moderate		Major	

Proposed mitigation measures.

- Compulsory medical examinations for Project workers, contractors and sub-contractors working during construction and operation stage to ensure they are fit for work and to monitor the prevalence of communicable disease and STD detected through annual medical check-ups.
- Conduct a monitoring of disease prevalence in community surrounding the project location by doing regular coordination with public health centre
- Conduct and induction and training on the community engagement code of conducts regarding to interaction with locals, especially about communicable disease and STD.
- Engagement with local authorities relevant to crime (local police), health (local health service/hospital) and social problems (village leaders) for prevention of any community and workers health.

Establish and implement a Project grievance mechanism to report crime, health, social problems concerns related to workers that is understood by and accessible for the affected communities in every affected village.

Residual impact

As a result of implementation of the proposed additional measures, the residual negative impact of Community health impact associated with the presence of non-local workers will be **Minor** significance**.**

[69] Accessed on 9 March 2024, accessed at: https://memontum.com/lokalisasi-padang-bulan-singojuruh-tetap-jadi-destinasi-esek-esek-di-banyuwangi

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6.2.11 Community Safety and Security

6.2.11.1 SIA11 – Impact on Community Safety Associated with Road Safety due to Increase of Traffic Volume on Existing Road due to Project Construction Equipment and Material Mobilization

Discussion of Impacts

The Project construction will be required to deliver the heavy equipment and material through existing public road to the project site. As mentioned in Section 3.6.2.3, they will be unloaded at Tanjung Perak seaport and Banyuwangi seaport for main equipment unloading. The trans-shipped using trailer trucks and transported to the Banyuwangi site by road transport. Access road to the Banyuwangi site will be used for equipment and material mobilization during construction. The road transport will use existing national collector road, Situbondo – Banyuwangi Road, then connect to collector road Argopuro Road and Joyoboyo Road.

Based on Baseline condition, the road friction or land use type along the road access is identified as mixed use between settlement, commercial, industry, public facilities, and cultivation/paddy field. Regarding the road safety perspective, the road sign indicating at sensitive receptor location (zebra-cross for school), speed limit, and turn sign was identified along the existing road. During the traffic observation, the traffic accident occurred at the Argopuro Road at the railroad crossing. The accident occurred due to the break failure of heavy vehicle that cannot control the vehicle speed on the downhill road. There is no injured victim, the accident causes short traffic congestion and delay on train schedule. The road user behaviour was also observed does not comply with safety standard such as not wearing helmet and carrying exceed load for motorcycle user.

Impact Evaluation and Significance

As the EPC contractor has not been assigned yet, no details are available at this stage on the number of vehicles requires to deliver the equipment and material. Therefore, for impact evaluation purposes assumption for 100 MW Solar PV development based on Traffic Management Plan (ANDALALIN) of Ground mounted Solar PV 100 MW Banyuwangi sites. The ANDALALIN document estimated the maximum heavy vehicle during mobilisation of equipment and material is 17 (seventeen) trucks per hour[70].

The period of construction is expected will be 12 months, it is expected the mobilisation equipment and material likely not occurred throughout the construction period. The existing road width between 4 - 5 meters at Joyoboyo Road and 7 – 8 meters at Argopuro Road. The road pavement of bot road has good pavement. While the national road (Situbondo – Banyuwangi Road) has road width about 6 meters/lane with good pavement road. The bridges width at Joyoboyo Road identified about 3.5 – 4 meter and limited for one way light/heavy vehicles. Therefore, severity considered as **medium**.

Based on the baseline secondary data, referring to online publish news[71], the traffic accident occurred at Banyuwangi Regency in 2023 recorded 1,304 cases with death

[70] Traffic Management Plan or *Analisis Dampak Lalu Lintas* (ANDALALIN) of 100 MW Solar Power Plant Bayuwangi Sites
[71] https://surabaya.kompas.com/read/2024/01/04/183821778/angka-kecelakaan-di-banyuwangi-meningkat-1304-kejadian-220-korban-jiwa#:~:text=BANYUWANGI%2C%20KOMPAS.com%20%2D%20Angka,2022%20yang%20mencapai%201.187%20kasus.

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victim 220 persons, major injuries 11 persons, and minor injuries 1,476 persons. There is no further information about the detailed of the traffic accident-causing reasons.

Although the local communities were observed easily adapting to the traffic volume and heavy vehicle mobilisation from current activities, the unsafe behaviour of the local road users (not wearing proper helmet and loading large goods by motorbike) are likely to increase the potential traffic accident. In addition, the traffic accident was observed during traffic survey. Considering the road user behaviour and existing traffic condition the sensitivity is assessed as **medium** level.

With severity/magnitude classified as **medium** and sensitivity of impact as **medium**, consequently the impact significance falls under **moderate**.

Table 6-39 *Community safety related risks and impacts*

Impact Description	*Risk and impact on Community Safety Associate with Road Safety due to Increase of Traffic Volume on Existing Road due to Project Construction Equipment and Material Mobilization*								
Impact Nature		Positive			✔	Negative			
Impact Type	✔	Direct				Indirect			
Severity/ Magnitude		Negligible		Small	✔	Medium		Large	
Sensitivity/Vulnerability		Low	✔	Medium		High			
Significance		Negligible		Minor	✔	Moderate		Major	

Proposed Mitigation Measures

It is expected that the following mitigation measures will be incorporated to Traffic Management Plan prepared by the EPC contractor:

- Conduct or inform the community around Project area about the construction activity, including project schedule and mobilisation route of heavy vehicles.
- Scheduling the mobilisation of heavy equipment and material outside the peak hour of traffic volume and consider after school and public weekly market schedule; and it expected to inform relevant governance agency (Transportation Agency/Dinas Perhubungan) of the project schedule/activity and for escorting if the vehicle convoy is needed.
- Install the Project traffic sign and road markings for safety reason.
- Provide road officer who is responsible for managing traffic flow at the gate of project area and install the post security.
- Provide the laydown area to store the heavy equipment and material, as well as the parking area for light and heavy vehicles to avoid parking on the public roadside.
- Ensure the vehicles and drivers in good condition and have a valid licence to operate according to standard operation procedure.
- Ensure the heavy vehicle weight loading accordance with the road load capacity standard.
- Ensure the heavy vehicle loading handling accordance with applied standard operation procedure (i.e. for material loading shall be covered, provide tire washing area to avoid material spill on the road).
- Vehicle speed limit to apply in accordance to standard road speed limit (i.e. for collector road inter-city is 40 km/hour and settlement area at local road is 15 – 20 km/hour)

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- Improved the road paving with poor condition at local road segment that expected cannot accommodate heavy vehicle load and repair the road damage cause by the Project's heavy vehicle mobilisation activity after Project construction activity.
- Provide grievance mechanism platform to accommodate community perception related to transportation.

Residual Impact

If the mitigation measures are implemented well with regular monitoring of the mitigation measures above, the residual impact is deemed to be **minor** significance.

6.2.12 Occupational Health and Safety

6.2.12.1 SIA12 – Impact Associated with Workers/Occupational Health and Safety during Construction and Operation

Discussion of Impact

There are likely to be potential impacts on worker's health and safety due to exposure to risks through the Project development activities. The construction of the Banyuwangi Solar PV Project involves the following activities:

- Land preparation and civil work
- Equipment and material mobilization
- Waste handling and disposal
- Mechanical and electrical works (PV power plant installation); and
- Construction of Transmission Line

The following occupational health and safety risks are frequently present, in particular during the Project construction phase:

- Mobile vehicles and heavy equipment accidents.
- Heat stress when working in humid and high temperatures.
- Manual handling and musculoskeletal disorders.
- Hand-arm vibration impacts from concrete breakers, grinders, hammer drills, chipping hammers, chainsaws, scrabbles, and needle guns.
- Tripping due to uneven surfaces and obstacles.
- Falling during working at height.
- Fire due to hot works, smoking, and failure in electrical installations.
- Electric shocks.
- Exposure to dust and noise, and hazardous chemicals.

Construction workers in general, in particular the local workforce which commonly having a very limited knowledge and understanding of OHS risks will be the party who has the highest risk of being exposed to the impacts and risks. If not anticipated and managed adequately, the following activities could cause risk of injury of even fatality.

Impact Evaluation and Significance

According to the result of the Project Feasibility Study (FS), construction phase from NTP to COD of the plant is estimated to be 12 (twelve) months and the operation phase

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is 25 years according to the design lifetime of the PV module, and Project Purchase Agreement (PPA) term.

During the peak of the construction activities there will be approximately 431 workers involve in the Project. It is expected that 80% of the total workforce during the peak of the construction or around 341 workers are from the local workforce. The local workforce is expected to be recruited from the villages or sub-districts within the Project area of influence as a priority. The construction workforce is expected to work maximum 8 hours a day per the Indonesian labour regulations. As such, the severity of impact related to OHS is assessed as **Medium.**

It is expected that the majority of the local workforce will be a non-skilled to a semi-skilled workforce considering the general jobseeker within the project area is having a middle-to high school educational level background. In general, the local workforce typically doesn't have a sufficient knowledge regarding the occupational health and safety on a Solar PV Project. Historically there has never been a similar project developed and operated in the area participated by the local community.

Should a work-related accident occur to the workers during the construction phase it is expected the EPC will provide a medical treatment and facilities onsite. However, for a major accident, it may require to be transferred to the nearest health facilities equipped with more adequate equipment and treatment. According to the baseline, the nearest such health facility is the Community Health Centre in Kelir village which is located near the project main construction site. As such the Sensitivity of the impact receptor is assessed as **Medium.**

Therefore, the Significance of impact related Occupational Health and Safety (OHS) during construction phase is assessed as **Moderate** significance as presented in **Table 6-40**.

Table 6-40 *Risks / Impacts related to Occupational Health and Safety*

Impact Description	*Risks / Impacts related to Occupational Health and Safety*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Low	✔	Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible		Minor	✔	Moderate		Major

Proposed Mitigation Measures

It is anticipated that the EPC will develop an Occupational Health and Safety Plan to safeguard the health and safety of the local workers who are likely to be less experienced in this area.

The following are the additional proposed measures to mitigate the risk/impact related to OHS:

- Construction worker standards to be aligned with minimum national requirements for health and safety during construction and operation, along with inductions, training, refreshers, and inspections.
- The Project will prioritise worker health and safety standards such as preparing SOPs for each type of construction activity, conducting regular health and safety

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training and briefings (in the local languages as required) before the implementation of the activities (toolbox meeting) and compulsory use of personal protective equipment (PPE).
- Strict Occupational Health and Safety requirements will be embedded in the EPC contract to ensure occupational injuries, worker rights, deaths, disability, and diseases are managed as per the Project's commitments.
- Should non-compliance repeatedly occur, a zero-tolerance approach to be adopted.
- Establish and implement a Worker Grievance Mechanism that will be accessible for all workers and contractors to report issues (a confidential option to be provided). When complaint is submitted, the project will undertake an immediate investigation.

Residual Impact

If health and safety is prioritised by the EPC and with proper implementation, regular monitoring, and improvement of the mitigation measures above, the residual impact is deemed to be **Minor** significance.

6.2.13 Human Rights Impact

6.2.13.1 SIA13 – Risks and Impact Associated with Labour Rights and Working Condition during Workforce Recruitment, Project Construction and Operation

Description of Impact

The use of contracted/sub-contracted services for smaller works under the Project is usually staffed by local unskilled workers. It is anticipated that from the total 431 workforce during the peak of the construction, some portions of the personnel working on site for the construction of the Banyuwangi Solar PV Power Plant will be employed through contractor or sub-contractors. Although at the time of this ESIA was developed there is still no information related to the contractor/subcontractor arrangement.

If Project workforce is not properly managed, the informal / casual / non-skilled labour and local workers who are contracted under the sub-contractors are considered more vulnerable to potential violation of labour rights such as inadequate waging system, excessive working hours, and working in an unhealthy working environment or working with insufficient health and safety supports. Such violation as described above, in an extreme case can relate to violation of human rights.

Impact Evaluation and Significance

Considering the size of the workforce will be utilized during the peak of the construction, and the duration of the project construction schedule as described under the description of impact and adding the likely absorption of local workforce will be from the key affected village within the Project Area of Influence, therefore, the Severity of impact related to Labour Rights is assessed as **Medium.**

Considering the typical local and unskilled workforce is having limited knowledge and awareness on labour rights, thus very vulnerable to becoming victims of labour violations. In addition, where workers are employed by sub-contractor or local subcontractors, there is a greater risk that local contractors during construction will have insufficient human resource policies and procedures and also lack of capacity to deal with human resources issues. Therefore, the sensitivity of the risk and impact related to labour rights is assessed as **Medium.**

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As such, the significance of impact related to Labour Rights is assessed as **Moderate** Significance as presented in **Table 6-41.**

Table 6-41 *Risk / Impact associated with Labour Rights*

Impact Description	*Risks / Impacts related to Occupational Health and Safety*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Low	✔	Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible		Minor	✔	Moderate		Major

Proposed Mitigation Measures

The following are the key mitigation measures proposed to address impact associated with labour rights and working conditions:

- Development of a Labour Management Plan (LMP) to ensure that the labour rights and working conditions for the Project and its Contractor's workers are protected, with consideration of both national regulation and international best practice adopted by the Banyuwangi Solar PV Power Plant Project.
- Require contractors to adhere to the PT PLN Indonesia Power/Project labour management plan through contract requirements to ensure the same standards are applied to all contractors and the supply chain.
- Project to work with the contractors to ensure adequate resources and technical knowledge to cover issues relating to labour rights and working conditions, non-discrimination, and grievances; and
- Establish and implement worker grievance mechanism for workers and to be adequately communicated to workers at the time of recruitment, as part of the labour management plan.

Residual Impact

As a result of implementation of the proposed additional measures, the residual impact related labour rights and working conditions is assessed as **Minor** significance.

6.2.13.2 SIA14 – Gender-Based Discrimination and Violence during Construction

Discussion of Impact

The Project feasibility study and ESIA Project Description doesn't specifically mentioned the number of female workers expected to be required by the Project. However, it is expected for some role and position such as administrative, catering or cleaning roles can be filled by female workers, although it can be expected only in a small number. The construction activities of Banyuwangi Solar PV Power Plant Project may likely to resulting in the employment of male dominance workers given the type of skill sets required during construction activities. These types of activities are locally considered as formal employment and mainly associated as men's jobs. This local believe or tradition may potentially limit and discriminate female participation, discouraging them to apply for employment under the Project.

The presence of small female workers may potentially be exposed to workplace risks given the largely male workforce portion (local and non-local male workforces) particularly during the Project construction phase. Interactions may lead to culturally

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insensitive behaviour and relationships, including incidences of gender-based violence (GBV) and sexual harassment/abuse.

Impact Evaluation and Significance

Given the type of activities planned in the pre-construction and construction process as well as the culture and customs of the communities within the Banyuwangi Project Area of Influence, the opportunities for the project to attract female job seekers in the community is limited. Majority of the Project workforces will be allocated during the construction phase which expected to last approximately 12 months which is considered as short term. This will include possibility of recruitment of female workers during construction. Project employment positions that can potentially be filled by female workers are considered the type of work requiring a semi-skill capability which expected can be sourced from the key affected villages and sub-district such as Kalipuro village and Kalipuro sub-district. As such the Severity of the impact or risks related to gender-based discrimination and GBV is assessed as **Medium.**

Female workforce in the Project is predicted to become a minority due to its small number. In addition, based on the baseline study, the workforce education level in the projected affected villages mostly falls within the elementary school level, thus there is a potential that the public awareness on GBV is still low and doesn't consider gender-based discrimination and violence as a serious matter. There is also a potential if a case of sexual harassment occurs, the victim does not have the courage to reveal and seek a resolution to the act of violence as it is sometime still considered embarrassing. As such severity of impact is assessed as **Moderate**.

Therefore, the risk of Gender-Based Discrimination and Violence during Project construction phase is assessed as **Medium** significance as presented in **Table 6-42**.

Table 6-42 *Significance of impact related to Gender Based Discrimination and GBV*

Impact Description	*Impact related to Gender Based Discrimination and risk related GBV on female workers.*							
Impact Nature		Positive			✔	Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Low	✔	Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible		Minor	✔	Moderate		Major

Proposed Mitigation Measures

The following are the proposed impact mitigation measures that will need to be applied by the Banyuwangi Solar PV Project and its contractors and sub-contractors:

- Development of a Labour Management Plan (LMP) to ensure that the labour rights and working conditions for the Project and its Contractor's workers are protected, with consideration of both national regulation and international best practice adopted by the Banyuwangi Solar PV Power Plant Project. The Labour Management Plan will incorporate policies and procedure to address risk of SEAH/GBVH particularly for female workers and implemented throughout the life cycle of the Project.
- Ensure that the Project follows gender inclusion policies, reporting on recruitment targets, processes and hiring numbers, as well as suitable provisions for female personnel. This is not limited to equal pay and conditions, but also to

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facilities for lactating mothers, flexible working arrangements and access to female supervisors and mentors.
- Promote the Project GBV policies and ensure socialisation of the policies and procedures to contractors and workers.
- Provide separate, secure, and safe worker accommodation for men and women working in construction, particularly for the non-local workforce.
- In the GRM implementation, ensure that a female officer is involved as a team member and that there is a private grievance reporting process, referral channels, and systems of support for employees and the community, to help encourage reporting of any GBV or discrimination related grievances, and protect the complainant.

Residual Impact

The residual impact is deemed to be **Minor** Significance if the Project contractor and sub-contractor consistently follow and implement properly the Labour Management Plan, and PT PLN Indonesia Power/Project owner to regularly conduct monitoring related to Project workforce management.

6.2.14 Community Perception

6.2.14.1 SIA15 – Change in Community Perception Throughout the Project Phases (Pre-Construction, Construction, and Operation)

Discussion of Impact

Community perception refers to the attitudes and belief held by members of a community towards a particular issue or topic or in this case towards the development of the Banyuwangi Solar PV Project. Perception of the community may change overtime / throughout the phases of the Project development (pre-construction, construction to operation) influence by various factor such as interest, experience, and expectations of the perceiver. The change of community perception is also determined by how the project conveys the detail information regarding the project and how the project engage with the impacted communities / parties. During the Project construction phase where most of the environmental and social impact occurs, potential changes of community perception is much greater. It typically depends on how affected communities satisfy with how the project mitigate the impacts received due to the Project. A negative perception may potentially lead to low acceptance of the community toward the project.

Impact Evaluation and Significance

The development / construction of the Banyuwangi Solar PV project is focused on land owned by PTPNXII, but the construction of the transmission line has a wider impact to several villages and sub-districts. So that it can have a wider impact on public perception of the land acquisition process, impact compensation, labour recruitment and equipment mobilization. The duration of the solar panel and transmission line construction project is quite short, but the impact of land acquisition will be felt forever. Meanwhile, recruiting local workers will form a positive public perception, and may change when the workforce is demobilized at the end of the construction period. Thus, the severity of the impact is assessed as **Medium**.

Based on the survey results, 70% of respondents did not know about the Solar PV Power Plant project plan. Information about this project has not yet been widely communicated to the public. People who are aware of this project are because they have social relationships with the village government or got information from neighbours or friends.

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The majority of people (59%) have a neutral perception of the project, because they do not have a clear understanding of the project description, including a detailed explanation of the project's impacts. Around 36% of respondents had a positive perception of the project's impact. Meanwhile, there was a negative perception from some respondents who expressed concern about the loss of jobs as sugar cane labourers, the location was close to the community's settlement, the reduction of green land, the temperature around the location increased in heat and there was no socialization about the project which provide space for the community to assess and criticize the project plan. The community expect that the construction of Ground-Mounted PV can absorb quite a lot of labour for construction and maintenance so that it can have a positive impact on the surrounding community, improvement of road infrastructure, lighting, and educational assistance.

With the above notes and expectations, the level of impact sensitivity related to changes in community perception is assessed as **Medium**. Therefore, the significance of the impact is assessed as **Moderate** as presented in the **Table 6-43**.

Table 6-43 *Impact on Changes Community Perception*

Impact Description	*Changes in public perception during the pre-construction, construction, and operation stages of the project*							
Impact Nature	✔	Positive				Negative		
Impact Type	✔	Direct				Indirect		
Severity/ Magnitude		Negligible		Small	✔	Medium		Large
Sensitivity/Vulnerability		Low	✔	Medium		High		
Significance		Negligible		Minor	✔	**Moderate**		Major

Proposed Mitigation Measures

Mitigation efforts to manage the negative impacts of changes in community perception and unrest due to the project include, among others:

- The project (PT PLN Indonesia Power) discloses information regarding the project description, activity phases, duration and potential impacts as well as detailed mitigation that will be carried out, to the closest communities who will be affected;
- Conduct regular approaches and involvement of stakeholders (SEP), both from government and community leaders, village institutions, non-governmental organizations (NGOs);
- Carrying out the land acquisition process in accordance with LARAP document, applicable regulations and appropriate compensation for affected land and other assets;
- Implement safety and environmental management measures to minimize adverse impacts on society; and
- Project/PT PLN Indonesia Power has built a complaints mechanism that provides opportunities for communities and groups to easily submit complaints regarding project activities, as well as ensuring that the Project complaints mechanism is well socialized.

Residual Impact

As a result of implementation of the proposed mitigation measures, the residual negative impact of the community perception will be **Minor** significance.

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7 Climate Change Risk Assessment

This Climate Change Risk Assessment (CCRA) is performed in accordance with the requirements of the fourth version of the Equator Principles (EP4), published in September 2020. The assessment was conducted with the following objectives:

- To establish the baseline context of potential hazards related to the Project based on historical data,
- To assess future climate variables (e.g., temperature, precipitation etc.) and implications of the proposed Project on the communities and ecology in the surrounding area, and
- Provide potential adaptation measures for the Project to adapt to the projected physical impacts of climate change.

7.1 Scope of Assessment

Area of Assessment

This CCRA will cover the physical risks of the whole of the Project including the PV module, plant switchyard, TL, and additional area at Banyuwangi Station.

Time Horizons

The time horizons considered within this CCRA are the years between 2030 and 2050 with a focus on the operation phase, which is in line with the TCFD recommendation of short-to-medium-term time horizons and in consideration of the Project's life span of 25 years.

Climate-related Scenarios

The IPCC has developed four scenarios for global climate projections that relate to how the world may respond to the challenge of a changing climate, the need to continue to produce and use energy and resources, and the global GHG emissions that may occur. These scenarios incorporate diverging tendencies based on alternative economic, globalisation, and environmental pathways.

Representative Concentration Pathways (RCPs) are projections of radiative forcing, which is the change in the balance between incoming and outgoing radiation to the atmosphere caused primarily by changes in atmospheric composition. These projections will serve as the key inputs in climate modelling. Mainly, four trajectories of GHG emissions, also termed as RCPs, were adopted by the IPCC for climate change modelling and include RCP 2.6, RCP 4.5, RCP 6.0, and RCP 8.5.

This physical risk assessment looks at projected change under two future emission scenarios, RCP 4.5 and RCP 8.5. The RCP 4.5 scenario assumes that CO_2 emissions will peak in 2040 and decline afterwards, which is the most probable scenario according to the IPCC; whereas RCP8.5 assumes a worst-case, business-as-usual scenario with steadily rising carbon emissions.

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7.2 Method of Assessment

Two key stages proposed in this assessment including:

Stage 1: Screening and Scoping

This stage aims to establish the context and identify hazards as applicable to the Project. Global databases and literature reviews will be used to obtain baseline conditions, historical trends and projection data for the Project area. The output of this stage is potential risks of scope-in hazards presented in 7.3.1.3.

Stage 2: Risk Assessment

To evaluate potential risks from climate change, a risk-based approach is used. Risk rating is defined based on likelihood, which reflects the probability of occurrence of the unplanned event and consequence, which is the severity of the impact, based on the sensitivity of the resource/receptor and the magnitude of the impact as presented in **Figure 7-1**. The likelihood and consequence of an event occurring using IFC risk categorized presented in **Table 7-2**.

Table 7-1 *Risk Assessment for Climate Change*

		Likelihood of Occurrence		
		Unlikely	Possible	Likely
Consequence	Low	Minor	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Table 7-2 *Likelihood and Consequence of Risk*

Risk categorization

Risk Level	Description (Likelihood)	Description (Consequence)
Low / No Risk	There is no meaningful change in current and projected climate change impacts when compared to historic averages.	Climate-related adverse effects on revenue or operational costs are not expected, are expected to be limited or have been fully mitigated.
Medium	There are predicted changes in current and/or projected climate change impacts when compared to historic averages.	Climate-related adverse effects on revenue or operational costs are expected but are within acceptable ranges of financial impact or have been partially mitigated to become within an acceptable range.
High	There are predicted significant changes in current and/or	Climate-related adverse effects on revenue or operational costs are

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Risk categorization

Risk Level	Description (Likelihood)	Description (Consequence)
	projected climate change impacts when compared to historic averages.	expected to be significant and mitigation options should be explored.

7.3 Assessment of Impacts

7.3.1 Screening and Scoping

Indonesia is highly vulnerable to climate change impacts, including extreme events such as floods and droughts, and long-term changes from sea level rise, shifts in rainfall patterns and increasing temperature. Indonesia faces high exposure to natural hazard risks and is ranked 59th out of 181 countries by the 2019 INFORM Risk Index. Indonesia has extremely high exposure to flooding (ranked 17th), including, riverine, flash, and coastal flooding. Indonesia also has exposure to tropical cyclones and their associated hazards (ranked 23rd).

The screening of relevant climate change hazards will be assessed in this section, based on the desktop literature review.

7.3.1.1 Baseline Condition

Heat Waves and Drought, Water Availability

According to data from the World Bank [72], the Project area regularly experiences high maximum temperatures, with an average maximum of around 28.8 °C and a daily maximum temperature of 31.2 °Cover the period from 1950 to 2014. The number of days with a daily maximum temperature > 30 °C is 96.6 days per year, whereas the number of days with a daily maximum temperature > 35 °C is 0.2 days per year during this period.

Extreme heat is defined as a period of three or more days of above-average temperatures, generally defined as passing a certain threshold (for example, above the 85th percentile for average daily temperature in a year). The definition of extreme heat varies based on many different factors, such as location, weather conditions (such as temperature, humidity, and cloud cover), and the time of year.

Extreme heat is assessed using a widely accepted heat stress indicator, the Wet Bulb Globe Temperature (WBGT)[73]. The WBGT is a measure of the heat stress in direct sunlight, which takes into account temperature, humidity, wind speed, sun angle, and cloud cover (solar radiation). It differs from the heat index, which takes into consideration temperature and humidity and is calculated for shady areas. The WBGT has obvious relevance to human health, but it is also relevant to all kinds of projects and sectors, including infrastructure, as heat stress affects personnel and stakeholders, and therefore the design of buildings and infrastructure. In general, the WBGT is a relevant enough proxy to quantify the strain on physical infrastructure (energy, water,

[72] Data Catalog | Climate Change Knowledge Portal (worldbank.org)
[73]https://thinkhazard.org/static/documents/thinkhazard-methodology-report_v2_0.pdf

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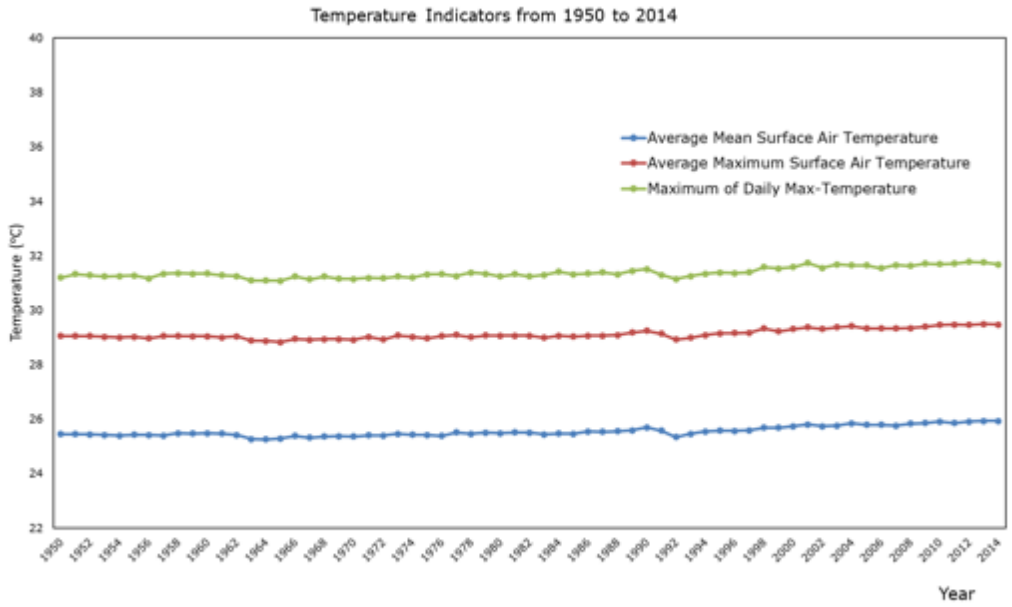
transport), such as increased demands for water and electricity, which may also affect decisions related to infrastructure[74] [75].

The extreme heat hazard was evaluated based on Worldbank datalog[76] for the project area is shown in **Figure 7-2**. Accordingly, the extreme heat hazard at the Project Area is reported to be medium under baseline conditions.

A rise in the average temperature of the project site can affect the efficiency of the equipment and cause less electricity production. A rise in the maximum temperatures of the project site can cause deterioration of the equipment efficiency and therefore decrease the electricity production efficiency and even equipment shut down as a safety measure. Increased the rate of evaporation of surface water runoff may increase the onsite water demand for operational use. In addition, increasing high temperatures and longer hot durations could lead to adverse human health effects or general amenity issues for staff.

A rise in the average temperature of the project site can affect the efficiency of the equipment and cause lesser electricity production. A rise in the maximum temperatures of the project site can cause deterioration of the equipment efficiency and therefore decrease the electricity production efficiency and even equipment shut down as a safety measure. Increased the rate of evaporation of surface water runoff may increase the onsite water demand for operational use. In addition, increasing high temperatures and longer hot durations could lead to adverse human health effects or general amenity issues for staff.

The seasonal variability map is presented in **Figure 7-3**. **Figure 7-3** indicated High variability in the Project Area. This indicates that the supply of water over different months in a year is variable. High seasonal variability may lead to further reliance on alternate water sourcing, resulting in higher costs or disruption to site operations.



[74] https://www.weather.gov/tsa/wbgt#:~:text=The%20WetBulb%20Globe%20Temperature%20(WBGT,is%20calculated%20for%20shady%20areas.
[75] https://thinkhazard.org/static/documents/thinkhazard-methodology-report_v2_0.pdf
[76] https://datacatalog.worldbank.org/search/dataset/0040194/Global-extreme-heat-hazard

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Figure 7-1 *Historical Temperature Indicators*

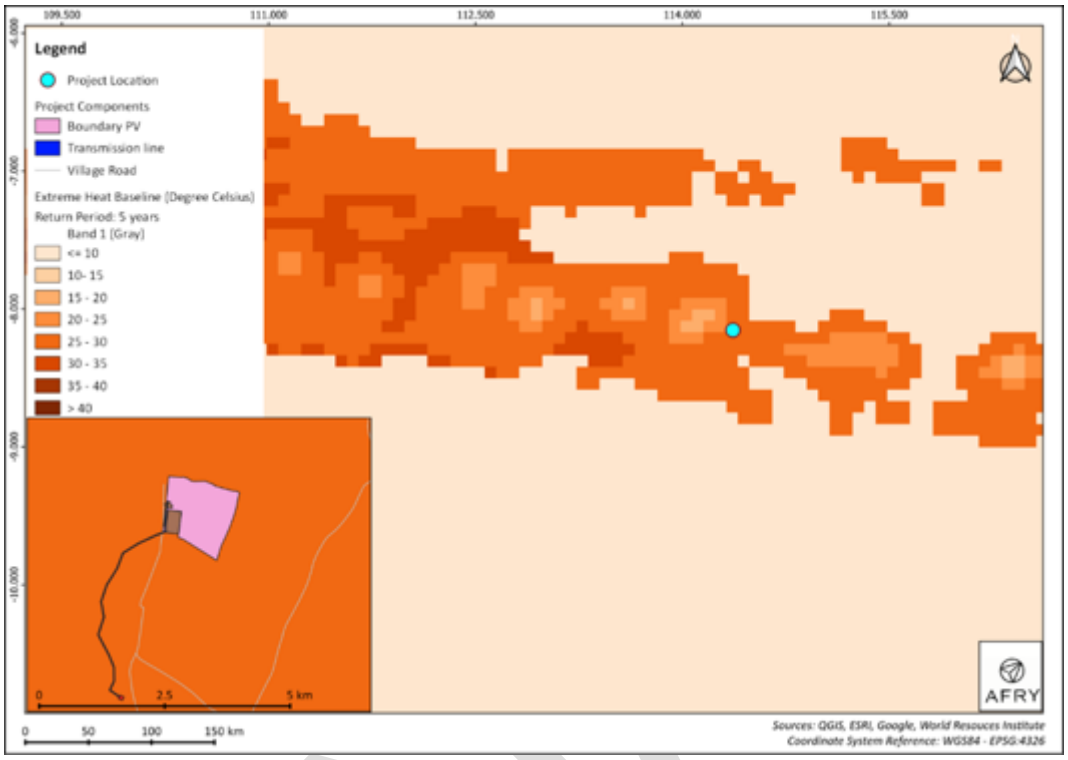


Figure 7-2 *Baseline Extreme Heat Hazard in the Project Area*

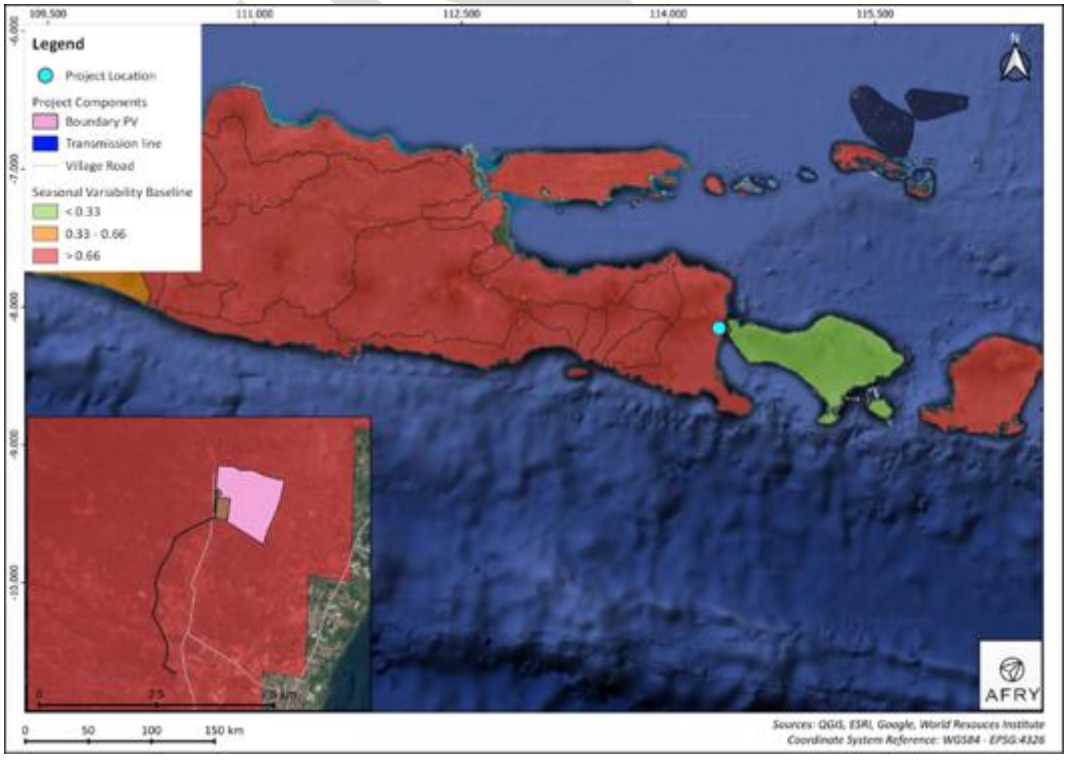


Figure 7-3 *Baseline Seasonal Variability*

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Heavy Rains, Storm and Floods

A flood can be defined as an overflow of water resulting in the submergence of drylands. Floods can be categorised as inland or coastal in nature. Inland flooding may be caused due to heavy rainfall, resulting in high run-offs leading to water accumulation in low-lying areas, or overtopping of water bodies such as rivers, streams, lakes, ponds, and tanks. Coastal flooding is a result of the ingress of the ocean or seawater via the coastal and/or estuarine systems onto open land. This could be a standalone event or could be combined with the effect of tides, surges created by storms, and an increase in the sea surface elevation. The Project is located 2 km from the coastline. Therefore, both riverine and coastal floods are considered in this assessment.

Floods can result in widespread local as well as regional inundation and impacts. They can lead to submergence; washing away and damage to infrastructure, buildings, structures, sewage systems, and power transmission services; disruption of power generation; loss of agricultural land and crops; contamination of freshwater sources; spread of water-borne diseases; and injury or loss of life.

According to data from the World Bank [77], the Project experiences high levels of rainfall, averaging over 2,168 mm/year over the period from 1950 to 2014. The highest 5-day rainfall average is 129 mm, while the highest daily rainfall is 42.9 mm. The riverine and coastal flood hazard maps developed by the WRI-Aqueduct Water Hazard Atlas[78] for a 100-year return period event (**Figure 7-4** and **Figure 7-5**, respectively) indicates inundation depths are less than 0.5 m in the Project area including all Project components and the surrounding transportation routes. However, according to section 2014.1.14, the Project area are prone to flash flood risk due to the presence of several river that crosses through the transmission line area. The several rivers are intermittent river and flow depend on wet season.

Increased rainfall may lead to overflow of the Project components and inundation of the Project area. This may result in electrical, communication and security system failures which would require repairs and temporary loss of services.

For the purpose of giving the overview of the baseline of the cyclone hazard in the Project area, cyclone tracks maps produced by NOAA, representing cyclone track maps for the storms that occurred during 1842-present, were also reviewed. The historical hurricane tracks recorded from 1842 to present show that only one tropical depression (GILLIAN 2014) has been found within a 100 km buffer from the Project location (**Figure 7-6**). In general, the Project area has less influence compared to other regions of Indonesia.

[77] Data Catalog | Climate Change Knowledge Portal (worldbank.org)
[78] WRI-Aqueduct Water Risk Atlas 3.0

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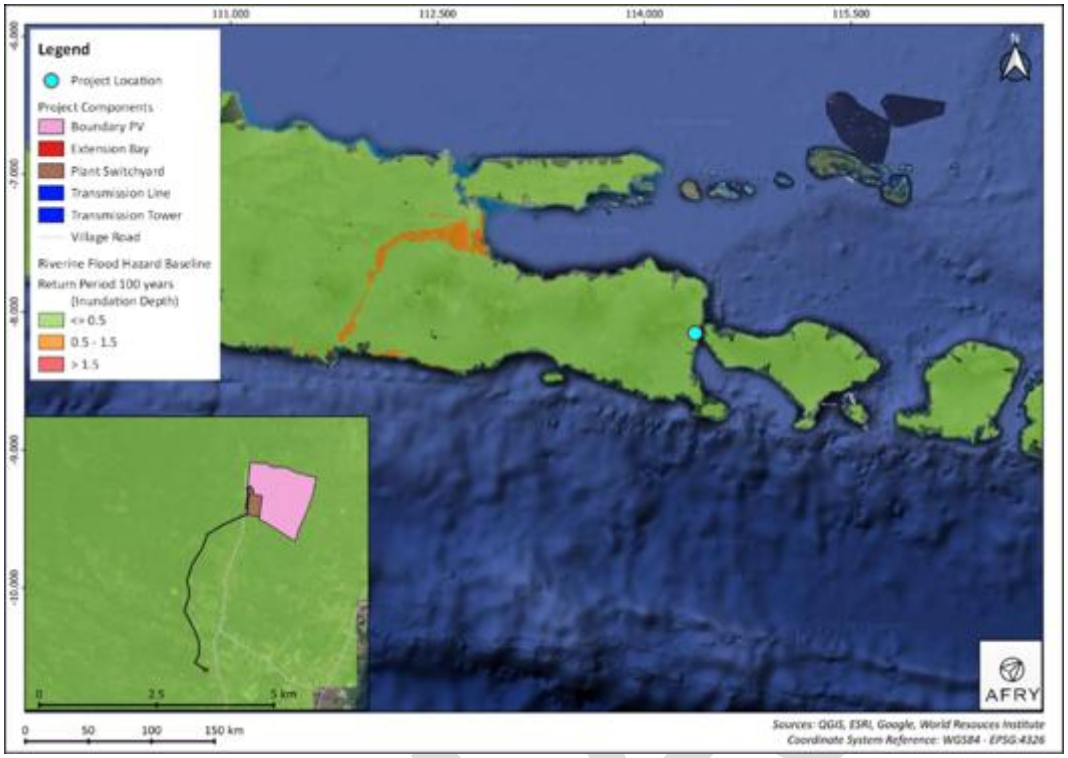


Figure 7-4 *Baseline Riverine Flood Hazard*

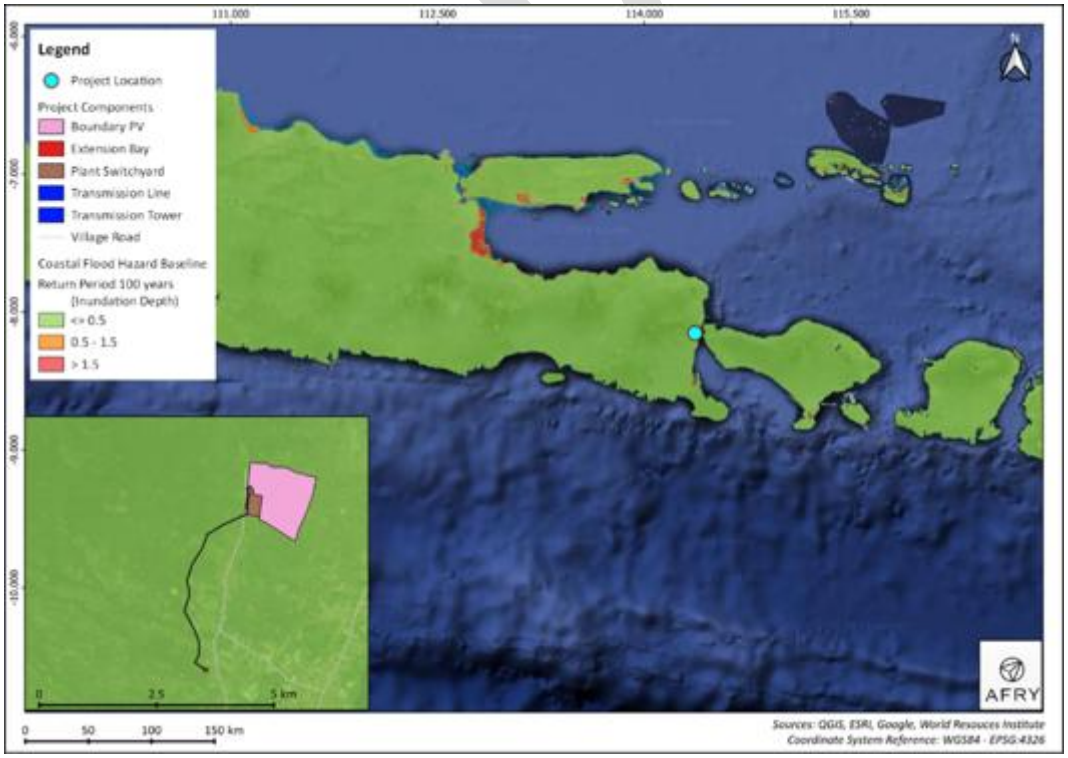


Figure 7-5 *Baseline Coastal Flood Hazard*

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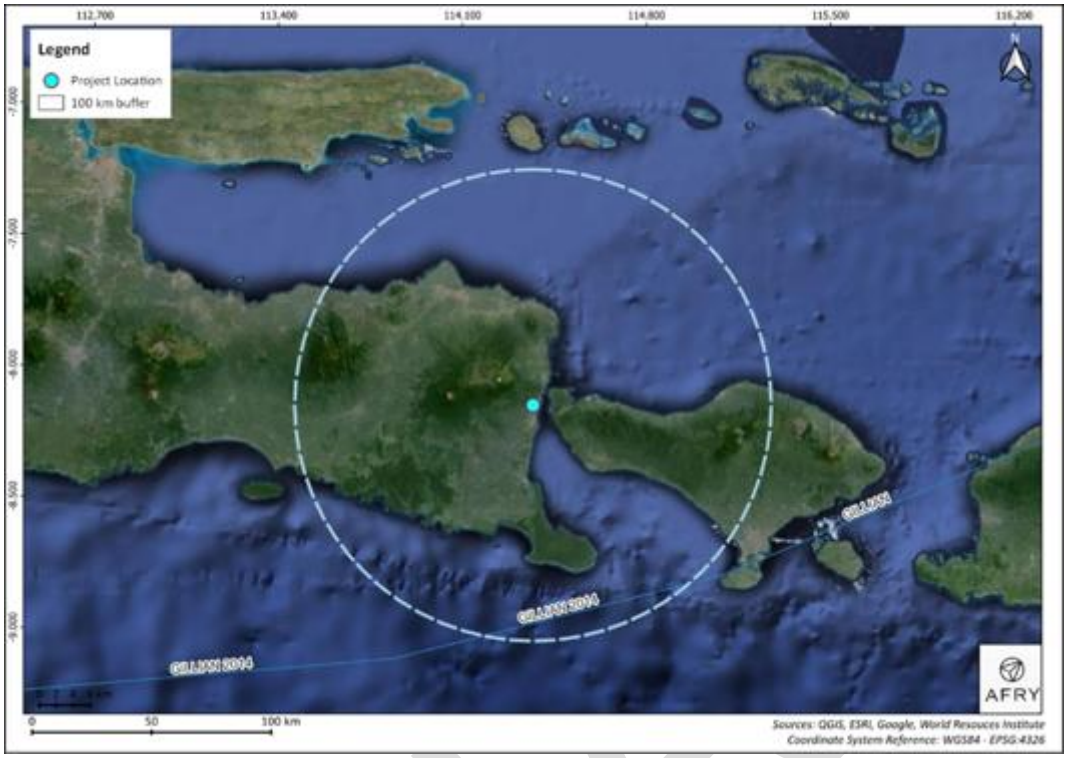


Figure 7-6 *Historical Cyclone Track Map from NOAA within a 100 km Distance from the Project Site*

7.3.1.2 Climate Change Projections

Scenarios for Changes in Temperature

The average maximum temperature, maximum daily maximum temperature, and number of hot days (Tmax > 35 °C) are derived from datasets made available on the WBG and presented in **Table 7-3**.

Under the RCP 4.5 scenario, the average maximum temperature will likely increase by 0.83 °C and 1.31 °C by 2030 and 2050, respectively. It indicated that climate change will cause an increase in maximum temperatures by 2.87% and 4.54% during 2030 and 2050, respectively. Whereas, under the RCP 8.5 scenario, the maximum temperature is projected to rise 0.89 °C and 1.72 °C, equivalent to an increase of 3.08% in 2030 and 5.96% in 2050, respectively.

In addition, the number of hot days increases by 2.66 and 6.15 days; and 3.64 and 10.67 days in 2050 with RCP 4.5 and RCP 8.5, respectively.

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Table 7-3 *Climate Change Projection for Temperature under RCP 4.5 and RCP 8.5*

Climate Index	Baseline	Projections				Percentage Changes			
		RCP 4.5		RCP 8.5		RCP 4.5		RCP 8.5	
		2030	2050	2030	2050	2030	2050	2030	2050
Average Annual Temperature (°C)	25.5	26.38	26.93	26.44	27.3	3.26	5.41	3.50	6.86
Average Maximum Temperature (°C)	28.8	29.63	30.11	29.69	30.52	2.87	4.54	3.08	5.96
Maximum of Daily Max-Temperature (°C)	31.17	32.02	32.5	32.21	33.04	2.71	4.25	3.3	5.98
Number of hot day (Tmax > 35°C) (day)	0.2	2.66	6.15	3.54	10.67	1,230	2,975	1,670	5,235

Scenarios for Changes in Precipitation

The precipitation, average largest 1-day precipitation, and largest 5-day precipitation are derived from datasets made available on the WBG and presented in **Table 7-4**.

While the annual precipitation has a slight reduction trend, the average largest 1-day and 5-day precipitation is likely to increase under both scenarios and timelines.

Table 7-4 *Climate Change Projection for Precipitation under RCP 4.5 and RCP 8.5*

Climate Index	Baseline	Projections				Percentage Changes			
		RCP 4.5		RCP 8.5		RCP 4.5		RCP 8.5	
		2030	2050	2030	2050	2030	2050	2030	2050
Precipitation (mm)	2,168	2170	2027	2167	2117	0.10	-6.52	-0.07	-2.35
Average Largest 1-Day Precipitation (mm)	42.9	46.5	45.5	49.3	47.0	8.49	6.16	14.88	9.64
Average Largest 5-Day Precipitation (mm)	129	134	134	139	138	3.94	3.95	8.10	6.73

Scenarios for Changes in Inundation

Riverine and Costal Flood hazard maps by 2030 and 2050 under climate change scenarios (RCP 4.5 and RCP 8.5) from the WRI-Aqueduct Flood Tool (GDFL-ESM2M model) were utilised to assess the future flood hazard in the Project areas. The

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inundation maps by 2030 and 2050 under the RCP 4.5 and RCP 8.5 scenarios are presented in **Figure 7-7** and **Figure 7-8**, respectively. In general, the inundation depths remain to be less than 0.5 m in the Project area including all Project components and the surrounding transportation routes at all scenarios for a 100-year return period event.

Scenarios for Changes in Water Availability

The seasonal water variability maps by 2030 and 2050 under the RCP 4.5 and RCP 8.5 scenarios are presented in **Figure 7-9**. In general, seasonal variability under all climate change scenarios and timeframes is projected to remain High.

7.3.1.3 Risk Identification

Based on the trends in climate factors, the natural hazards, and the projection scenarios at the Project site, the causes and potential risks of each hazard are presented in **Table 7-5**.

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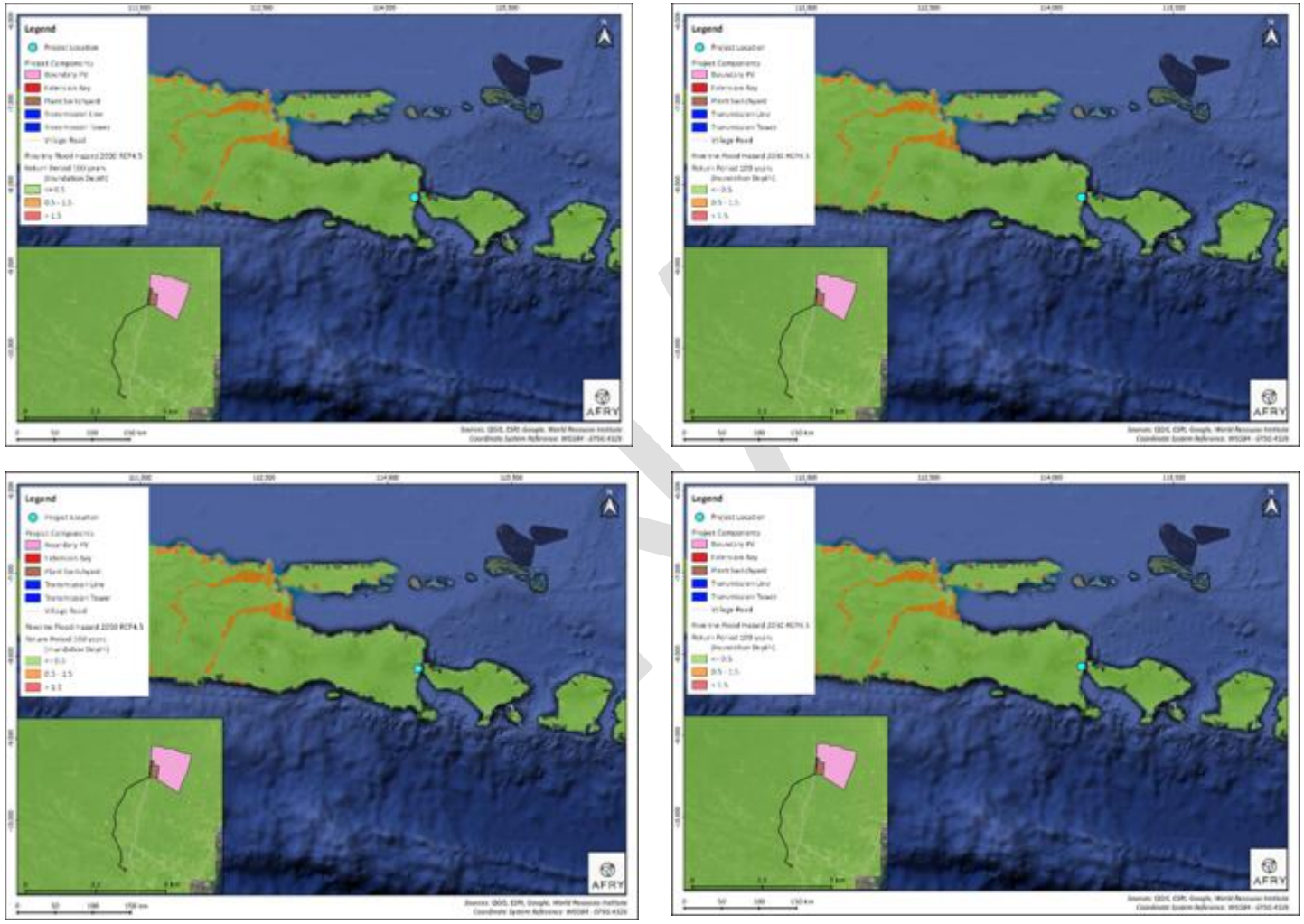


Figure 7-7 *Projection of Riverine Flood Hazard in 2030 and 2050 under RCP 4.5 and RCP 8.5 Scenarios*

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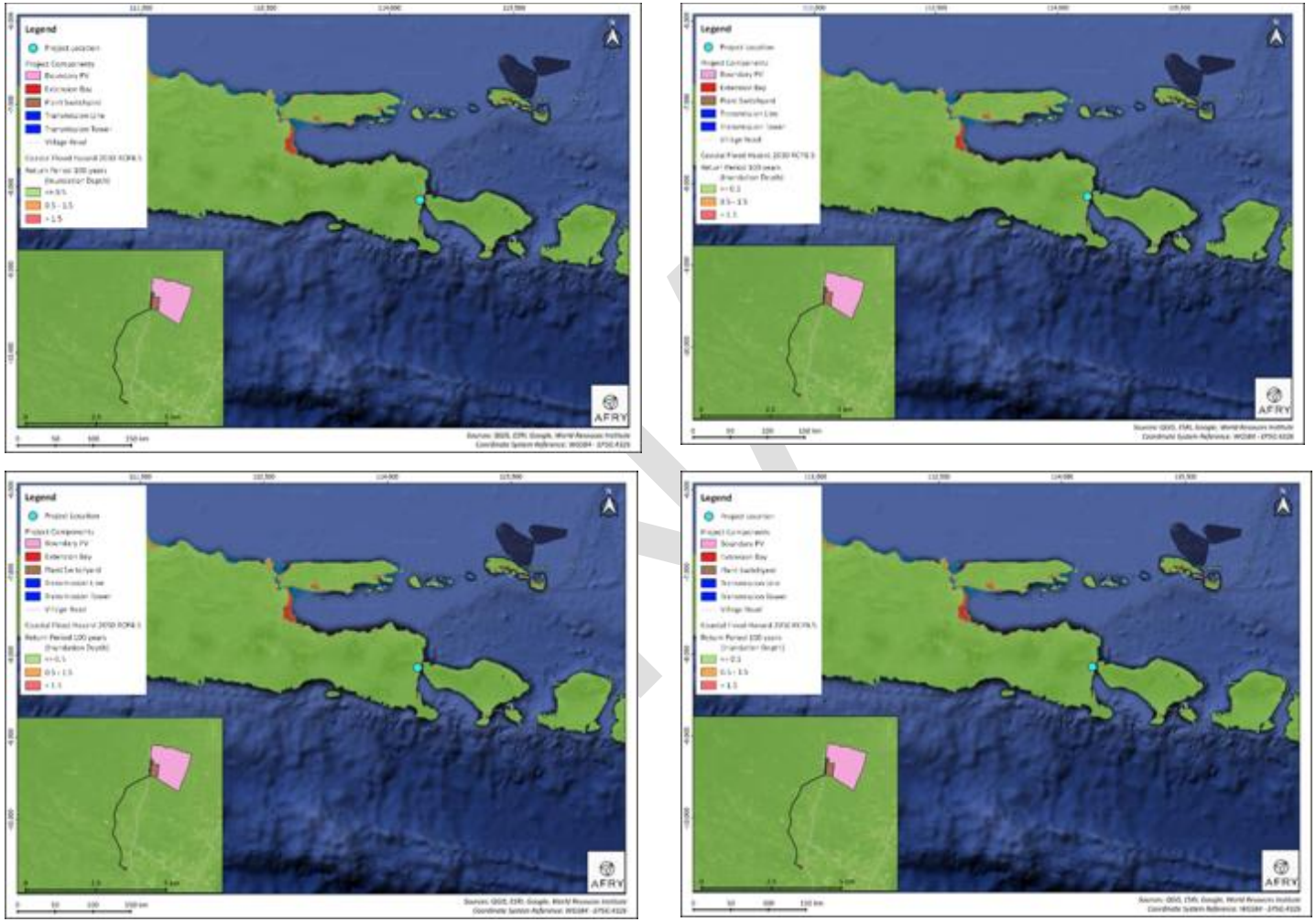


Figure 7-8 *Projection of Coastal Flood Hazard in 2030 and 2050 under RCP 4.5 and RCP 8.5 Scenarios*

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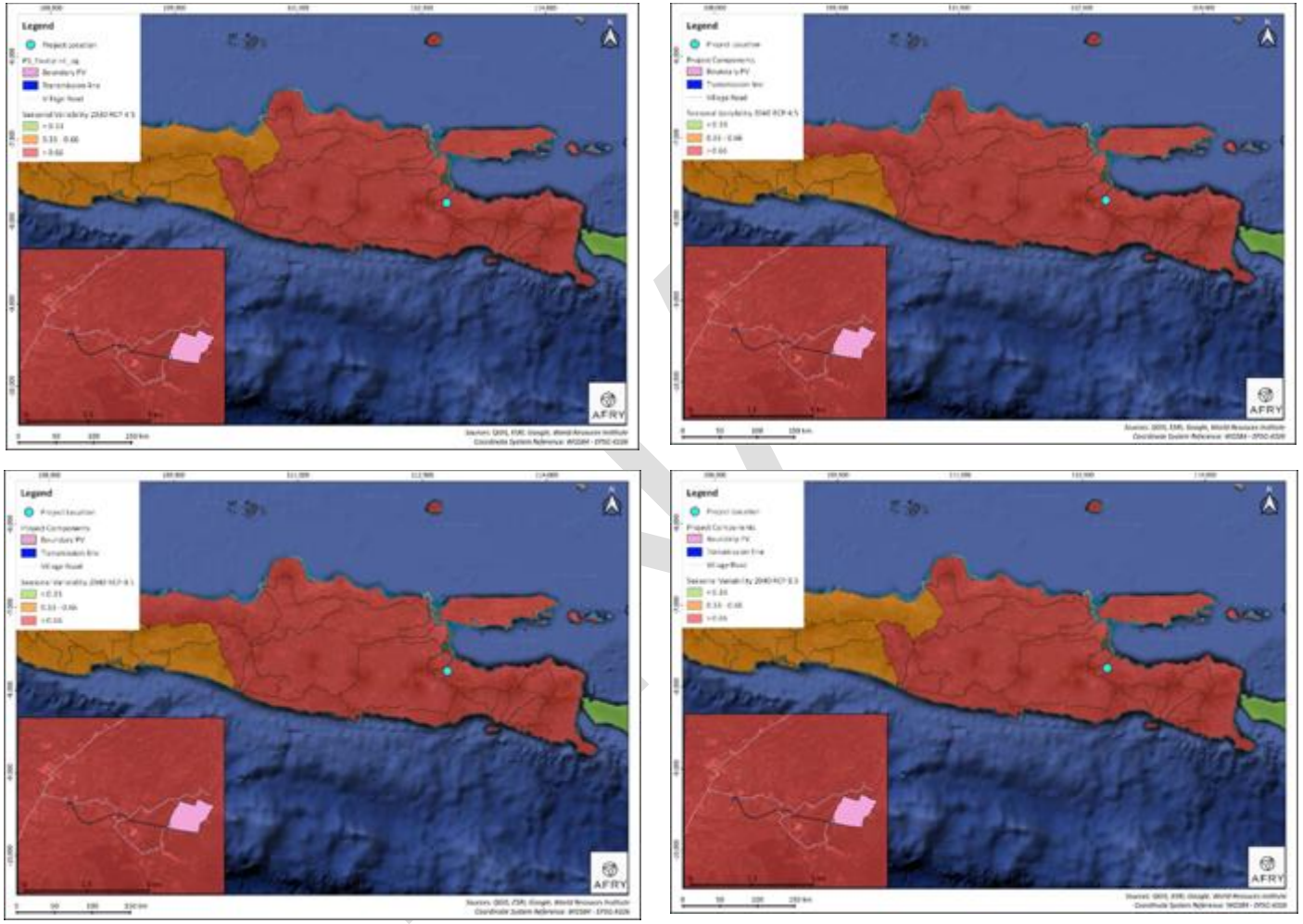


Figure 7-9 *Projection of Seasonal Water Availability in 2030 and 2040 under RCP 4.5 and RCP 8.5 Scenarios*

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Table 7-5 *Causes and Potential Risks of Climate Hazards*

Risk ID	Climate Hazard	Cause	Baseline Condition	Projections	Potential Risks
1a	Extreme Heat	• High temperature • Long dry hot days	• Highest temperature recorded was 31.1 °C • About 0.2 days having the temperature larger than 35 °C	• Average maximum temperature will increase by 0.83 and 1.31 °C by 2030 and 2050 under RCP 4.5, and 0.89 and 1.72 °C in 2030 and 2050 under RCP 8.5, respectively. • The number of hot days increases by 2.66 and 6.15 days; and 3.54 and 10.67 days in 2050 with RCP 4.5 and RCP 8.5, respectively.	• A rise in the average temperature of the project site can affect the efficiency of the equipment and cause lesser electricity production
1b	Extreme Heat				• A rise in the maximum temperatures of the project site can increase electricity demand for air-conditioning systems
1c	Extreme Heat				• Increasing high temperatures and longer hot durations could lead to adverse human health effects or general amenity issues for staff.
2a	Flooding	• High rainfall • Cyclone	• The highest annual rainfall recorded was 2,295 mm/year • The highest daily rainfall recorded was 46 mm • No storm has been found within a 100 km buffer from the Project location. In general, the Project area has less influence compared to other regions of Indonesia. • The inundation depth of the Project area including all Project components and the surrounding transportation routes is less than 0.5 m	• Annual rainfall will increase by 0.1% by 2030 but decrease by 6.52% by 2050 under RCP 4.5. The annual rainfall will decrease by 0.07% and 2.35% by 2030 and 2050 under RCP 8.5. • Maximum daily rainfall can increase to 8.49% and 14.9% by 2030 with RCP 4.5 and RCP 8.5, respectively and 6.16% and 9.64% by 2050 with RCP 4.5 and RCP 8.5, respectively. • Inundation depths remain to be less than 0.5 m in the Project area including all Project components and the surrounding transportation routes at all scenarios.	• Inundation of the Project area (e.g., substation, platforms, electricity yard) may result in electrical, communication and security system failures which would require repairs and temporary loss of services.
2b	Flooding				• In addition, flooding of external access roads may cause short-term disruption to employees, customers or neighbours.

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Risk ID	Climate Hazard	Cause	Baseline Condition	Projections	Potential Risks
3	Water Availability	• Water Seasonal Variability • Long dry hot days • Less rainfall receiving.	• The seasonal variability indicated High variability in the Project Area. This indicates that the supply of water over different months in a year is variable. • About 0.2 days having a temperature larger than 35 ^{o}C. • Average annual rainfall recorded was 2,168 mm/year.	• The seasonal variability remains High variability in the Project Area. • The number of hot days increase by 2.66 and 6.15 days; and 3.54 and 10.67 days in 2050 with RCP 4.5 and RCP 8.5, respectively. • Annual rainfall will increase by 0.1% by 2030 but decrease by 5.46 by 2050 under RCP 4.5. The annual rainfall will decrease by 0.85 and 2.24 by 2030 and 2050 under RCP 8.5.	• High seasonal variability may lead to further reliance on alternate water sourcing, resulting in higher costs or disruption to site operations. • Increased the rate of evaporation of surface water runoff may increase the onsite water demand for operational use.

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7.3.2 Risk Assessment

Six potential physical climate risks for each timeline (i.e., 2030 and 2050) and scenario (i.e., RCP 4.5 and RCP 8.5) are assessed without additional mitigation measures, and the results are summarised in **Table 7-6** for pre-risk.

7.3.3 Adaption Measures

7.3.3.1 Existing Adaptation Measures

Extreme Heat Risks

- There are currently no specific adaptation measures in place for extreme heat.

Flooding Risks

- Design early warning systems for floods to provide workers or surrounding communities with advanced warning of upcoming flood events and can be used to trigger the deployment of portable flood defences or evacuation to mitigate the impacts.

Water Availability Risks

- Explore opportunities to reuse and recycle water e.g., onsite rainwater tank collection, onsite water treatment,
- Explore alternative water sources/supplies, and
- Identify water storage infrastructure to ensure uninterrupted water supply during the dry season.

7.3.3.2 Additional Adaptation Measures

Extreme Heat Risks

- Educate machine operators to identify temperature thresholds of equipment and assess. This additional adaptation aligns with the mitigation hierarchy and can be easily implemented through O&M training. Despite its simplicity, it can bring meaningful benefits to the Project. It is therefore recommended that this measure be incorporated into the preparation of the O&M contract.
- Instances of when the equipment needs to be shut off to cool down. This additional adaptation aligns with the mitigation hierarchy and can be easily implemented through O&M training. Despite its simplicity, it can bring meaningful benefits to the Project. It is therefore recommended that this measure be incorporated into the preparation of the O&M contract.
- Make appropriate considerations while designing the cooling systems (if required), for the different assets. Based on AFRY's experience with similar infrastructure projects, equipment such as solar panels, substations, and inverters are sensitive to ambient temperature. Operating these systems beyond their rated temperature thresholds can lead to: (i) Reduced energy conversion efficiency, (ii) Accelerated equipment degradation, (iii) Increased risk of thermal shutdowns or failures. Therefore, projected increases in maximum ambient temperatures under future climate scenarios should be considered during equipment selection and, if necessary, in the design of cooling systems. As the project is still in its early stages, this adaptation measure should be incorporated into the EPC contract preparation particularly under climate resilience and extreme heat management provisions. Evidence of implementation may include the EPC contract clauses and design

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documentation or equipment specifications that reflect consideration of future maximum ambient temperatures based on climate projections.

- Set up 'Stop Work Procedures' to stop work immediately in case of any unexpected extreme heat-related impacts. This additional adaptation aligns with the mitigation hierarchy and can be easily implemented. It is recommended that this be incorporated into the preparation of the EPC and O&M contracts under the heat stress management plan below.
- Develop a heat stress management plan. This additional adaptation aligns with the mitigation hierarchy and can be easily implemented. It is recommended that this be incorporated into the preparation of the EPC and O&M contracts.
- Train workers to identify the symptoms of heat stress and first aid. This additional aligns with the mitigation hierarchy and can be easily implemented. It is recommended that this be incorporated into the preparation of the EPC and O&M contracts under the heat stress management plan for training requirements.
- Increase vegetative cover to lower outdoor temperatures. This additional adaptation aligns with the mitigation hierarchy and can be easily implemented. It is recommended that this be incorporated into the preparation of the EPC and O&M contracts when possible.
- Include precautions and management arrangements (e.g., additional breaks, Worker's resting areas, water stations, access to shaded areas, etc.) to manage the safety of site personnel in the event of extreme weather events in the Health and Safety management plan. This additional adaptation aligns with the mitigation hierarchy and can be easily implemented. It is recommended that this be incorporated into the preparation of the EPC and O&M contracts under the heat stress management plan or Health and Safety management plan.

Flooding Risks

- Proper design of the flood protection facilities for all project components to prevent flood exposure to the Project area. It is understood that the flood design is based on historical data corresponding to a 100-year return period. However, it does not account for future climate change scenarios. Our assessment indicates that, under RCP 8.5, the average maximum 1-day precipitation is projected to increase by approximately 15% by 2030. This could lead to flooding if not considered in the current design. As the project is still in its early stages, this adaptation measure should be incorporated into the EPC contract preparation particularly under climate resilience and flooding management provisions. Evidence of implementation may include the EPC contract clauses and design documentation that reflect consideration of future maximum rainfall based on climate projections.

  Categorise flooding as one of the hazards in the Emergency Response Plan. This additional adaptation aligns with the mitigation hierarchy and can be easily implemented. It is recommended that this be incorporated into the preparation of the EPC and O&M contracts under Emergency response plan.

7.3.4 Residual Risks

Assuming that the proposed adaptation measures are implemented correctly and diligently, post risks of the physical climate risks for each timeline (i.e., 2030 and 2050) and scenario (i.e., RCP 4.5 and RCP 8.5) are summarised in **Table 7-7**.

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Table 7-6 *Climate Change Risk Assessment - Pre-Risk Rating (Without Adaptation Measures)*

Risk ID	Potential Risks	Justification	Likelihood				Consequence				Risk Ranking			
			2030		2050		2030		2050		2030		2050	
			RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
1a	Reduce efficiency of the equipment and electricity production	Forecasts indicate a clear but minor increase in mean annual temperatures and maximum temperature over the life of the project (7 and 6 % in the worst-case scenario, respectively) implicating the possible likelihood. According to AFRY experience from other similar projects, the impact on the energy output is assessed to be low in comparison to the expected yield (less than 2%).	Possible	Possible	Possible	Possible	Low	Low	Low	Low	Minor	Minor	Minor	Minor
1b	Increased electricity demand for air-conditioning systems	Forecasts indicate a clear but minor increase in mean annual temperatures and maximum temperature over the life of the project (7 and 6 % in the worst-case scenario, respectively). However, the longer hot day duration in 2030 and 2050 of both Scenario RCP 4.5 and RCP 8.5 (53 times higher than baseline in the worst-case scenario) lead to financial loss for energy. The longer hot day duration in 2050 results in the likely likelihood compared to the possible likelihood of 2030. The financial loss for increased electricity is likely small with all scenarios and timelines. Therefore, the likely impact is assessed to be low.	Possible	Likely	Possible	Likely	Low	Low	Low	Low	Minor	Moderate	Minor	Moderate
1c	Increased health impacts and wellbeing of staff	Forecasts indicate a clear but minor increase in mean annual temperatures and maximum temperature over the life of the project (7 and 6 % in the worst-case scenario, respectively). However, the longer hot day duration in 2030 and 2050 of both Scenario RCP 4.5 and RCP 8.5 (53 times higher than baseline in the worst-case scenario) lead to increased health impacts and well-being of staff. The consequence of increased health impacts and the wellbeing of staff is likely low with all scenarios and timelines.	Possible	Likely	Possible	Likely	Low	Low	Low	Low	Minor	Moderate	Minor	Moderate
2a	Inundation of the Project Plant	Forecasts indicate a clear but minor increase in the average highest precipitation amount in a 1-day period over the life of the project under RCP 4.5 by both 2030 and 2050 and RCP 8.5 for 2050 (< 10%). However, an increase in the average highest precipitation amount in a 1-day period is predicted under RCP 8.5 by 2030 (15%). In addition, the inundation depths remain to be less than 0.5 m in the Project area including all Project components by 2030 and 2050 of both Scenario RCP 4.5 and RCP 8.5. The current Project area is prone to flash flood risk due to the presence of several rivers that cross through the transmission line area. Considering these indicators, the likelihood is assessed as possible for RCP 4.5 for both 2030 and 2050 and RCP 8.5 for 2050. The likelihood of 2030 under RCP 8.5 is considered likely. The consequence of inundation of the Project Plant is considered to be Moderate because the risk can cause some damage to the environment and humans.	Unlikely	Unlikely	Possible	Unlikely	Medium	Medium	Medium	Medium	Minor	Minor	Moderate	Minor
2b	Inundation of the Access Road and Project Area's Surrounding	Forecasts indicate a clear but minor increase in the average highest precipitation amount in a 1-day period over the life of the project under RCP 4.5 by both 2030 and 2050 and RCP 8.5 for 2050 (< 10%). However, an increase in the average highest precipitation amount in a 1-day period is predicted under RCP 8.5 by 2030 (15%). In addition,	Unlikely	Unlikely	Possible	Unlikely	Low	Low	Low	Low	Minor	Minor	Minor	Minor

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Risk ID	Potential Risks	Justification	Likelihood				Consequence				Risk Ranking			
			2030		2050		2030		2050		2030		2050	
			RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
		the inundation depths remain to be less than 0.5 m in the Project area including all Project components by 2030 and 2050 of both Scenario RCP 4.5 and RCP 8.5. The current Project area is prone to flash flood risk due to the presence of several rivers that cross through the transmission line area. Considering these indicators, the likelihood is assessed as possible for RCP 4.5 for both 2030 and 2050 and RCP 8.5 for 2050. The likelihood of 2030 under RCP 8.5 is considered likely. The consequence of inundation of the access road is considered to be low because it may only cause the short operation interruption.												
3	Increase the onsite water demand for operational use	Forecasts indicate the high seasonal water variability in the Project Area, indicating that the supply of water over different months in a year is variable. The longer hot day duration in 2030 and 2050 of both Scenario RCP 4.5 and RCP 8.5 (53 times higher than baseline in the worst-case scenario) is predicted. The longer hot day duration in 2050 results in the likely compared to the possible likelihood of 2030. Whereas the annual rainfall has decreased trends, especially in 2050 for both Scenario RCP 4.5 and RCP 8.5. Considering these indicators, the likelihood is assessed as possible for 2030 under both RCP 4.5 and RCP 8.5. The likelihood of 2050 under both RCP 4.5 and RCP 8.5 is considered likely. The consequence of increased onsite water demand is likely low with all scenarios and timelines.	Possible	Likely	Possible	Likely	Low	Low	Low	Low	Minor	Moderate	Minor	Moderate

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Table 7-7 *Climate Change Risk Assessment - Post-Risk Rating (With Adaptation Measures)*

Risk ID	Potential Risks	Likelihood				Consequence				Residual Risk Ranking			
		2030		2050		2030		2050		2030		2050	
		RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
1a	Reduce efficiency of the equipment and electricity production	Possible	Possible	Possible	Possible	Low	Low	Low	Low	Minor	Minor	Minor	Minor
1b	Increased electricity demand for air-conditioning systems	Possible	Possible	Possible	Possible	Low	Low	Low	Low	Minor	Minor	Minor	Minor
1c	Increased health impacts and wellbeing of staff	Possible	Possible	Possible	Possible	Low	Low	Low	Low	Minor	Minor	Minor	Minor
2a	Inundation of the Project Plant	Unlikely	Unlikely	Possible	Unlikely	Low	Low	Low	Low	Minor	Minor	Minor	Minor
2b	Inundation of the Access Road and Project Area's Surrounding	Unlikely	Unlikely	Possible	Unlikely	Low	Low	Low	Low	Minor	Minor	Minor	Minor
3	Increase the onsite water demand for operational use	Possible	Possible	Possible	Possible	Low	Low	Low	Low	Minor	Minor	Minor	Minor

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8 Cumulative Impacts Assessment

Cumulative impacts are defined within the IFC Good Practice Handbook on Cumulative Impact Assessment (CIA) as "those that result from the successive, incremental, and/or combined effects of an action, project or activity when added to other existing, planned and/or reasonably anticipated futures one". While a single activity may itself result in an insignificant impact, when combined with other impacts (significant or insignificant) in the same geographical area and occurring at the same time, it may result in a significant cumulative impact.

The potential for cumulative impacts is likely to arise where:

- Two or more projects are visible from the same locations.
- Delivery of construction materials takes place at the same time using the same roads for two or more projects.
- Two or more projects take place in nearby locations resulting in increased pressure on services.
- Two or more projects take place in nearby locations resulting in increased number of construction workers required from the local area or where larger numbers of workers are brought in from outside the local area.
- Two or more projects could interfere with migratory routes or wildlife movement.
- Two or more projects take place in the same area which both put pressure on the availability of alternative land.
- As noise and dust impacts are generally localized, only projects that are in very close proximity are considered to contribute to any cumulative effect.

The above considerations will be taken into account in developing the Banyuwangi Ground-Mounted Solar PV Project CIA.

8.1 CIA Methodology

The CIA process is defined by IFC as follow:

i. Analysing the potential impacts and risks of proposed developments in the context of potential effects of other human activities and environmental and social drivers on the chosen Valued Environmental and Social Components (VECs) over time.

ii. Proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible.

Cumulative impacts can occur when:

i. There is "spatial crowding" as a result of overlapping impacts from various actions on the same VEC in a limited area.

ii. There is "temporal crowding" as impacts on a VEC from different actions occur in a shorter period of time that the VEC needs to recover.

The process needs to identify the overall impacts which may arise from a group of projects and distinguish the contribution of each individual project. The identification and management of cumulative impacts have been limited to those effects generally

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recognized as relevant based on expected potential impacts and/or concerns of affected stakeholders.

As such, the existing and future developments located in the Project's AoI have been considered as defined at the time the impacts identification process is conducted.

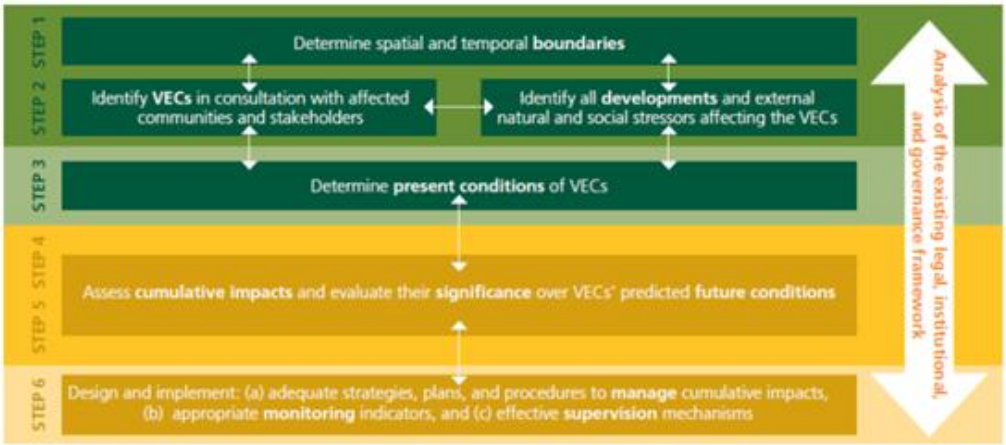
As defined by IFC, a six-step process has been undertaken for the CIA purposes:

- Step 1: Determine spatial and temporal boundaries of the analysis and identify VECs.
- Step 2: Identify other existing or planned developments within the assessment boundaries and related environmental and social drivers which would have potential impacts on the VECs.
- Step 3: Establish information on baseline status of VECs.
- Step 4: Assess cumulative impacts on VECs.
- Step 5: Assess significance of predicted cumulative impacts.

  The significance of cumulative impacts is typically evaluated against several criteria, similar to the approach used in evaluating the significance of impacts in the ESIA. The criteria include:

  - *Magnitude and Severity*: How severe or intense are the cumulative effects
  - *Duration and Reversibility*: Are the impacts short-term or long-term? Are they reversible, or do they result in permanent change?
  - *Vulnerability of the Affected Area/Population*: Are the receptors (e.g., ecosystems, communities) sensitive or vulnerable to the impacts?
  - *Extent of Impact*: How widespread are the impacts geographically and across various sectors?
- Step 6: Use the mitigation hierarchy to design management strategies and to propose mitigation and monitoring programs aimed at addressing significant cumulative impacts on selected VECs.

Figure 8-1 illustrate the general approach of Cumulative Impact Assessment process.



Source: IFC,2013

***Figure 8-1** Cumulative Impact Assessment Process*

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8.2 Identification of VEC, Spatial and Temporal Boundaries

The Spatial boundary of the CIA study is determined as to cover the Banyuwangi Solar PV Project's Area of Influence (AoI), including the main Project site, access roads, Transmission Line and its surrounding.

The Temporal boundary of the CIA study is determined as the timeframe from the beginning of land preparation activities planned to be conducted in 2024 until the end of the Banyuwangi Solar PV Power Plant Project operational lifetime (approximately 25 years from the COD). The Plant is planned to be fully operational in 2025, with the construction period lasting for approximately 6 months.

As presented in **Table 8-1**, the VECs considered for the CIA within the established Banyuwangi Solar PV Project's AoI are mainly part of ambient air quality, socio-economic conditions, cultural aspects, and community health, etc.

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Table 8-1 *Identified Specific VEC's*

Environmental /Social Aspect	Valued Environmental and Social Component- VECs
Socio-Economic	Employment opportunities for the local workforce from various developments within the Banyuwangi Project Area of Influence.
Socio, Economy, and Culture	Social investment / benefit sharing program received by the local communities.
Social Economic and Livelihood	Local community using the local land for agriculture purposes
Environmental – air quality	The quality of ambient air at Project area of influence
Environmental – noise	Noise level at Project area of influence
Environmental – Biodiversity	Avian fauna within the EAAA
Infrastructure	Road access that is used by the community from various activities at the Project location.

Information on the baseline status of the VECs identified in the CIA boundaries are presented in the Section of Environmental and Social Baseline of this ESIA report.

8.3 Other Developments and Related Environmental and Social Drivers

Other existing and foreseeable developments and associated environmental and social drivers within the spatial and temporal boundaries of this CIA study, which would have potential impacts on the VECs, have been identified based on secondary data research, baseline study findings and outcomes of stakeholder's interviews.

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The existing and future developments identified within the CIA boundaries are provided in the following **Table 8-2.**

Table 8-2 *Identified developments within the CIA boundaries.*

Other Project Development	Development Description	Distance from the Banyuwangi Project Site	Project Phase
State-Owned Plantation managed under the PTPN XII	The Wangkal Plantation with the size of approximately 182 Hectares located in Kalipuro Sub-District, Banyuwangi Regency owned and managed by PTPN XII.	The location for the Banyuwangi Solar PV Power Plant Project, switchyard area is part of the Wangkal Plantation.	Existing operational and production phase
PT INKA Wokshop Industri Karata Api (INKA) - Indonesia Train Industry Workshop	Founded on 18 May 1981, PT INKA Workshop Banyuwangi is the first integrated manufacturer in Southeast Asia.	The PT INKA Workshop Located in Ketapang Village, Kalipuro Sub-District. Approximately 500 – 700m from the area intended for the Solar PV panels area.	Operational
• Trans-Java Toll Road between Probolinggo – Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road	• The toll to connect Kraksaan, Probolinggo to Ketapang, Banyuwangi, East Java. • Expansion of the inner ring road and outer ring road of Ketapang, in Kalipuro Sub-district	Toll road entry and exit is in the Ketapang Village, Kalipuro Sub-district.	Construction phase (estimate completion of toll road – end of 2024)
Tanjung Wangi Port transformation	The collecting port becomes the main port to support the development of container ports the container and general cargo (general goods) ports.	Approximately 4km	Development phase
Development of electric power transmission and substation	• Development of the Extra High Voltage Overhead (SUTET) transmission network in the form of the development of the 500 KV SUTET Java – Bali crossing transmission network. • Development of the 150 KV SUTT transmission network. • Development of PLN substation	Kalipuro and Giri Sub-districts	Development phase

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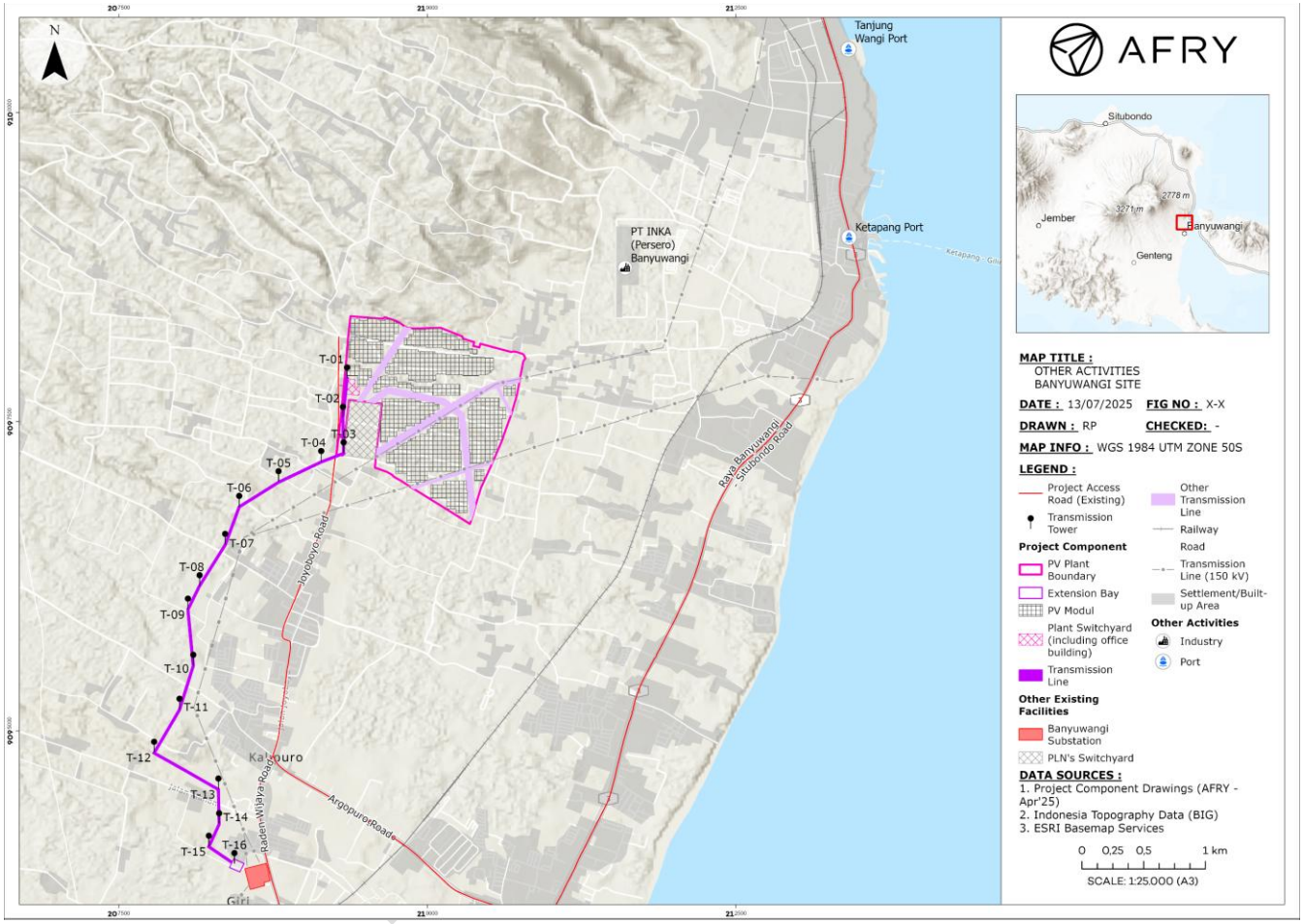


Figure 8-2 *Other activities surrounding Project Area*

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8.4 Assessment of Cumulative Impacts on VECs

The cumulative impact potential on the VECs has been evaluated considering the projects affecting the VECs along with the Banyuwangi Solar PV Project. If a VEC is found likely to be affected by one or more Projects in addition to the Banyuwangi Project, a potential cumulative impact on that VEC has been recognized and presented in **Table 8-3**, Considering the existing/operational and future developments identified in the CIA boundaries, potential for cumulative impacts is anticipated on socio-economic, cultural heritage, community health and ambient air quality, etc.

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Table 8-3 *Potential cumulative impact of the identified existing and future developments on the VECs*

Environmental / Social Aspect	Specific VECs	Existing / Future Projects						Potential for Cumulative Impact
		Project Under Assessment (Banyuwangi Solar PV)	State-Owned Plantation managed under the PTPN XII	PT INKA Train Industry Workshop	• Trans-Java Toll Road between Probolinggo–Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road	Tanjung Wangi Port transformation	Development of electric power transmission and substation	
Social-Economic	Employment opportunities / absorption of local labour or workforce	✔	✔	✔	✔		✔	**Yes** – increased the potential recruitment of local workforce. It is understood that to support the operational of PTPNXII Plantation (harvesting process) and operational of PT INKA Train Industry Workshop may source their labourers from the local community with specific skill requirement. Also, within the proximity of the Banyuwangi Solar PV project there are ongoing development of

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Environmental / Social Aspect	Specific VECs	Existing / Future Projects: Project Under Assessment (Banyuwangi Solar PV)	State-Owned Plantation managed under the PTPN XII	PT INKA Train Industry Workshop	• Trans-Java Toll Road between Probolinggo–Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road	Tanjung Wangi Port transformation	Development of electric power transmission and substation	Potential for Cumulative Impact
								Trans-Java Toll Road and the development of electric power transmission and substation. The construction of both projects is likely to require involvement of local workforce. During the construction phase of the Banyuwangi Solar PV Project, it may add significant opportunities for employment to the local workforce.
Socio, Economy, and Culture	Social investment / benefit sharing program	✔	✔	✔	✔		✔	**Yes –** During the construction of the Banyuwangi Solar PV Project, it is

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Existing / Future Projects								
Environmental / Social Aspect	**Specific VECs**	**Project Under Assessment (Banyuwangi Solar PV)**	**State-Owned Plantation managed under the PTPN XII**	**PT INKA Train Industry Workshop**	**• Trans-Java Toll Road between Probolinggo–Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road**	**Tanjung Wangi Port transformation**	**Development of electric power transmission and substation**	**Potential for Cumulative Impact**
	received by the local communities.							recommended for the Project to implement a social investment/benefit sharing program that will benefit the local community neighbouring to the Project. This will potentially add to the existing benefit sharing program implemented/delivered by the Plantation company and PT INKA. During the construction of the Toll Road and the electric transmission and power station, typically the Project will

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Environmental / Social Aspect	Specific VECs	Existing / Future Projects: Project Under Assessment (Banyuwangi Solar PV)	State-Owned Plantation managed under the PTPN XII	PT INKA Train Industry Workshop	• Trans-Java Toll Road between Probolinggo–Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road	Tanjung Wangi Port transformation	Development of electric power transmission and substation	Potential for Cumulative Impact
								also implement benefit sharing program as part of the impact mitigation measures.
Social-Economic and Livelihood	Local community use the local land for agriculture purposes	✔			✔		✔	**Yes** – increased potential for pressure on the availability of alternative land. The development of Trans-Java Toll Road and the electric power transmission and substation are likely to require acquisition of land own individually by the local communities.
Environmental	Ambient air quality	✔			✔		✔	**Yes** – potentially decrease the ambient air quality.

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Existing / Future Projects								
Environmental / Social Aspect	**Specific VECs**	**Project Under Assessment (Banyuwangi Solar PV)**	**State-Owned Plantation managed under the PTPN XII**	**PT INKA Train Industry Workshop**	**• Trans-Java Toll Road between Probolinggo–Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road**	**Tanjung Wangi Port transformation**	**Development of electric power transmission and substation**	**Potential for Cumulative Impact**
								Trans Java toll road and development of electric power transmission and substation will involve mobilization of equipment and material which will potentially introduce dust and gas emission from it.
Environmental	Noise	✔			✔			**Yes** – potentially increase noise level. Trans-Java Toll Road will potentially generate noise from during the construction phase. Meanwhile, the rest of the Projects are not expected to generate

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Environmental / Social Aspect	Specific VECs	Existing / Future Projects: Project Under Assessment (Banyuwangi Solar PV)	State-Owned Plantation managed under the PTPN XII	PT INKA Train Industry Workshop	• Trans-Java Toll Road between Probolinggo–Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road	Tanjung Wangi Port transformation	Development of electric power transmission and substation	Potential for Cumulative Impact
								high noise level during construction.
Biodiversity	Avian fauna	✔					✔	**Yes –** Potential increase in avian fauna mortality within the Ecologically Appropriate Area of Analysis (EAAA). The proposed 500 kV Java–Bali overhead transmission line (SUTET), the proposed 150 kV transmission line, together with the existing 150 kV transmission line within the EAAA, have the potential to generate cumulative impacts on

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Environmental / Social Aspect	Specific VECs	Existing / Future Projects: Project Under Assessment (Banyuwangi Solar PV)	State-Owned Plantation managed under the PTPN XII	PT INKA Train Industry Workshop	• Trans-Java Toll Road between Probolinggo–Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road	Tanjung Wangi Port transformation	Development of electric power transmission and substation	Potential for Cumulative Impact
								avian fauna through the collision and electrocution.
Infrastructure	Access road	✔	✔		✔		✔	**Yes –** increase the potential pressure on traffic volume around the Project Area of Influence. It is very likely that those projects will use the same road for mobilization and commuting and introduce additional traffic volume to the road.

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8.5 Assessment of Significance of Predicted Cumulative Impact and Mitigation Measures

Based on the approaches suggested by IFC and the CIA limitations, the significance of cumulative impacts has been evaluated not in terms of the amount of change, but in terms of the potential resulting cumulative effects to the VECs assessed.

The results of the cumulative impact assessment are mainly to be linked to potential physical interference between the considered developments, give the proximity of the development's footprints. It is worth noting that cumulative impacts are mostly expected during the construction phase of the Project, as during the operational phase of the Banyuwangi Solar PV Project only routine maintenance activities will be undertaken.

Since cumulative impacts typically result from the actions of multiple developments, the responsibility for their management is collective, requiring individual actions to eliminate or minimise individual development's contributions. As described under Section 8 of this ESIA, project specific on-site mitigations and monitoring programmes will be implemented in order to minimise potential impacts of the Project on the environmental and social receptors including the specific VECs identified by the CIA.

Table 8-4 presents the Significance of cumulative impact and the proposed mitigation measures.

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Table 8-4 *Significance of Cumulative Impacts and Mitigation Measures*

Environmental / Social Aspect	Specific VECs	Existing / Future Projects: Project Under Assessment (Banyuwangi Solar PV)	State-Owned Plantation managed under the PTPN XII	PT INKA Train Industry Workshop	• Trans-Java Toll Road between Probolinggo – Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road	Tanjung Wangi Port transformation	Development of electric power transmission and substation	Significance of Potential Cumulative Impact	Mitigation Measures
Social-Economic	Employment opportunities / absorption of local labour or workforce	✔	✔	✔	✔		✔	**Minor to Moderate** It is expected that local employment opportunity/recruitment provided by the Project during the construction phase will add to the existing employment opportunities from the existing plantation company (PTPN XII) and PT INKA Train Industry Workshop. It is expected that both existing companies mentioned above occasionally requires a local labourer to support their operational and maintenance process. It is expected the requirement of local labour workforce in the same timeframe as the construction of the Banyuwangi Solar PV Power Plant Project.	Refer to the mitigation and monitoring measures for the impact no **SIA04 in 6.2.5.2** of this ESIA report.
Socio, Economy, and Culture	Social investment / benefit sharing program received by	✔	✔	✔	✔		✔	**Positive Cumulative Impact -** The presence of Banyuwangi Solar PV Project and the likely of the Project to implement its social benefit sharing program will likely add to the social investment program	N/A

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Environmental / Social Aspect	Specific VECs	Existing / Future Projects: Project Under Assessment (Banyuwangi Solar PV)	State-Owned Plantation managed under the PTPN XII	PT INKA Train Industry Workshop	• Trans-Java Toll Road between Probolinggo – Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road	Tanjung Wangi Port transformation	Development of electric power transmission and substation	Significance of Potential Cumulative Impact	Mitigation Measures
	the local communities.							implemented by the existing business activities in the area (Plantation company and PT INKA). While the development of the Trans Java Toll Road and the electric power transmission and substation is likely to have the similar timeframe of the Banyuwangi Project construction, therefore it is likely both Project will also deliver/implement social investment program to the local communities.	
Social-Economic and Livelihood	Local community using the local land for agriculture purposes	✔			✔		✔	**Moderate -** The development of Banyuwangi Solar PV Project requires acquisition of land owned by the local community, particularly for the Transmission Tower footing. While the development of the Trans-Java Toll Road and development of electric power transmission and substation may also require acquiring land from the local community at the same time frame of the Banyuwangi Project development. Generally, the affected landowners will be compensated for the loss of assets, however it may be	Refer to the mitigation and monitoring measures for the impact no **SIA01** in **6.2.3.1** of this ESIA report.

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Environmental / Social Aspect	Specific VECs	Existing / Future Projects: Project Under Assessment (Banyuwangi Solar PV)	State-Owned Plantation managed under the PTPN XII	PT INKA Train Industry Workshop	• Trans-Java Toll Road between Probolinggo – Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road	Tanjung Wangi Port transformation	Development of electric power transmission and substation	Significance of Potential Cumulative Impact	Mitigation Measures
								difficult to find replacement land within the Project area for agriculture activities.	
Environmental	Ambient air quality	✔			✔		✔	**Minor to Moderate** It is expected that the mobilization phase of Banyuwangi ground-mounted solar PV will generate dust and other exhaust gas from fuel combustion. And likely the activity will occur at the same timeframe with Trans Java Toll Road construction and development of electric power transmission and submission which will generate the similar emission and dust.	Refer to the mitigation and monitoring measures for the impact no **EIA04** and **EIA05** in **Table 9-1** of this ESIA report.
Environmental	Noise	✔			✔			**Minor to Moderate** Noise is expected to be generated during construction phase of Banyuwangi ground-mounted Solar PV mainly during mobilization. That activity is likely to be occurred at the same timeframe of Trans Java Toll Road.	Refer to the mitigation and monitoring measures for the impact no **EIA06** and **EIA07** in **Table 9-1** of this ESIA report.
Biodiversity	Avian fauna	✔					✔	**Moderate** The presence of multiple transmission line corridors may increase the overall risk of bird mortality through collision with overhead conductors	Refer to the mitigation and monitoring measures for the impact no **EIA17** in **Table 9-1** of this ESIA report.

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Environmental / Social Aspect	Specific VECs	Existing / Future Projects: Project Under Assessment (Banyuwangi Solar PV)	State-Owned Plantation managed under the PTPN XII	PT INKA Train Industry Workshop	• Trans-Java Toll Road between Probolinggo – Banyuwangi • Expansion of Banyuwangi Regency inner and outer ring road	Tanjung Wangi Port transformation	Development of electric power transmission and substation	Significance of Potential Cumulative Impact	Mitigation Measures
								(particularly earth/shield wires) and, to a lesser extent, electrocution where birds perch on or interact with transmission structures.	
Infrastructure	Access road	✔	✔		✔		✔	**Moderate** The introduction of ground-mounted solar PV, mainly during the mobilization phase will potentially increase the traffic volume around the Project area of influence as the road that will be used for mobilization is the same road that the existing projects are using, and they will also be performed at the same timeframe. Unless for the Tanjung Wangi Port transformation, no information is identified on the timeframe of this Project.	Refer to the mitigation and monitoring measures for the impact no **EIA11 in Table 9-1** of this ESIA report**.**

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9 Environmental and Social Management Plan

9.1 Environmental and Social Management Requirements

The ESIA process has identified the key environmental and social issues, impacts and risks associated with the Banyuwangi Ground Mounted Solar PV Power Plant Project requiring the implementation of a wide range of mitigation measures. The necessary actions required to manage these issues, impacts and risks are presented in this Environmental and Social Management Plan (ESMP); these include identification of all Project commitments, mitigation measures that have been identified from the impact assessment, and other best practice measures designed to avoid, minimize, or reduce negative impacts and enhance positive impacts.

The objectives of an Environmental and Social Management Plan (ESMP) are to:

- Identify the set of response to potentially adverse impacts.
- Define the responsibilities for implementation and monitoring.
- Determine requirements for ensuring that mitigation and management measures are implemented effectively and in a timely manner; and
- Describe the means for meeting those requirements.

The purpose of this Chapter is to demonstrate how the mitigation commitments made through the impact assessment process will be put into practice, monitored, and upheld. This ESMP Chapter provides information and instructions on how Environmental and Social commitments of the Banyuwangi Ground Mounted Solar PV Project will be managed from pre-construction through the construction and operation phases.

9.2 Environmental Management and Monitoring Plan

The mitigation and management measures take place throughout the Project lifetime, from pre-construction, construction, operation through decommissioning. In addition, there are common mitigation and monitoring requirements that apply to all phases of the Project.

The mitigation and monitoring measures specific to the environmental impact assessment conducted for the Banyuwangi Ground mounted Solar PV Power Plant Project ESIA are detailed in **Table 9-1**.

As earlier discussed on pre-ESIA, an electromagnetic field baseline survey will not be conducted, and its impact assessment is excluded from Section 6 of this ESIA document. However, a monitoring plan has been established, as detailed in **Table 9-1**.

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Table 9-1 *Proposed Environmental Impact Mitigation and Monitoring Plan*

Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
Construction	Civil Works (including access road, drainage, TL tower footing and right of way (RoW); Construction of Groundmounted PV and Supporting Facilities)	**EIA01:** Impact on Surface Water Quality due to Erosion, Sedimentation and Soil Disturbance	• The Project shall install construction boundary to avoid unnecessary clearing beyond the boundary. • Erosion management plan shall be prepared before the construction phase commenced; it includes but not limited to the construction of temporary drainage temporary selected sediment ponds and soil & vegetation disposal prior to commencement of any earthwork activities and designated disposal sites. • Ensure cleared debris is promptly removed from the site to prevent obstruction of drainage, reduce pest risk, and minimize potential impacts on soil quality. • Minimize vegetation clearing by restricting land disturbance to only areas essential for construction and preserve natural vegetation buffers, particularly near slopes and water bodies. • Conduct an inventory of other wood-producing plants before clearing. Where feasible, retain mature or healthy trees at buffer zones or transplant them to suitable nearby areas. Minimize run of water carrying soil from the tree uprooting for replanting that might result sedimentation in the nearby river. • Strip and store topsoil separately for future site rehabilitation or landscaping and protect topsoil stockpiles with tarpaulin or grass cover to avoid erosion. • Establishing temporary or permanent vegetation on disturbed areas to stabilize the soil and minimize erosion. • Material Handling Plan shall be developed to the safe, efficient, and environmentally responsible handling, storage, transport, and installation of materials required for the ground-mounted solar PV and transmission line project. ▪ Establish an effective grievance mechanism to document and address complaints related to spoil spillage, transmission line tower footing access, and right-of-way issues affecting nearby agricultural properties.	EPC Contractor and EHSS Department of the SPC.	Prior to Land Preparation and Civil Works (including access road, drainage, TL tower footing and right of way; Construction of Groundmounted PV and Supporting Facilities)	▪ Erosion (Estimated soil loss, rainfall intensity, slope stability, soil erodibility and vegetation cover) ▪ TSS concentration meets quality standards stipulated in GR 22 of 2021 ▪ Effectiveness implementation of temporary drainage, and temporary selected sediment ponds/soil disposal	EPC Contractor and EHSS Department of the SPC to assign a dedicated team to conduct regular monitoring; Independent third party.	Once every 3 months along with monitoring the land preparation, civil works and construction of Ground-mounted PV and supporting facilities activities.
Construction and Operation	Construction Phase including Operation of Basecamp.	**EIA02:** Impact on Surface Water Quality.	• Erosion and drainage management plan shall be prepared before the construction phase commenced. Design and implement temporary surface drainage systems to control runoff, prevent ponding and uncontrolled flow across exposed soil surfaces. Sediment pond design with	EPC Contractor and EHSS Department of the SPC.	During Wastewater Discharge during Construction Phase including	▪ Discharge point of domestic wastewater, parameters to be monitored are based on MoEF Reg.No.68 Year 2016 on Domestic Wastewater Standard.	EPC Contractor and EHSS Department of the SPC to assign a	Once every 3 months along with monitoring the construction and operation basecamp activities.

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			adequate volume to accommodate peak flow during rain events and allow sufficient detention time for sediment to settle. • Conduct land clearing and earthworks in phases to reduce exposed soil area. • Designated spoil disposal area to Identify and use clearly designated spoil disposal sites with appropriate containment. • Proper design of the wastewater treatment plant complies with applicable standards where the septic tank process and size align with the expected volume and characteristic of wastewater, and installed at a safe distance from water sources. • Vehicle washing will be covered in the wastewater management plan, which will specify the treatment methods and discharge procedures to ensure that wastewater from vehicle and equipment washing areas is directed to the sediment pond. • Wastewater management plan, shall be developed to ensure all wastewater is properly treated before being discharged into water bodies, including an emergency response procedure if any case the wastewater treatment is not working. ▪ Secondary containment shall be ready at working area where oil or chemicals are handled to effectively manage any potential spills, leaks and others unplanned incident.		Operation of Basecamp.	▪ Sampling results will be analysed and compared with quality standards based on MoEF Reg.No.68 Year 2016 on Domestic Wastewater Standard and and EHS Guideline for Sanitary Wastewater Discharge (2007)	dedicated team to conduct regular monitoring; Independent third party.	
Operation	Ground-mounted PV Operation and Maintenance	**EIA03:** Impact on Surface Water Quality.	▪ De-ionized water with a total hardness of less than 75 ppm, as recommended by the manufacturer and required by the Company, shall be used by the third party for cleaning ground-mounted PV module. ▪ If de-ionized water is not available, rainwater or tap water shall be used as an alternative. ▪ No chemical detergents or cleaning agents will be used, especially since the runoff is discharging directly into the surrounding soil/drainage.	PT PLN Indonesia Power, EHSS Department (environmental safeguard specialist) of SPC.	During Wastewater Discharge from Solar Modules Cleaning	▪ Surface water quality at baseline water quality sampling point ▪ Sampling results will be analysed and compared with quality standards based on GR 22 of 2021.	EHSS Department of the SPC to assign a dedicated team to conduct regular monitoring; Independent third party.	Once every 3 months along with monitoring the Ground-mounted PV Operation and Maintenance activities.
Construction and Operation	Mobilization of Equipment, Materials and Workers during Construction and Operation	**EIA04:** Impact to Ambient Air Quality.	• Develop Air Quality Management Plan which include providing a tire washing facility for trucks/heavy vehicles that leave construction site, conduct dust/particulate matter suppression and maintenance and regular inspection on construction machinery; • Conduct maintenance and regular inspection on construction machinery;	EPC Contractor and EHSS Department of the SPC.	During Mobilization of Equipment, Materials and Workers.	▪ Ambient air sampling at baseline air quality sampling points ▪ Data will be analysed quantitatively and compared with ambient air quality standards based on GR 22 of 2021 and Air	EPC Contractor and EHSS Department of the SPC to assign a dedicated team to	Once every 3 months along with monitoring the Civil Works and Construction of Ground-mounted PV and Supporting Facilities activities.

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			• Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits; • Ensure all vehicles and equipment switch off their engines when stationary; • Avoid long queueing of vehicles outside the site for long duration by proper planning of receipt or dispatch of materials. If materials are delivered in bulk in several shipments, then prepare a Construction Logistics Plan to manage the sustainable delivery of goods and materials. ▪ Carry out emission test for genset during commissioning stage although the genset is used as power back up to collect baseline data on the emission quality of the genset. Maintenance of genset and data record on the genset running hours to follow Minister of Environment and Forestry regulation No. 11 of 2021.			Quality Guidelines Global Update (WHO, 2005).	conduct regular monitoring; Independent third party.	
Construction	Civil Works and Construction of Transmission Line, Groundmounted PV and Supporting Facilities.	**EIA05:** Impact on Ambient Air Quality.	• Develop Air Quality Management Plan which include providing a tire washing facility for trucks/heavy vehicles that leave construction site, conduct dust/particulate matter suppression (water spraying on road) and maintenance and regular inspection on construction machinery. • The Project shall install construction boundary to avoid unnecessary clearing beyond the boundary. • Speed of vehicles on site will be limited to 10-15 km/hr which will help in minimising fugitive dust emissions due to vehicular movement. • Exhaust emissions from equipment operating within the site will be controlled by the contractor by ensuring that emissions are minimized through regular servicing of machinery to meet the relevant emission standards. • Manage material transfer activities to minimize the fugitive dust arising from unloading/loading. • Ensure covering of soil stockpile on site (if any) with tarpaulins. • Conduct maintenance and regular inspection on construction machinery. ▪ Re-vegetate earthworks and exposed areas/soil stockpiles shall be carried out as soon as practicable to stabilise surfaces. Once work in a specific area is completed, the soil shall be reinstated immediately before moving on to other areas. This approach will help to reduce dust emission.	EPC Contractor and EHSS Department of the SPC.	During Land Clearing, Civil Works and Construction of Groundmounted PV and Supporting Facilities.	▪ Ambient air sampling at baseline air quality sampling points. ▪ Data will be analysed quantitatively and compared with ambient air quality standards based on GR 22 of 2021 and Air Quality Guidelines Global Update (WHO, 2005)	EPC Contractor and EHSS Department of the SPC to assign a dedicated team to conduct regular monitoring; Independent third party.	Once every 3 months along with monitoring the Civil Works and Construction of Groundmounted PV and Supporting Facilities activities.

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
Construction	Civil Works and Construction of Transmission Line, Groundmounted PV and Supporting Facilities.	**EIA06:** Impact from Noise Level and Vibration.	• Development and implementation of Noise and Vibration Management Plan; • Limit exposure of workers handling noisy and vibrating equipment; • Construction activities shall be limited to daylight hours although scheduling will require overnight operations on occasion; • Plan the layout of the site by considering using materials and other large structural equipment or even stockpile to act as noise barriers; • Use of hoarding/temporary noise barriers or permanent noise barriers where noisy activities are to be installed close to sensitive receivers; and ▪ Develop an effective grievance mechanism to record and respond to noise and vibration complaints.	EPC Contractor and EHSS Department of the SPC.	During Land Clearing, Civil Works and Construction of Groundmounted PV and Supporting Facilities.	▪ Noise and Vibration survey at baseline noise sampling points ▪ Data will be analysed quantitatively and compared with Noise level standards according to MoEF Decree No.48/1996 and and Guideline for Community Noise (WHO, 1999), while for vibration standards according to MoEF Decree No. 49 of 1996 regarding Vibration Standards.	EPC Contractor and EHSS Department of the SPC to assign a dedicated team to conduct regular monitoring; Independent third party.	Once every 3 months along with monitoring the Civil Works and Construction of Ground-mounted PV and Supporting Facilities activities.
Construction	Mobilization of Equipment, Materials and Workers.	**EIA07:** Increased in noise level and vibration.	• Development and implementation of Noise and Vibration Management Plan. • Limit the hours of operation for specific loud pieces of equipment or operations. Attention will be paid to operations in the proximity of community areas. • Mobilization activities shall be limited in daytime. • Conduct maintenance and regular inspection on the vehicle will be used. ▪ Develop an effective grievance mechanism to record and respond to noise and vibration complaints.	EPC Contractor and EHSS Department of the SPC.	During Mobilization of Equipment, Materials and Workers.	▪ Noise and vibration survey at baseline noise and vibration sampling points ▪ Data will be analyzed quantitatively and compared with Noise level standards according to MoEF Decree No.48/1996 and and Guideline for Community Noise (WHO, 1999), while for vibration standards according to MoEF Decree No. 49 of 1996 regarding Vibration Standards	EPC Contractor and EHSS Department of the SPC to assign a dedicated team to conduct regular monitoring; Independent third party.	Once every 6 months along with monitoring the Equipment and Material Mobilization activities.
Construction	Land and vegetation clearance during Construction	**EIA08:** Solid Waste/Non-Hazardous Waste.	• Develop and implement a Waste Management Plan, including solid waste management component to ensure proper segregation, collection, temporary storage, transportation, and disposal of waste in accordance with the requirements aligned with the Project's safeguards. • Provision of waste temporary storage according to the waste types. • Provision soil disposal area and soil will be reused as foundation for all manner of groundworks. • Develop Contractor and Supplier Management Plan to ensure permitted local supplier for civil and structural material comply with the government requirements, including batching plants and temporary construction facilities within Project area; and conduct due diligence to ensure that its operations have proper E&S management practice	EPC Contractor and EHSS Department of the SPC.	During Civil Works and Construction of Grounmounted PV and Supporting Facilities	▪ Good housekeeping around the Project area ▪ Determine the location for final waste disposal in coordination with the local government and coordinate with the Environmental Agency of Banyuwangi Regency.	EPC Contractor and EHSS Department of the SPC to assign a dedicated team to conduct regular monitoring; Independent third party.	Once every 3 months along with monitoring the Land Preparation and Civil Works and Construction of Ground-mounted PV and Supporting Facilities activities.

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			and supported with the necessary quarry operation permits. ▪ Third party waste collector will then be permitted to take the wastes. Determine the location for final waste disposal in coordination with the local government and coordinate with the Environmental Agency of Banyuwangi Regency.					
Construction and Operation	Workers Activity During Construction and Operation	**EIA09:** Solid Waste/Non-Hazardous	• Develop and implement a Waste Management Plan, including solid waste management component to ensure proper segregation, collection, temporary storage, transportation, and disposal of waste in accordance with the Project's safeguards requirements. • Provision of rubbish bins according to the waste types. • Maintain the performance of septic tank to ensure that the septic tank works well and coordination with third party to periodically empty the septic tank. ▪ Third party waste collector will then be permitted to take the wastes. Determine the location for final waste disposal in coordination with the local government and coordinate with the Environmental Agency of Banyuwangi Regency.	PT PLN Indonesia Power, EHSS Department (environmental safeguard specialist) and EHSS Department of the SPC and EPC Contractor.	During Construction and Operation	▪ Good housekeeping around the Project area ▪ Determine the location for final waste disposal in coordination with the local government and coordinate with the Environmental Agency of Banyuwangi Regency.	PT PLN Indonesia Power and EHSS Department of the SPC to assign a dedicated team to conduct regular monitoring; EPC Contractor; Independent third party	Once every 6 months along with monitoring the Civil Works and Construction of Groundmounted PV and Supporting Facilities and Operation phase.
Construction and Operation	Project Activity During Construction and Operation	**EIA10:** Hazardous Waste	• Develop and implement a Waste Management Plan, including hazardous waste management component to ensure proper segregation, collection, temporary storage, transportation, and disposal of waste in accordance with the Project's safeguards requirements. • The selected solar PV modules will use monocrystalline panels that do not contain hazardous materials. The project intentionally avoids the use of PV technologies that contain cadmium or other highly toxic substances. • Damage solar panels including end-or-life disposal will be inspected and assessed for repair or disposal. Damaged panels classified as B3 waste will be temporarily stored in the project owned TPS B3 facility. • Provision of hazardous waste temporary (TPS B3) accordance with Indonesia's hazardous waste guidelines. • Trained personnel will handle damaged panels using appropriate PPE. • Loading and unloading activities will minimize physical stress to avoid further damage or material leakage. • Coordination with licensed hazardous waste agency (for transport and disposal facility), and	PT PLN Indonesia Power, EHSS Department (environmental safeguard specialist) and EHSS Department of the SPC and EPC Contractor.	During Construction and Operation	▪ Good housekeeping around the Project area. ▪ Manifest of hazardous waste disposal to licensed facility. ▪ Compliance with Government Regulation No. 22 of 2021 on Environmental Protection, Organisation and Management.	PT PLN Indonesia Power and EHSS Department of the SPC to assign a dedicated team to conduct regular monitoring; EPC Contractor; Independent third party	Once every 6 months along with monitoring the Civil Works and Construction of Groundmounted PV and Supporting Facilities and Operation phase.

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			perform hazardous waste management in accordance with the operational technical document for hazardous waste management owned; and • Develop and implement emergency prepadness and response plan. • Develop and implement an Asbestos Management Plan (AMP) as refer to the Regulation Ministry of Manpower No. 3 of 1985 on Occupational Health and Safety the Use of Asbestos, Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management Appendix IX for List of Hazardous Wastes from Unspecific Sources and the Asian Infrastructure Investment Bank (AIIB) Environmental and Social Codes of Practice (ESCOPs), including procedures for safe handling, storage, transportation, and disposal which covering: - Asbestos identification in the workplace; - An outline on how the risks for each Asbestos Containing Material (ACM) are controlled; - Control measures on the management of asbestos and ACM in the workplace; - Procedures for accidents, incidents and emergencies involving asbestos in the workplace; - Responsibilities in implementation of the plan; - Worker requirements for conducting asbestos work; - Air monitoring requirement during each type of asbestos work; and - Requirement of communication of the plan to workers and other relevant stakeholders.					
Construction	Traffic congestion due to traffic volume increment from mobilization of heavy equipment and material	**EIA11:** Impact on Existing Local Public Road Condition due to Increment of Traffic Volume Associated with Mobilization Activity and Road Safety	• The ANDALALIN or Traffic Management Plan is part of AMDAL and prepared during the planning stage of a project, including coordination Transportation Agency of Banyuwangi Regency, and coordination with community surrounding Project area (scheduling and mobilisation). Develop and implement a Traffic Management Plan in alignment with The ANDALALIN document and Good Practice Note for Road Safety (WB, 2019) and in accordance with the Project's safeguards, including stakeholder coordination, vehicle movement scheduling, and control of vehicle volumes to minimize emissions. • Engage and inform the community around Project area about the construction activity, including	PT PLN Indonesia Power, EHSS Department (environmental safeguard specialist) and EHSS Department of the SPC and EPC Contractor.	In the beginning of Construction phase (Mobilisation equipment and Material and Construction Workers activity).	▪ Compliance the implementation of Traffic Management Plan (TMP) associated with The ANDALALIN approved by The Ministry of Transportation and coordination with Transportation Agency of Banyuwangi Regency. ▪ No traffic congestion occurred caused by project activities. ▪ Any grievance related to traffic congestion shall be	EPC Contractor and EHSS Department of the SPC	Monthly inspection and report quarterly during mobilisation of heavy equipment and material activity of the Project construction phase.

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			project schedule and mobilisation route of heavy vehicles. • Scheduling the mobilisation of heavy equipment and material outside the peak hour of traffic volume and consider after school and weekly market schedule and it expected to inform relevant governance agency (Transportation Agency/Dinas Perhubungan) of the project schedule/activity and for escorting if the vehicle convoy is needed. • Install the Project traffic sign and road markings for safety reason. • Provide road officer who responsible to manage traffic flow at the gate of project area and install the post security. • Provide the laydown area to store the heavy equipment and material, as well as the parking area for light and heavy vehicles to avoid parking on the public roadside. • Ensure the vehicles and drivers in good condition and have valid licence to operate according to standard operation procedure. • Conduct regular orientation sessions for Project and/or EPC drivers focusing on the ANDALALIN requirements and road safety protocols. The sessions should cover topics such as speed limits, the meaning of traffic signs and road markings, and other relevant traffic regulations. • Ensure the heavy vehicle weight loading accordance with the road load capacity standard. • Ensure the heavy vehicle loading handling accordance with applied standard operation procedure. • Vehicle speed limit shall apply standard road speed limit (i.e. for collector road inter-city is 40 km/hour and settlement area at local road is 15 - 20 km/hour). • Improved the road paving with poor condition at local road segment that expected cannot accommodate heavy vehicle load and repair the damaged road cause by the Project's heavy vehicle mobilisation activity after Project construction activity. • Provide grievance mechanism platform to accommodate community perception related to transportation.			recorded, manage, and resolved immediately within the determined timeline.		

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
Construction	Greenhouse gas emission generated by fuel combustions from the operations of vehicles during mobilization of equipment, materials and workers	**EIA12:** Impact of Greenhouse Gas (GHG) Emission due to of Fuel Combustions during mobilization of Equipment, Materials and Workers	▪ Exhaust emissions from off-road and on-road equipment operating within the site will be controlled by the contractor by ensuring that emissions are minimized through regular servicing of machinery to meet the relevant emission standards; and ▪ Ensure that the engines of all vehicles and machinery on site are not left running unnecessarily.	EPC Contractor and EHSS Department of the SPC.	During Mobilization of Equipment, Materials and Workers.	Exhaust emission monitoring to each vehicle that includes CO_2 parameter	EPC Contractor and EHSS Department of the SPC	Prior to purchase/ rent Every 6 months
Construction	Greenhouse gas emission generated by fuel combustions from the operations of vehicles and motorized equipment during land clearing, civil works and construction of FPV and its supporting facilities	**EIA13:** Impact of Greenhouse Gas (GHG) due to Land Clearing, Civil Works and Construction of Solar PV and Supporting Facilities	▪ Exhaust emissions from equipment operating within the site will be controlled by the contractor by ensuring that emissions are minimized through regular servicing of machinery to meet the relevant emission standards; ▪ Ensure that the engines of all machinery on site are not left running unnecessarily; and ▪ Disturbed areas that will no longer be developed can be revegetated with local vegetation to serve as buffer for future activities and operation and to increase local sequestering capacity for greenhouse gases.	EPC Contractor and EHSS Department of the SPC.	During Land Clearing, Civil Works, and Construction of FPV and its Supporting Facilities.	Exhaust emission monitoring to each vehicle that includes CO_2 parameter	EPC Contractor and EHSS Department of the SPC	Prior to purchase/ rent Every 6 months
Operation	Operation of the Solar PV power plant	**EIA14:** Positive Impact due to Greenhouse Gas Emission Reduction from Solar PV Operations	**N/A**. A GHG inventory and reporting is not required as the project's GHG emission will not exceed 25,000 tons CO_2 per year	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Construction	Construction of PV plant and their associated facilities typically requires removal of vegetation and surface grading across large areas of land. This may cause habitat loss, leading to a reduction in species richness and density.	**EIA15:** Habitat Loss due to Construction	• Project to provide clear Land Preparation and Civil Work Plan including relevant site layout map to allow all construction personnel have clear understanding on their working area boundary. • Under the supervisory of Project Owner and/or Consultant Supervisor, construction personnel shall conduct join inspection to determine the designated project footprint boundary prior to the commencement of land clearing. • Biodiversity Site Induction by involving Biodiversity Specialist shall be conducted together with HSE Site Induction prior to joint site inspection. • Using the approved site layout map, construction personnel shall conduct the land clearing within designated project footprint boundary. Land clearing outside the boundary is out of conduct and remedial action shall be conducted. • Implement "3 R" procedure (Report, Rescue and Release) to trapped wildlife within Project site. Consultation with professional Ecologist or Veterinarian may be required if serious or	EPC Contractor and EHSS Department of the SPC.	Prior to and during land clearing	The following check list is used to monitor the implementation of this management plan: • Approved Land Preparation and Civil Work Plan including relevant site layout map. • Evidence of Biodiversity and HSE Site Induction (list of attendance and attachment of personnel signature). • Minutes of pre-civil work commencement join inspection (signed by representative of Project owner, Consultant Supervisor, EPC Contractor). • Record of daily work progress.	EPC Contractor and EHSS Department of the SPC	• Follow the working activity progress. • Management and monitoring progress report is prepared in monthly and quarterly basis.

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			emergency situation occurred (i.e. handling injured wildlife).					
Construction	The potential for solar PV developments to result in habitat modification and fragmentation with potential significant negative impacts on biodiversity in areas of high ecological value.	**EIA16 :** Habitat Modification or Fragmentation	No mitigation measures is required since the impact significance is considerably negligible.	EPC Contractor and EHSS Department of the SPC.	Prior to and during land clearing	• Refer to the monitoring on EIA 15	EPC Contractor and EHSS Department of the SPC	• Follow the working activity progress. • Management and monitoring progress report is prepared in monthly and quarterly basis.
Construction (and Operation)	The attraction of birds to solar PV installations and power line were recognized as a concern to determine the potential hazards of large-scale PV development	**EIA17**: Avian fauna mortality due to collision and/or electrocution	• The proposed transmission-line route and corridor shall not be changed without further assessment of bird collision and electrocution risk. • If any significant change to the OHTL route, corridor, tower locations, span lengths or conductor/earth wire configuration occurs during detailed engineering design (DED), the avian collision and electrocution risk assessment shall be updated by a qualified ornithologist/ecologist. • During DED, the final OHTL alignment, tower schedule, span configuration and earth wire/OPGW arrangement shall be reviewed against the VP survey results to identify priority higher-risk collision spans. These shall include, but not be limited to, spans near VP2, mature tree vegetation, mixed plantation edges, agricultural foraging areas and locations where Band 2 bird activity was recorded. • Prior to energization, effective bird flight diverters shall be installed on identified higher-risk OHTL spans. Diverters shall be installed preferentially on the earth wire/OPGW, and where required on conductors, in accordance with manufacturer recommendations and good international practice. • The final OHTL design shall be reviewed to confirm bird-safe clearances at tension towers, jumper arrangements, gantry structures, terminal structures and substation-interface areas. Where any configuration presents a potential electrocution risk to medium- or large-bodied birds, appropriate redesign, insulation or shielding shall be implemented. • Post-construction fatality/mortality monitoring shall be undertaken for a minimum of one year after energization. Monitoring shall include systematic carcass searches beneath representative and higher-risk spans, with correction for searcher efficiency, carcass persistence/scavenger removal, habitat visibility and survey interval. Monitoring shall cover	EHSS Department of the SPC.	During and operation	▪ Monitoring to record number of avian fauna mortality (Operation Stage) for at least a year through Post Construction Fatality Monitoring (PCFM) in line with good international practice..	EHSS Department of the SPC.	• Quarterly (Construction Stage) • Semi-annual (Operation Stage)

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			relevant seasonal periods and peak bird movement periods. • If monitoring identifies bird mortality above agreed trigger levels, adaptive management shall be implemented. This may include installation of additional bird flight diverters, increased diverter density, extension of diverters to additional spans, review of tower/perching management, and extension of monitoring beyond one year. • Routine operational inspections shall include checks for bird nesting or frequent perching on towers, particularly by raptors such as Crested Honey Buzzard, Chinese Sparrowhawk, Peregrine Falcon and other birds of prey. Any nest management or perch deterrent measures shall be developed and implemented by qualified specialists.					
Construction	Removal of vegetation and surface grading across large areas of land may cause disturbance on biodiversity due to displacement during the construction activity	**EIA18**: Disturbance Displacement	Refer to mitigation measures on habitat loss.	EHSS Department of the SPC.	Prior to and during land clearing	Refer to monitoring of mitigation measures on habitat loss.	EHSS Department of the SPC.	• Follow the working activity progress. • Management and monitoring progress report is prepared in monthly and quarterly basis.
Construction	Solar plants typically have security perimeter fencing installed. In some cases, existing ground clearance under fences, gaps in the fence weave, and gates allow small to medium sized mammals to pass. However, such fencing could still pose a barrier to large mammal movement and/or migrations.	**EIA19**: Barrier Effects due to Solar PV Arrays Installation	• By the involvement of biodiversity specialist, the Project shall conduct a joint pre-land clearing inspection to ensure that the Project site is not overlapping with the existing wildlife corridor as part of their home range. • The Project shall ensure that they will not close the existing wildlife corridor if it was identified during the joint pre-land clearing inspection activity. • The Project shall provide space within the Project footprint for conserving the existing wildlife corridor if the case of item #2 is occurred.	EHSS Department of the SPC.	During construction	• Minutes of join inspection (check whether any indication of existing wildlife corridor is presence or not).	EHSS Department of the SPC.	• After join inspection • After mitigation measures implementation
Construction	The changes in hydrology and water quality and/or quantity will lead to aquatic habitat degradation.	**EIA20**: Aquatic Habitat Degradation	Refer to mitigation measures on EIA01.	PT PLN Indonesia Power; EHSS Department of SPC;	During construction	Refer to monitoring of mitigation measures on EIA01.	EHSS Department of the SPC.	Refer to monitoring of mitigation measures on EIA01.
Pre-construction	Land take for solar developments and their associated facilities could lead to reduced access to, and the loss of important provisioning services	**EIA21**: Loss of important provisioning services	Refer to mitigation measures on SIA03.	PT PLN Indonesia Power; EHSS Department of SPC;	During Pre-construction	Refer to monitoring mitigation measures on SIA03.	EHSS Department of the SPC.	Refer to mitigation measures on SIA03.

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
Operation	The operation of transmission lines and solar power plant	Electromagnet Field	Ensure that design of free space and minimum clearance of the TL according to MEMR Regulation No. 13 of 2021 and SNI 04-6918-2002 on Free Space and Minimum Clearance of Electricity Transmission Line	PT PLN Indonesia Power	Prior to TL construction and during operation.	MEMR Regulation No. 13 of 2021 Appendix IV of electric field and magnetic field.	PT PLN Indonesia Power EHSS Department to assign a dedicated team to conduct regular monitoring; Independent third party	Annually during operation phase
Pre-construction	Extreme heat	**Risk ID 1a:** A rise in the average temperature of the project site can affect the efficiency of the equipment and cause lesser electricity production.	Make appropriate considerations while designing the cooling systems (if required), for the different assets.	PT PLN Indonesia Power and EPC Contractor.	Prior to construction	EPC contract clauses and design documentation or equipment specifications that reflect consideration of future maximum ambient temperatures based on climate projections.	PT PLN Indonesia	Once before construction
Operation	Extreme heat		• Educate machine operators to identify temperature thresholds of equipment and assess. • Instances of when the equipment needs to be shut off to cool down.	PT PLN Indonesia Power; EHSS Department of SPC; Project Operator or Proponent	During operation	Training document	PT PLN Indonesia	Quarterly
Pre-construction and operation	Extreme heat	**Risk ID 1b:** A rise in the maximum temperatures of the project site can increase electricity demand for air-conditioning system	Refer to mitigation measures on Risk 1a	Refer to Management PIC on Risk 1a	Refer to Timing on Risk 1a	Refer to monitoring mitigation measures on Risk 1a	PT PLN Indonesia	Once before construction
Construction and operation	Extreme heat	**Risk ID 1c:** Increasing high temperatures and longer hot durations could lead to adverse human health effects or general amenity issues for staff	• Set up 'Stop Work Procedures' to stop work immediately in case of any unexpected extreme heat related impacts. • Develop a heat stress management plan. • Train workers to identify the symptoms of heat stress and first aid. • Increase vegetative cover to lower outdoor temperatures. • Include precautions and management arrangements (e.g., additional breaks, Worker's resting areas, water stations, access to shaded areas, etc.) to manage the safety of site personnel in the event of extreme weather events in the Health and Safety management plan.	PT PLN Indonesia Power, EHSS Department of SPC, EPC Contractor, Project Operator or Proponent	During construction and operation phases	• EPC and O&M contract clauses and design documentation that reflect consideration of extreme heat in Health and Safety management plan • Stop Work Procedures • Heat stress management plan • Health and Safety management plan with extreme heat consideration • Training documents	PT PLN Indonesia	• Once before construction and operation (contracts, procedures and management plan, design an arrangement) Quarterly (Training activities)

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Project Phase	Aspect or Project Activities	Potential Impact	Proposed Mitigation	Management PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
Pre-construction	Flooding	**Risk ID 2a:** Inundation of the Project area (e.g., substation, platforms, electricity yard) may result in electrical, communication and security system failures which would require repairs and temporary loss of services.	• Proper design of the flood protection facilities for all project components to prevent flood exposure to the Project area. • Design early warning systems for floods to provide workers or surrounding communities with advanced warnings of upcoming flood events and can be used to trigger the deployment of portable flood defenses or evacuation to mitigate the impacts	PT PLN Indonesia Power and EPC Contractor	Once before construction	• EPC contract clauses and design documentation that reflect consideration of future maximum rainfall based on climate projections. Alarm system showing the food risks	PT PLN Indonesia	Once before construction
Construction and operation	Flooding	**Risk ID 2b:** Inundation of the Project area (e.g., substation, platforms, electricity yard) may result in electrical, communication and security system failures which would require repairs and temporary loss of services.	Categorize flooding as one of the hazards in the Emergency Response Plan.	PT PLN Indonesia Power, EHSS Department of SPC, EPC Contractor, Project Operator or Proponent	During construction and operation phases	• EPC and O&M contract clauses and design documentation that reflect consideration of flooding in Emergency Response Plan. • EMR plan with flooding risks Training document	PT PLN Indonesia	• Once before construction and operation (contracts, EPR plan) Quarterly (Training activities)
Pre-construction	Water Availability	**Risk ID 3:** High seasonal variability may lead to further reliance on alternate water sourcing, resulting in higher costs or disruption to site operations. Increased the rate of evaporation of surface water runoff may increase the onsite water demand for operational use.	• Explore opportunities to reuse and recycle water e.g., onsite rainwater tank collection, onsite water treatment. • Explore alternative water sources/supplies, and • Identify water storage infrastructure to ensure uninterrupted water supply during the dry season.	PT PLN Indonesia Power and EPC Contractor	Once before construction	Technical design requirements for supply water system with consideration of alternatives.	PT PLN Indonesia	Once before construction

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9.3 Social Management and Monitoring Plan

The mitigation and management measures take place throughout the Project lifetime, from pre-construction, construction, operation through decommissioning. In addition, there are common mitigation and monitoring requirements that apply to all phases of the Project.

The mitigation and monitoring measures specific to the impact assessment conducted for the Banyuwangi Solar PV Power Plant Project ESIA are detailed in **Table 9-2**.

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Table 9-2 *Proposed Social Impact Mitigation and Monitoring Plan*

Project Phase	Aspect or Project Activities	Potential Impacts	Proposed Mitigation	PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
Pre-Construction	Project Land Acquisition	**SIA01** Negative-Disturbance or Impact on Socio Economy and Livelihood of Landowner and Land users as a Result of Project Land Acquisition	• Conduct a land acquisition and resettlement study to outline the land acquisition policy principles, procedures, and institutional arrangements to mitigate risks and offer livelihood and development opportunities to the affected people affected by the land acquisition of the Project. This will include the plantation workers and vulnerable people (women and people below poverty rate) who potentially affected by the land use change of the plantation area. • Monitor the livelihood conditions of workers of PTPN XII who have lost their regular daily work as a result of project impacts, particularly those from three affected village. A detailed assessment of these impacts, along with the proposed mitigation measures, is presented in the LALRP. • Consider establishing a Community Development or a CSR program coordinating with relevant local government, PTPN XII and stakeholders to support local economic and social development. • Establishment and implement a Project grievance mechanism that is understood by and accessible for the affected communities. The mechanism will be simple, efficient, and timely and fully consultative.	PT PLN Indonesia Power Land Acquisition team or the appointed LARAP consultant.	▪ Along the implementation of land acquisition process – preconstruction ▪ In line with proposed timeline under the LARAP	▪ Available LARAP document ▪ Number of vulnerable landowners ▪ Numbers of harvesting workers and land users impacted by land acquisition especially from 3 affected villages ▪ Number of landowners that loss more than 10% of their total land holding in the project location ▪ Landowners Income data from KJPP collected during land acquisition process ▪ Available LRP/CSR related to mitigation of land acquisition impact ▪ Gender segregated data must be available ▪ Grievance submitted on land acquisition	One of land acquisition team assigned to record data during land acquisition process; CSR / community relation team member	Once by the end of land acquisition process complete and to align with the proposed monitoring timeframe under the LARAP.
Construction and operation	Construction and operational activities of Banyuwangi Ground-mounted Solar PV Project	**SIA02:** Disturbance of Impact on the Economy and Livelihood due to Project Construction and Operation	• Engage the community leaders, local community, business party and especially farmers who also as breeder to socialize the development of Banyuwangi Ground-mounted Solar PV Project, the benefits from the Project as new attraction in the area, and the restriction area for community to access the site, as well as how to mitigating the restriction access; • Grievance mechanism to be established by the Project to allow individuals or community groups the opportunity to raise issues in regard to the disturbance of community economy and livelihood due to the Project construction and operation; • Consider establishing a Community Development or a CSR program coordinating with relevant local government, PTPN XII and stakeholders to support local economic and social development; and • Project/PT PLN Indonesia Power to ensure the Project's grievance mechanism is well socialized, and when grievances are submitted, the PT PLN Indonesia Power and EPC will investigate and address the issue in a timely manner.	EHSS Department of Project SPC; Site Manager and Community liaison/Public Relation	During construction and operation phase	• Documentation of formal socialization on restricted solar PV boundary for public access, and explaining the development of project including the benefit of project to the community surrounding • Grievance redress mechanism is in place. • Available CSR program related to developing economic and livelihood • Record of implementation grievance mechanism and resolution progress for received grievances.	EHSS Department of Project SPC to assign a dedicated team to conduct regular monitoring; Independent third party	Once every 6 months along with monitoring the construction and operation process
Construction	Project land preparation and civil work.	**SIA03:** Employment and business opportunity during Project land preparation and civil work.	• Prioritizing local workers in accordance with the Project qualification. • Develop a transparent, clear and neutral procedure of local worker recruitment which is appropriately disclosed to the local community; coordinate with the local Labour Agency, sub-district or village government and leaders (e.g., posters of recruitment	• EHSS Department of Project SPC; Site Manager and community liaison/Public Relation.	During land preparation and civil work	• Stipulation of requirement on maximizing local employment and provision of local goods and services in the EPC Contract, which will be cascaded to its sub-contractors and suppliers. • Reporting on workforce number and composition (including local and	EHSS Department of Project SPC to assign a dedicated team to conduct regular monitoring; Independent third party	One time in the land preparation and civil work activity.

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Project Phase	Aspect or Project Activities	Potential Impacts	Proposed Mitigation	PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			process to be installed at sub-district and village government office); • Ensuring wages for the local workers are in accordance with each expertise or skill level and implementing applicable labour regulation including compliance with the Provincial/Regional Minimum Wage; and • Inclusion of the Project commitment to optimise local employment and local business opportunities from the Project and its EPC contractors and sub-contractors in written contract.	• EPC Contractors and sub-contractors.		non-local, position in the project, education and gender)		
Construction	Construction of Project main components and supporting facilities.	**SIA04:** Employment and Business Opportunities during the Project Workforce Recruitment during Construction and Operation of the Project	A number of measures to optimise the Project's positive impact to employment and business opportunities suggesting to continues from the Positive impact in the Section 6.2.5.1 SIA03. Additional mitigation efforts in accordance with the AIIB ESF are as follows: • Measures related to workforce management to be included in a Labour Management Plan (LMP) which is developed by the Project in accordance with the applicable national and regional regulations, as well as the AIIB ESF on Labour and Working Conditions. • As part of the Project social responsibility, to optimize positive impacts on business opportunities for locals, to develop and implement community development/ empowerment plan for potential local business partners through (a) Consultation with the local business to identify need and potencies for development; and (b) Implement a series of training sessions targeted at improving community capacity to provide materials and services required by the Project. • Follow Indonesia Labour law and regulation as well as International Labour Organization (ILO) requirements related to the worker recruitment with attention given to appropriate contracting and the establishment of clear terms and conditions to address issues related to child and forced labour as well as human trafficking; and • Grievance redress mechanism (GRM) to be established to allow all groups of affected people to share their concerns and complaints regarding the Project worker recruitment process.	EHSS Department of Project SPC and social safeguard specialist)	During construction phase	• Documentation of employment recruitment process and records of employment number and composition between local and non-local, position in the project, education and gender. • Increased incomes due to the absorption of local workers by construction activities; • Data collection on potential construction material resources owned by individual or communal as well as transportation services/car rental, food catering and homestays regarding the business opportunities and the existence of migrant workers - Number and type of local business start-up within the project vicinity. • Report of community empowerment / CSR program implementation, which includes photo documentation, success stories of program as well as challenges, and problem-solving strategies.	EHSS Department of Project SPC to assign a dedicated team to conduct regular monitoring; Independent third party	Once every 6 months along with monitoring the construction and operation process.
Construction and Operational	Recruitment and the presence of Project security personnel	**SIA04A:** Risks related to the recruitment and the presence of Project security personnel during construction and operational of the Banyuwangi Solar PV Project	• Conduct a security risk assessment for the Banyuwangi Solar PV Project • Security personnel for the Project to be trained not only in general security protocols but also in the specifics of solar PV systems. This includes understanding the equipment, layout, and potential hazards. • Providing the security personnel with training in conflict de-escalation techniques to minimize the risk of confrontations with workers, local communities, or visitors	EHSS Department of Project SPC	During construction and operational of the Project.	• Risk assessment of security personnel recruitment process • Security personnel training plan and documentation of training conducted. • Record of engagement between security personnel and local communities	EHSS Department of Project SPC to assign a dedicated team to conduct regular monitoring; Independent third party	One every month during the construction phase and every 6 months during operational phase.

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Project Phase	Aspect or Project Activities	Potential Impacts	Proposed Mitigation	PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			• Provide training for the security personnel on local customs and norms, traditions, and values of the local community. The training should include aspect such as local etiquette, religious practices, appropriate dress code, and communication styles. • Maintain transparent communication with local communities and stakeholders regarding the role of security personnel and the project's overall goals. This helps mitigate any concerns or misunderstandings about the project. • Develop comprehensive ERP that include procedures for security-related incidents, ensuring security personnel are well-prepared to respond to any potential issues, including unauthorized access or sabotage.			• Emergency Response Plan document and regular report on its implementation.		
Construction	Construction and operation of Solar PV Project.	**SIA05:** Risk of impact on road damage, dust, noise and vibrations which disturb to community amenity and public facilities as a result of project construction.	▪ The Contractor will establish a Traffic Management Plan (TMP) to manage potential congestion to ensure community safety and project mobilisation. ▪ Community Liaison Office (CLO) or Community Relation to be appointed to do stakeholder engagement with community and consult regularly with communities on the Project traffic routes and peak traffic times. ▪ Keep communicate and coordinate with the village government, village leaders, local institutions and PTPN XII regarding the progress of the panel installation project phase in PTPNXII land area; ▪ Regular maintenance during construction and rehabilitation after construction – restore roads to equal or better condition; and ▪ Grievance mechanism to be established by the project to allow individuals or community groups the opportunity to raise any issues regarding project activity.	EPC Contractor; EHSS Department of Project SPC and EPC Contractor	During the Project construction phase.	▪ Compliance with the implementation of Traffic Management Plan (TMP) documents. ▪ Records of engagement and consultation with all stakeholders and adequate documentation to clearly demonstrate the objectives and outcomes of consultations. ▪ There are no differences in the condition of the quality of roads and public facilities based on survey documentation before and after heavy equipment and vehicle mobilization activities. ▪ Documentation or record of GRM socialization and record of any grievance and follow-up mechanisms for outstanding grievances; number of grievances addressed within the determined timeline.	EHSS Department of Project SPC to assign a dedicated team to conduct regular monitoring	Weekly inspection and monthly implementation report during the Project construction phase.
Construction and Operation	Construction and Operation of Transmission Line and Solar PV Panels of the Project.	**SIA06:** Impact on Landscape and Visual associated to Project construction and operation (Transmission Line and Solar PV)	During construction phase: ▪ Minimise the site clearing and maintained the vegetation cover around construction boundary area. ▪ Install the temporary fence during construction around Project area which adjacent with settlement with limited vegetation cover to prevent visual intrusion. ▪ Ensure proper housekeeping and instruct the workforce accordingly (i.e. ensure that all machines, vehicles, and tools used during construction to be removed from after construction works finished as earliest as possible and waste, including tree cutting waste from site preparation shall be handling in a timely manner). During operation phase:	EHSS Department of Project SPC, and EPC Contractor Indonesian Power (for operation phase)	During construction and operation phase	During construction phase: ▪ Good housekeeping around the Project area. ▪ Provide and manage waste disposal (include hazardous waste, and tree cutting waste during site clearing) During operation phase:	EHSS Department of Project SPC Indonesian Power (for operation phase)	For construction: Monthly inspection and report quarterly along with construction activities. For operation: along the operation phases

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Project Phase	Aspect or Project Activities	Potential Impacts	Proposed Mitigation	PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			Engaged the local community tourism/educational association and/or regional stakeholder to expound the visual impact perspective as future green energy awareness and potential educational attraction.			Open and manage the PV Project for educational tourism for public (i.e., school fieldtrip)		
Construction	Construction of Project components	**SIA07:** The interaction of migrant workers with local communities or local workers can mutually influence culture, social jealousy and social behaviour.	▪ Consult with the local leaders (village government, community leaders and local institution) before the construction activities begin. Especially discussing the socio-cultural habits of the community, acceptance of immigrants, and the need for local workers according to the project phase. ▪ The project consulted with the Banyuwangi district Manpower Office regarding data on job seeker capacity and definitions of the scope of local employment. ▪ PT PLN Indonesia Power ensures that all contractors (EPCs) provide Workers Accommodation Management Plan (WAMP), Labour Management Plan (LMP) and induction to all workers, especially immigrants, regarding behaviour and adaptation to local customs and culture. ▪ Consultation approach and empowerment program for village institutions. ▪ Projects to be able to adapt and continue to support local culture by participating in its implementation. ▪ The project will continue to carry out further consultations involving various stakeholders related to customary issues and considering involving the Osing Kemiren community in Kemiren in the project's social investment program, which may be structured as part of the Corporate Social Responsibility (CSR) initiative. ▪ The project provides a Stakeholder Engagement Plan (SEP) document as a reference for coordinating with stakeholders related to the project and anticipating issues developing in the community. ▪ Project/PT PLN Indonesia Power to ensure the Project's grievance mechanism is well socialized, and when grievances are submitted regarding socio cultural, the PT PLN Indonesia Power and EPC will investigate and address the issue in a timely manner.	EHSS and HR Department of Project SPC and EPC Contractor	During workforce recruitment and construction phase	▪ Compliance with measures in the Labour Management Plan (LMP) document and an approach aligned with the SEP. ▪ Records of engagement and consultation with all stakeholders and adequate documentation to clearly demonstrate the objectives and outcomes of consultations. ▪ Documentation or record of GRM socialization and record of any grievance and follow-up mechanisms for outstanding grievances; number of grievances addressed within the determined timeline.	EHSS Department of Project SPC to assign a dedicated team to conduct regular monitoring	At least once during pre-construction and twice a year
Construction	Land preparation and Construction and installation of Solar PV panels	**SIA08:** Disturbance to Cultural Heritage as a result of Project construction and potential access restriction of the local community to the CH sites.	• Project to consult with the community leaders in Wangkal Hamlet to ensure that there is no family or close relative of the local village residents buried in the old burial site. This to anticipate any further measure required such as claim for compensation, etc. • Consult with the local relevant village leaders before construction activities to discuss/inform the areas of construction works and schedule and measure require to be taken should the burial site be disturbed or impacted. This can be the in the form of providing sign or boundary mark around the burial complex thus the construction activities can avoid or potential relocation of the site.	EHSS Department of Project SPC and EPC Contractor	Prior to the start of any construction activities within the main solar panels area	• Documentation or record of any form of engagement with relevant stakeholders from the local community, traditional leaders, government entities and relevant non-government organizations. • Compensation scheme for the impacted communities. • Documentation or record of GRM socialization and record of any grievance logged.	EHSS Department of Project SPC to assign a dedicated team to conduct regular monitoring	Monthly implementation report.

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Project Phase	Aspect or Project Activities	Potential Impacts	Proposed Mitigation	PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			• Develop and implement a Chance Finds Procedure (CFP), which provide celar guidance for managing and culturalheritage or archaeological artifacts that may be unexpectedly discovered during civil works. This includes requirements for immediate cessation of work in the affected area, protection of the find, notification of relevant authorities, and compliance with applicable national regulations and lender requirements. The implementation of this procedure will ensure appropriate protection and management of culturl heritage throughout project execution. • PT PLN Indonesia Power to ensure the Project's grievance mechanism is well socialized, and when grievances are submitted regarding cultural heritage, the PT PLN Indonesia Power and EPC will investigate and address the issue in a timely manner.					
Construction	Project construction, equipment, and material mobilisation	**SIA09:** Negative-Community Health Impact Associated with Dust and Air Quality	• Consultation with communities of Project's traffic routes, peak traffic and access road construction times (especially to agriculture/plantation workers) to manage/inform the number of vehicles, road construction time and wetting the road schedule, especially road section from Kalipuro (Wangkal hamlet) to Ketapang area. • Regular check on ARI data record from the nearby health facilities at least once every 6 months • Consider establishing community health assistance through a CSR Program coordinating with public health centres and focusing on managing ARIs and other similar health issues. • Establish and implement a Project grievance mechanism to report dust and pollution concerns that is understood by and accessible for the affected communities in every affected village.	HSSE team / Department of Project SPC.	• Along the construction (12 months) • Every six-month during operation	▪ Dust and pollution controls along the designated project activities ▪ Monitor the number of ARI case in 3 public health facilities surrounding the project location ▪ One consultation with affected community and plantation workers surrounding the solar PV area ▪ One consultation with affected community along the transmission line area ▪ Attendance list for each consultation related health impact disclosure equipped with gender segregated data ▪ Number of CSR activities related with community health along the project operation.	EHSS Department of Project SPC to assign a dedicated team to conduct regular monitoring	• Every month during construction • Every six-month during operation
Construction	Presence of local and non-local workers (worker's influx)	**SIA10:** Negative-Community Health Impact Associated with the presence of non-local worker	• Compulsory medical examinations for Project workers, contractors and sub-contractors working during construction and operation stage to ensure they are fit for work and to monitor the prevalence of communicable disease and STD detected through annual medical check-ups. • Conduct a monitoring of disease prevalence in community surrounding the project location by doing regular coordination with public health centre • Conduct and induction and training on the community engagement code of conducts regarding to interaction with locals especially about communicable disease and STD • Engagement with local authorities relevant to crime (local police), health (local health service/hospital) and social problems (village leaders) for prevention of any community and workers health.	HSSE team / Department of Project SPC.	• Along the construction (12 months • Every six-month during operation	▪ Number of PT PLN Indonesia Power workers and EPC workers have conducted medical examination and its result related ARI and STD ▪ Number of induction and training on community health and workers code of conduct ▪ Number of local and non-local workers ▪ Number of stakeholder engagement with local police, local health service, and village leaders for crime, health, and social problems	EHSS Department of Project SPC to assign a dedicated team to conduct regular monitoring	• Every month during construction • Every six-month during operation

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Project Phase	Aspect or Project Activities	Potential Impacts	Proposed Mitigation	PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			• Establish and implement a Project grievance mechanism to report crime, health, social problems concerns related to workers that is understood by and accessible for the affected communities in every affected village. • The Project require all EPC contractors and subcontractors to develop, adopt, and sign a strict Code of Conduct as par of their worker induction process. The Code of Conduct must explicitly prohibit Sexual Exploitation and Abuse and Harassment (SEAH) and Gender-Based Violence and Harassment (GBVH), and clearly outline expected standards of behavior, reporting mechanisms, and diciplinary actions for any violations. The Project should ensure that the Code of Conduct is effectively communicated, enforced throughout project implementation, and supported by regular awareness-raising and training activities.			▪ Monitor number of Cases for ARI and STD/HIV/AIDS in the 3 public health facility surrounding project locations ▪ Record of grievance submitted with community health topic		
Construction	Traffic congestion due to traffic volume increment from mobilization of heavy equipment and material	**SIA11:** Impact on Community Safety Associated with Road Safety due to Increase of Traffic Volume on Existing Road due to Project Construction Equipment and Material Mobilization	Develop and implement a Traffic Management Plan (TMP) associated with ANDALALIN as part of AMDAL document, including: • Conduct or inform the community as well as the stone quarry/industry around Project area about the construction activity, including project schedule and mobilisation route of heavy vehicles. • Scheduling the mobilisation of heavy equipment and material outside the peak hour of traffic volume and consider school schedule; and it expected to inform relevant governance agency (Transportation Agency/Dinas Perhubungan) of the project schedule/activity and for escorting if the vehicle convoy is needed. • Install the Project traffic sign and road markings for safety reason. • Provide road officer who responsible to manage traffic flow at the gate of project area and install the post security. • Provide the laydown area to store the heavy equipment and material, as well as the parking area for light and heavy vehicles to avoid parking on the public roadside. • Ensure the vehicles and drivers in good condition and have valid licence to operate according to standard operation procedure. • Ensure the heavy vehicle weight loading accordance with the road load capacity standard. • Ensure the heavy vehicle loading handling accordance with applied standard operation procedure. • Vehicle speed limit to apply standard road speed limit (i.e. for collector road inter-city is 40 km/hour and settlement area at local road is 15 – 20 km/hour) • Improved the road paving with poor condition at local road segment that expected cannot accommodate heavy vehicle load.	EHSS Department of Project SPC and EPC Contractor.	Construction phase (Mobilisation equipment and Material and Construction Workers activity)	▪ Compliance the implementation of Traffic Management Plan (TMP) documents. ▪ Good material and heavy equipment handling. ▪ Zero accident on traffic related activity. ▪ No damage to public road facilities causes by the Project activity. ▪ Any grievance related to community safety shall be recorded, manage, and resolved immediately within the determined timeline.	EHSS Department of Project SPC.	Monthly inspection and report quarterly during mobilisation of heavy equipment and material activity of the Project construction phase.

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Project Phase	Aspect or Project Activities	Potential Impacts	Proposed Mitigation	PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			• Provide grievance mechanism platform to accommodate community perception related to transportation.					
Construction and operation	Construction of Project main components and supporting facilities.	**SIA12:** Impacts associated to occupational, health, and safety during Project Construction.	It is anticipated that the EPC will develop an Occupational Health and Safety Plan to safeguard the health and safety of the local workers who are likely to be less experienced in this area. The following are the additional proposed measures to mitigate the risk/impact related to OHS: • Construction worker standards to be aligned with minimum national requirements for health and safety during construction and operation, along with inductions, training, refreshers, and inspections. • The Project will prioritise worker health and safety standards such as preparing SOPs for each type of construction activity, conducting regular health and safety training and briefings (in the local languages as required) before the implementation of the activities (toolbox meeting) and compulsory use of personal protective equipment (PPE) • Strict Occupational Health and Safety requirements will be embedded in the EPC contract to ensure occupational injuries, worker rights, deaths, disability, and diseases are managed as per the Project's commitments. • Should non-compliance repeatedly occur, a zero-tolerance approach to be adopted. • Establish and implement a Worker Grievance Mechanism that will be accessible for all workers and contractors to report issues (a confidential option to be provided). When complaint is submitted, the project will undertake an immediate investigation.	EHSS Department of Project SPC and EPC Contractor.	OHS plan to be completed one month prior to start any construction activities and mitigation measures implemented throughout the construction phase.	• OHS procedure in place. • Training material on OHS and number of workers participated in the training. • HS awareness program for the workers is implemented e.g., through posters and regular toolbox meeting. • The use of PPE on all workers • ERP in place and socialized to workers e.g., through posters and regular toolbox meeting.	EHSS Department of Project SPC to assign a dedicated team to conduct regular monitoring	Weekly inspection and monthly implementation report.
Construction and operation	Construction of Project main components and supporting facilities.	**SIA13:** Risk and impact associated to labour rights and working condition during workforce recruitment, project construction and operation.	• Development of a Labour Management Plan (LMP) to ensure that the labour rights and working conditions for the Project and its Contractor's workers are protected, with consideration of both national regulation and international best practice adopted by the Banyuwangi Solar PV Power Plant Project. • Require contractors to adhere to the PT PLN Indonesia Power/Project labour management plan through contract requirements to ensure the same standards are applied to all contractors and the supply chain. • Project to work with the contractors to ensure adequate resources and technical knowledge to cover issues relating to labour rights and working conditions, non-discrimination, and grievances; and • Establish and implement worker grievance mechanism for workers and to be adequately communicated to workers at the time of recruitment, as part of the labour management plan.	EHSS and HR Department of Project SPC and EPC Contractor.	To be implemented during the Construction period of approximately 12 months.	• Procedure of local workforce recruitment process and record of • LMP is in place and consistently implemented by the Project and its contractors and sub-contractors. • Documentation or record of mandatory and supplementary training provided to all relevant workers during construction and operation. • Worker Grievance Procedure is in place and implemented by the Project and its Contractor and subcontractors.	EHSS and HR Department of Project SPC to assign a dedicated team to conduct regular monitoring	Weekly inspection and monthly implementation report.

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Project Phase	Aspect or Project Activities	Potential Impacts	Proposed Mitigation	PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
Construction and operation	Construction of Project main components and supporting facilities.	**SIA14:** Gender-Based Discrimination and Violence during Construction	• Development of a Labour Management Plan (LMP) to ensure that the labour rights and working conditions for the Project and its Contractor's workers are protected, with consideration of both national regulation and international best practice adopted by the Banyuwangi Solar PV Power Plant Project. The Labour Management Plan will incorporate policies and procedure to address risk of SEAH/GBVH particularly for female workers and implemented throughout the life cycle of the Project. • Ensure that the Project follows gender inclusion policies, reporting on recruitment targets, processes and hiring numbers, as well as suitable provisions for female personnel. This is not limited to equal pay and conditions, but also to facilities for lactating mothers, flexible working arrangements and access to female supervisors and mentors. • Promote the Project GBV policies and ensure socialisation of the policies and procedures to contractors and workers. • Provide separate, secure, and safe worker accommodation for men and women working in construction, particularly for the non-local workforce. • In the GRM implementation, ensure that a female officer is involved as a team member and that there is a private grievance reporting process, referral channels, and systems of support for employees and the community to help encourage the reporting of any GBV or discrimination-related grievances and protect the complainant. • The Project require all EPC contractors and subcontractors to develop, adopt, and sign a strict Code of Conduct as par of their worker induction process. The Code of Conduct must explicitly prohibit Sexual Exploitation and Abuse and Harassment (SEAH) and Gender-Based Violence and Harassment (GBVH), and clearly outline expected standards of behavior, reporting mechanisms, and diciplinary actions for any violations. The Project should ensure that the Code of Conduct is effectively communicated, enforced throughout project implementation, and supported by regular awareness-raising and training activities.	EHSS and HR Department of Project SPC.	To be implemented during the Construction period of approximately 12 months.	• Labour Management Plan (LMP) established and consistently implemented. • Record of worker induction and training refresher. • Worker Grievance Procedure is in place and implemented by the Project and its Contractor and sub-contractors. • Documentation of record of worker GRM socialization and record of any grievance logged by workers.	EHSS and HR Department of Project SPC to assign a dedicated team to conduct regular monitoring	Weekly inspection and monthly implementation report during Construction phase.
All Project phases	All activities throughout all phases of the Project.	**SIA15:** Change in community perception during pre-construction, construction, and operation.	▪ The project (PT PLN Indonesia Power) discloses information regarding the project description, activity phases, duration and potential impacts as well as mitigation that will be carried out, to the closest communities who will be affected. ▪ Conduct regular approaches and involvement of stakeholders (SEP), both from government and community leaders, village institutions, non-governmental organizations (NGOs). ▪ Carrying out the land acquisition process in accordance with LARAP document, applicable regulations and appropriate compensation for affected land and other assets. ▪ Implement safety and environmental management measures to minimize adverse impacts on society; and	EHSS and HR Department of Project SPC and EPC Contractor.	To be implemented during the Construction period of approximately 12 months.	▪ Community perceptions can be controlled and do not interfere with the running of the project. ▪ Mitigation implementation and approaches are in accordance with the SEP. ▪ Records of engagement and consultation with all stakeholders and adequate documentation to clearly demonstrate the objectives and outcomes of consultations.	EHSS and HR Department of Project SPC to assign a dedicated team to conduct regular monitoring	Weekly inspection and monthly implementation report.

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Project Phase	Aspect or Project Activities	Potential Impacts	Proposed Mitigation	PIC	Timing	Monitoring Parameter	Monitoring PIC	Monitoring Frequency
			▪ Project/PT PLN Indonesia Power has built a complaints mechanism that provides opportunities for communities and groups to easily submit complaints regarding project activities, as well as ensuring that the Project complaints mechanism is well socialized			▪ Documentation or record of GRM socialization and record of any grievance and follow-up mechanisms for outstanding grievances; number of grievances addressed within the determined timeline.		

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9.4 Responsibility for Implementing the ESMP

The key parties and their primary roles in implementing the ESMP are as follows:

- PT PLN Indonesia Power (PT PLN IP) – as the Project Proponent is responsible for overall Project implementation and monitoring, ensuring compliance with environmental policy and obligations in the ESMP.
- SPC (Special Purpose Company) – a company appointed to be responsible for implementing the ESMP independently to prevent misuse. SPC plays a role in ensuring that projects are run in accordance with sustainability and social responsibility standards. SPC also ensures that environmental and social impacts are well managed, so that projects gain support from stakeholders.
- EPC Contractors – implement the project are required to develop Contractor Environmental and Social Management Plan (C-ESMP), responsible for complying with ESMP requirements set out by PT PLN Indonesia Power (PT PLN IP). Has an important role in ensuring that environmental and social aspects are well managed during the construction phase of the project. The EPC contractor helps ensure that the project is not only technically successful but also sustainable and acceptable to the community and stakeholders;
- Project Operator or Proponent - fully responsible for ESMP implementation during operations; It is understood that for the development and operation of the Banyuwangi Ground-Mounted Solar PV Project, Indonesia Power has formed a partnership with GCL. This partnership will subsequently establish a Special Purpose Company (SPC) to manage the construction as well as during the operation; and
- Other operational contractors – responsible for complying with ESMP requirements set out by PT PLN Indonesia Power (PT PLN IP).

Meanwhile, the Consultant have provided guidance on the types of position, roles and responsibilities that would be required by the above entities for implementation of the ESMP during construction and operation in the following **Table 9-3**.

Table 9-3 *The Proposed position and the roles and responsibility to implement ESMP.*

No	Position	Roles & Responsibility
1.	Project Manager	The Project Manager would normally be responsible for all construction activities and accountable for overall EHSS (Environmental, Health, Safety and Social performance) of the project. The role and responsibility would include: • Actively promote and participate in the Project EHSS Programs. • Ensure that the EHSS Management Plan and its derivative program, procedures and work practices are implemented on the project. • Ensure that the EHSS Program reflects the requirements of the Project in terms of resources, • Ensure that all legislative and company requirements are complied with. • Ensure that their work scope is conducted in accordance with the Project EHS rules and regulations, work practices

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No	Position	Roles & Responsibility
		and procedures, as detailed in this ESMP and other associated documentation. • Ensure that all contractors are made aware of their roles and responsibilities with regard to EHSS management. • Ensure that safety is an agenda item in every weekly contractor progress meeting. • Ensure that all contractors are evaluated throughout the duration of the Project, as to their capabilities and performance; and • Ensure implementation of EHSS audit recommendations for non-compliances.
2.	HSE Team/Department	Health, Safety and Environmental (HSE) Department would be expected to undertake the following roles: • Manage, review and develop the HSE program to ensure that it fulfils Project requirements, including measures observed in this ESMP, and monitor the implementation including e.g., patrol the job site daily to ensure construction works' compliance to Project HSE Procedures and safe working practices. • Coordinate and evaluate the effectiveness of all program elements. • Liaison with related government bodies as necessary. • Manage the Project HSE team and supervise them to ensure that all areas of the project are given the required level of safety support and attention. • Ensure proper housekeeping and waste disposal in accordance with company requirements and regulations. • Ensure that the respective control areas are given in the required level of safety support and attention including e.g., only safety-approved material and equipment are allowed to be brought onto site. • Ensure that all HSE reports/findings of any unsafe conditions/practices is brought to the attention of field management and those are immediately corrected, and coordinate accident/incident investigations and report to Project Manager; and • Manage HSE Audits and report the results to the Project Manager.
3.	Community Relation Team/Department	The Community Relations Department would be expected to undertake the following roles: • Manage, review, and develop the Social Program to ensure that it fulfils Project requirements, including measures. • Conduct, monitor, evaluate and maintain the record of all stakeholder engagement processes relevant to the project activities including Permits related consultation, ESIA consultation, Land Acquisition consultation. • Responsible for managing the complaint handling mechanism, starting from receiving complaints, resolving and recording.

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No	Position	Roles & Responsibility
3.	Administrative Team/Department	Administrative Department would be expected to undertake the following roles: • Coordinating with HR (Human Resources) person to ensure implementation of labour-related measures required in this ESMP.
4.	Contractor Site Representatives	Contractors, depending on their work scopes, would be expected to have an HSE team. Contractors' Site Representatives or HSE Department to be assigned clear responsibilities and expectations with respect to implementing the projects EHSS expectations and to be fully responsible for implementing any required expectations which fall under their work scopes. More specifically, they are responsible to the following: • Actively promote and implement all Project HSE Plans related with the work they are performing. Contractor shall make sure that all activities under his/her responsibility shall follow all safety regulation/requirement, coordinating with PT PLN Indonesia Power Project Manager; and • Ensure that committed resources (personnel, material, and equipment) used are consistent with achieving the objectives and requirements of Project EHSS Plan and its entire associated document.
5.	Project Operator or Proponent	Supported by internal E&S staff and ensuring compliance from all service providers: • Ensuring ESMP measures are implemented and monitored as committed. • Monitoring and reporting (e.g., environmental quality, social impacts) • Handling grievances and stakeholder engagement • Ensure all third-party providers follow the ESMP requirements.
6.	Employees	All employees including from the EPC contractors and sub-contractors involved in the Project shall be qualified through training, experience, or knowledge. Non-supervisory personnel employed on the project shall: • Familiarize themselves with the concept of the Project EHSS rules and regulations. • Work in accordance with Project EHSS Procedure, safe work practices, and method statements, risk assessments, permits to work and any other instructions that apply to their works. • Use only tools/equipment and materials, which have been approved for use, and employ them only for the purpose for which they were designed. • Take an active part in the protection of themselves, fellow workers, property, and the environment from accidental losses. • Immediately report to his respective supervisor or HSE office/inspector if any potential hazards (relates to unsafe

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No	Position	Roles & Responsibility
		conditions to unsafe conditions and/or unsafe acts), which could lead to an accident, are found. • Report promptly to immediate supervisor and HSE officer/inspector if any incidents/near misses as well as injuries, regardless how minor; and • Shall attend project safety training and drills programs as required.

9.5 Capacity Building and Training

PT PLN, Indonesia's state-owned electricity company, has developed an Environmental and Social Management System (ESMS), 2024, to establish a structured framework for identifying, assessing, preventing, mitigating, evaluating, and communicating environmental and social (E&S) risks and impacts associated with its operations and those of its partners. This ESMS ensures that PLN Indonesia Power, as a subsidiary, effectively manages E&S risks and impacts by assigning adequately qualified teams and personnel to implement the system. Additionally, the ESMS focuses on continuously enhancing employees' awareness, knowledge, and involvement in managing E&S risks and impacts across all levels of the organization.

The implementation of the Environmental and Social Management Plan (ESMP), based on the Environmental and Social Management System (ESMS) developed by PT PLN, will be carried out across all PLN subsidiaries. This approach ensures a consistent and structured framework for managing environmental and social risks and impacts, aligning the operations of each subsidiary with PLN's overarching sustainability goals and compliance requirements.

PLN’s environmental and social management (E&S) training and capacity building programs and curriculum are provided in the HSSE Academy[79] under the PLN Learning Management System (LMS)[80] platform. Development of these programs and curriculum is conducted through a program called by PLN as the PLN’s ‘Grand Design. The E&S training and capacity building aim to improve the capacity of the organization involved in environmental and social management. In this respect, emphasis is placed on enhancing the skills required for integrated policy and procedures, efficient cost recovery mechanisms, and overall planning and management abilities. Activities include upgrading the skills and knowledge base of staff and management to improve their performance in effectively working within institutional arrangements, systems, and procedures. Institutional arrangements for capacity building are required for the following reasons:

- Complex issues are faced and handled by several departments under the Project organization requiring cross analyses, coordination and liaison with someone

[79] HSSE Academy is developed under PLN Corporate University mainly focused on the training of occupational health, safety, security, and environmental aspect.
[80] Learning Management System (LMS) is a web-based platform that serves as the central hub for organizing and managing all training needs in PLN, developed and operated by PLN's Corporate University (PUSDIKLAT). It provides access to a standardized curriculum designed to determine work competencies at each level. The curriculum aims to enhance staff capacity by incorporating awareness training and fulfilling specific job requirements. Additionally, project-specific training programs are organized at the project level to address specific needs.

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outside the organization who can monitor the content and risks and provide guidance where necessary.
- There are requirements for comprehensive tracking of progress and adapting approaches to meet emerging needs (need to set performance targets and indicators for the targets).
- Analysis of the adequacy of action in the different fields and completeness with regard to fulfilling the objectives of the plans, requires comprehensive understanding of the project, context, benchmarks, requirements and impacts.

An ESMP requires systematic, holistic and sustainable systems where individual efforts from different departments contribute, to implement the ESMP in a coordinated manner.

Implementation of the ESMP shall be commenced with training and workshops. Some of the plans and procedures are specific to the work of the contractor (e.g. waste, water, noise, or air quality mitigation). However, all workers and contractors must have knowledge and understanding of following areas:

- Application and description of AIIB Environmental and Social Standard
- Application of Environmental and Social Management Plan (ESMP);
- Environmental Management Plans (Air quality, waste, water, noise);
- Asbestos Management Plan (AMP);
- Traffic Management Plan and Vehicle Maintenance Program;
- Land Acquisition and Livelihood Restoration Plan;
- Stakeholders Engagement Plan (SEP) and Grievance Redress Mechanism (GRM);
- Cultural Heritage Management Plan and Chance Find Procedure;
- Labour Rights and OHS management implementations in the Labour Management Plan (LMP);
- Worker Accommodation Management Plan (WAMP);
- Emergency Preparedness and response plan;
- Plan for Material handling;
- Biodiversity Management Plan.

It is expected that the PT PLN Indonesia Power (the Project Proponent) or through the SPC and EPC Contractor would implement a training and awareness program covering environmental, health, safety, and social expectations of the project. As a minimum, this should be implemented as an induction for all employees and contractors engaged on the project construction, with further training to be implemented depending on the level of responsibility for implementing HSE and social expectations and exposure to environmental and safety risks.

PT PLN Indonesia Power / SPC and its EPC and Contractors to ensure that all personnel responsible for the implementation of this ESMP are competent on the basis of education, training, and experience. All personnel shall be provided with environmental and social training appropriate to their scope of activity and level of responsibility.

9.6 Integration of ESMP with Project Management System

This ESMP will be part of the future construction and operational activities, and as the future construction and operational plans are prepared, these are expected to confirm how these commitments (ESMP) will be incorporated into the relevant EHSS management systems. This implementation will be under the responsibility of PT PLN Indonesia Power (PT PLN IP).

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The following plans and follow up actions were identified as being necessary within this ESIA to manage identified risks or further understand potential environmental and social impacts (See **Table 9-4**). These plans are intended as framework documents which will be developed by the PT PLN Indonesia Power (PT PLN IP) to manage specific risks or issues and also to align the Project with the expectation of the Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF), relevant EHS guidelines and all environmental and social standards applicable for the Banyuwangi Ground Mounted PV Power Plant Project.

Table 9-4 *Specific Proposed Management Plans and Procedure to be Developed.*

Management Plan	Description
Construction Environmental and Social Management Plan	EPC to develop a Construction Environmental and Social Management Plan (CESMP) to manage and mitigate potential environmental and social impacts and aligns with applicable environmental regulations, as well as national and international standards.
Operations Environmental and Social Management Plan (O-ESMP)	A document that outlines how a project will manage environmental and social risks and impacts during its operational phase. It builds on the commitments made in the construction-phase ESMP and adapts them to long-term, routine activities.
Contractor and Supplier Management Plan (CSMP)	The Contractor and Supplier Management Plan (CSMP) is a document that outlines procedures for selecting, managing, and monitoring contractors and suppliers engaged in the ground-mounted solar PV project. The plan ensures that all parties comply with contractual, technical, health and safety, social, and environmental requirements throughout the project lifecycle.
Material Handling Plan (MHP)	Provides safe procedures for transporting, storing, and disposing of construction and hazardous materials (e.g., fuel, chemicals). It aims to minimize the risk of spills, accidents, and environmental contamination, while ensuring compliance with safety and legal standards.
Erosion Management Plan	An Erosion Management Plan should be developed prior to land preparation and civil works (including access road, drainage, TL tower footing and right of way; construction of Groundmounted PV and supporting facilities).
Drainage Management Plan	The Drainage Management Plan shall be implemented to outline strategies for managing surface water runoff, preventing localized flooding, protecting soil and water quality, and ensuring the integrity of adjacent infrastructure and ecosystems, particularly in areas surrounding the Paleran River and nearby agricultural land.
Emergency Preparedness and Response Plan	Details the procedures and responsibilities in case of emergencies (fire, oil spills, natural disasters, accidents). It includes early warning systems, evacuation plans, emergency contacts, training, and coordination with local responders. The plan ensures a rapid and effective response to protect people and the environment.

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Management Plan	Description
Air Quality Management Plan	An Air Quality Management Plan should be prepared prior mobilization of equipment, materials, workers and prior activity land Clearing, civil works and construction of Groundmounted PV & supporting facilities.
Traffic Management Plan	A Traffic Management Plan (TMP) shall be developed in accordance with Indonesian regulation and the applicable international standards adopted by the Project. The TMP is to outline the manner in which vehicular, plant and pedestrian movements will be managed on the Banyuwangi Ground mounted PV Project during construction, as well as the control measures in place to manage risks associated with Project-related traffic.
Noise and Vibration Management Plan	A Noise and Vibration Management Plan should be developed prior to prior activity land Clearing, civil works and construction of Groundmounted PV & supporting facilities.
Waste Management Plan	A Waste Management Plan should be developed in accordance with Indonesia regulation and coordination with licensed hazardous waste agency (for transport and disposal facility). Including Wastewater Management Plan (WMP) that outlines strategies and procedures for handling wastewater generated from project activities to prevent pollution and comply with environmental regulations.
Asbestos Management Plan	An Asbestos Management Plan should be developed in accordance with Indonesia regulation and the Asian Infrastructure Investment Bank (AIIB) Environmental and Social Codes of Practice (ESCOPs), including procedures for safe handling, storage, transportation, and disposal, which covers asbestos identification, risks, control measures procedures, responsibilities, worker requirements for conducting asbestos work, air monitoring; and requirement of communication of the plan to workers and other relevant stakeholders.
Land Acquisition and Livelihood Restoration Plan (LALRP) / Resettlement Study	This ESMP identifies the need for the development and implementation of measures to manage Project land acquisition and mitigate its adverse impact (potential economic displacement). It is expected that the PT PLN Indonesia Power will develop LALRP adhering to the AIIB ESF requirement for the Banyuwangi Ground mounted Solar PV Project and be implemented consistently.
Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism / Procedure (GRM)	A Stakeholder Engagement Framework will be developed, to include: ▪ Guidelines and recommendations to conduct future engagement, including consultation with project DMS Das, relevant community groups, relevant government institution in managing impact from the Project pre-construction, construction, and operation.

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Management Plan	Description
	▪ Provides a framework to manage grievances which can be accessed by all groups of community; and ▪ Recommendation for regular monitoring of stakeholder engagement and grievance resolutions.
Labour Management Plan (include HR policy, retrenchment plan for post operation purposes, Local Procurement plan, and worker accommodation management plan)	A code of conduct or management plan for labour and working condition shall be developed in accordance with Indonesia regulation and the applicable international standards adopted by the Project to manage impact from non-local workforce presence to community health and social structure.
Occupational Health and Safety (OHS) Plan	An Occupational Health and Safety (OHS) Plan shall be developed in accordance with Indonesia regulation and the applicable international standards adopted by the Project. The OHS Plan is a comprehensive approached aimed at ensuring the safety and health of employees within the Project working environment, particularly during the construction phase. The Plan sets out processes and practices to help prevent injuries, illnesses, and fatalities on the job. Its emphasis in on proactive measures to identify and mange workplace hazards, thereby reducing risks.
Cultural Heritage Management Plan (CHMP)	A CHMP will be developed as Cultural Heritage objects are identified in and around the project area. The CHMP is developed in accordance with national procedures and international safeguard requirements, to manage and mitigate impacts on the CH and its associated activities. The CHMP also contains the steps for stakeholder consultation to be undertaken and documentation of the process.
Worker Accommodation Management Plan (WAMP)	A detailed plan for designing, operating, and maintaining worker accommodation facilities (camps, barracks, and messes) throughout the project lifecycle. The WAMP ensures decent living conditions—room space, sanitation, clean water, security, and waste management—while minimizing social impacts on the surrounding community.
Biodiversity Management Plan (BMP) (including the PCFM).	Sets out actions to avoid, minimize, and offset impacts on biodiversity and natural habitats. It includes species protection, habitat restoration, and monitoring strategies. If Post-construction Fatality Monitoring (PCFM) is undertaken, the BMP integrates specific protection and buffer measures aligned with conservation goals.

This ESMP is a live document and will be updated periodically, for example, depending on Project execution and performance.

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Appendix A Applicable Indonesia Laws and Regulations for the Projects

Table A-1 Indonesia laws and regulation on environmental and social

Aspect	Indonesia Law and Regulation	Key Regulatory Requirements for Project Compliance
Amdal	• Law No. 32 of 2009 on Environmental Protection and Management • Law No. 11 of 2020 on Job Creation (Omnibus Law) • Government Regulation No. 5 of 2021 regarding the Implementation of risk-Based business licensing • Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management • Ministry of Environment and Forestry Regulation No. 4 of 2021 on Types of Business Plans and/or Activities that Require and Environmental Impact Assessment • Ministry of Environment Regulation No. 16 of 2012 on Guideline for the Preparation of Environmental Document • Ministry of Environment Regulation No. 17 of 2012 on Guideline for Community Involvement in the Process of Environmental Impact Assessment and Environmental Permit	Determine if AMDAL or UKL-UPL is required; ensure E&S assessments include stakeholder participation and impact management aligned with risk-based licensing.
Spatial Plan	• Law No. 26 of 2007 on Spatial Planning • Government Regulation No. 15 of 2010 on Implementation of Spatial Planning • Government Regulation No. 13 of 2017 on Amendment of Government Regulation No. 26 of 2008 on National Spatial Planning • Ministry of Agrarian Affairs and Spatial Planning/Head of the National Land Agency No. 1589/SK-HK.02.01/XII/2021 on protected rice fields • Banyuwangi Regency Regional Regulation (PERDA) No. 8/2012 on Banyuwangi Regency Spatial Plan Year 2012 - 2032	Confirm project location compliance with local and national spatial zoning, including protection of rice fields and buffer zones.
Energy	• Ministry of Energy and Mineral Resources Regulation No. 53 of 2018 on the Amendment of Ministry Regulation No. 50 of 2017 on the Use of Renewable Energy Sources for Power Supply • Ministry of Energy and Mineral Resources Regulation No. 4 of 2020 on the Second Amendment of Ministry Regulation No. 50 of 2017 on the Use of Renewable Energy Sources for Power Supply	Align with national targets for renewable energy integration and power purchase agreements.

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Aspect	Indonesia Law and Regulation	Key Regulatory Requirements for Project Compliance
Electricity	• Law No. 30 of 2009 on electricity • Ministry of Energy and Mineral Resources Regulation No. 10 of 2021 on Electrical Safety • Presidential Regulation No. 112 of 2022 on Accelerating the Development of Renewable Energy for the Provision of Electric Power	Ensure compliance with power generation licensing, technical safety standards, and procurement schemes.
Transmission Line and Electromagnetic Field	• Ministry of Energy and Mineral Resources Regulation No. 13 of 2021 on Free Space and Minimum Clearance of Electricity Transmission Line and Compensation for Land, Building, and/or Vegetation Under Free Space of the Electricity Transmission Line • SNI 04-6950-2003 on High Voltage Transmission Line and Extra High Voltage Transmission Line – Threshold Value of Electric and Magnetic Field • SNI 04-6918-2002 on Free Space and Minimum Clearance of Electricity Transmission Line	Maintain minimum clearance zones, EMF exposure below threshold, and ensure compensation for affected land/buildings.
Greenhouse Gas (GHG)	• Ministry of Energy and Mineral Resources Decree No. 163.K/HK.02/MEM.S/2021 on Determination of the GHG Emission Factor of the Electrical System	Apply relevant emission factors in GHG estimation and reporting for project emissions.
Water	• Government Regulation No. 43 of 2008 on Groundwater • Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management Appendix VI for National Water Quality Standards • Minister of Public Works Regulation No. 14/PRT/M/2010 on Minimum Service Standards in Public Works and Spatial Planning • Ministry of Environment Regulation No. 1 of 2010 on Procedure for Water Pollution Control • Minister of Health (MoH) Regulation No. 2 Year 2023 regarding Implementing Regulation for Government Regulation No. 66 Year 2014 concerning Environmental Health	Ensure wastewater treatment meets standards; protect groundwater and surface water quality.
Waste	• Law No. 18 of 2008 on Waste Management • Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management • Ministry of Public Works Regulations No. 3 of 2013 on Provision on Waste Facilities and Infrastructures on Household and Household-like Waste Management • Ministry of Environment and Forestry Regulation No. 68 of 2016 on Domestic Wastewater Quality Standard	Develop and implement hazardous and non-hazardous waste management procedures including emergency protocols.

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Aspect	Indonesia Law and Regulation	Key Regulatory Requirements for Project Compliance
	• Ministry of Environment Regulation No. 33 of 2009 on Procedure for Restoring Land Contaminated by Hazardous Waste • Ministry of Environment Regulation No. 14 of 2013 on Hazardous Waste Symbols and Labels • Ministry of Environment and Forestry Regulation No. P.74 of 2019 on the Hazardous Waste Management Emergency Program • Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management Appendix IX for Hazardous Waste List • Ministry of Environment and Forestry Regulation No. 6 of 2021 on Guidelines and Requirements for Hazardous Waste Management	
Hazardous Material	• Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management Appendix IX for List of Hazardous Wastes from Unspecific Sources • Government Regulation No. 74 of 2001 on Hazardous Material Management • Ministry of Environment Regulation No. 3 of 2008 on the Guidelines for Hazardous Material Symbols and Labels • Regulation Ministry of Manpower No. 3 of 1985 regarding Occupational Health and Safety the Use of Asbestos	Ensure proper hazardous wastes list, labelling, storage, and handling of hazardous materials in compliance with national labelling and safety requirements.
Air Quality	• Government Regulation No. 22 of 2021 on Implementation of Environmental Protection and Management Appendix VII for Ambient Air Quality Standards	Monitor and manage air emission to meet ambient air quality standards.
Noise	• Ministry of Environment Decree No. 48 of 1996 on Noise Quality Standards	Ensure construction and operational noise levels remain within permissible thresholds.
Vibration	• Minister of Environmental Decree No. 49 of 1996 on the Vibration Level Standard	Control construction-induced vibrations to prevent impact on nearby structures and communities.
Road and Traffic	• Law No. 22 of 2009 on Traffic and Road Transport	Mitigate traffic impacts from construction activities; apply safety protocols.
Biodiversity	• Law No. 5 of 1990 on Conservation of Biological Resources and Ecosystems • Law No. 5 of 1994 on Ratification on the United Nations Convention on Biological Diversity	Avoid impacts on protected species; comply with protected area regulations and permit requirements.

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Aspect	Indonesia Law and Regulation	Key Regulatory Requirements for Project Compliance
	• Government Regulation No. 68 of 1998 on Natural Protection Area and Natural Conservation Area • Government Regulation No. 8 of 1999 on Utilization of Wild Plants and Animals • Government Regulation No. 45 of 2004 on Forest Conservation • Government Regulation No. 60 of 2007 on Fish Resources Conservation • Government Regulation No. 60 of 2009 on Amendment of Government Regulation No. 45 of 2004 on Forest Conservation • Government Regulation No. 28 of 2011 on Natural Reserve and Natural Conservation Area Management • Government Regulation No. 108 of 2015 on Amendment of Government Regulation No. 28 of 2011 on Natural Reserve and Natural Conservation Area Management • Presidential Decree No. 43 of 1978 on Ratification of Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora • Presidential Decree No. 32 of 1990 on Protected Area Management • Ministry of Environment and Forestry Regulation No. 94 of 2016 on Invasive Species • Ministry of Environment and Forestry Regulation No. P.106/MENLHK/SETJEN/KUM.1/12/2018 on Second Amendments to the Ministry of Environment and Forestry Regulation No. P.20/MENLHK/SETJEN/KUM.1/6/2018 on Types of Protected Plants and Animals.	
Natural Resources	• Law No. 05 of 1990 on Natural Resources Conservation and its Ecosystems • Law No. 41 of 1999 on Forestry • Law No. 7 of 2004 on Water Resources • Law No. 37 of 2014 on Land and Water Conservation • Government Regulation No. 10 of 2010 on Procedures for Changing of Forest Use and Function • Presidential Decree No. 26 of 1989 on Ratification of Convention of Protection of the World Cultural and Natural Heritage	Obtain necessary permits for land use changes; protect natural resources and ensure sustainable usage.
Land Acquisition	• Law No. 2 of 2012 on Land Acquisition for Development of Public Interest • Government Regulation No. 19 of 2021 on Implementation of Land Acquisition for Development of Public Interest	Follow legal procedures for land acquisition, compensation, and handling social impacts.

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Aspect	Indonesia Law and Regulation	Key Regulatory Requirements for Project Compliance
	• President Regulation No. 62 of 2018 on Handling of Social Impacts in the Context of Provision of Land for National Development • Presidential Regulation No. 68 of 2018 on Handling of Social Impacts of Granting Land for National Development • President Regulation No. 88 of 2017 on Settlement of Land Tenure in Forest Areas • Ministry of Agrarian and Spatial Planning/ Head of National Land Agency Regulation No. 6 of 2015 on Amendments to the Head of National Land Agency Regulation No. 5 of 2012 on Technical Guideline for Land Acquisition Implementation • Ministry of Energy and Mineral Resources Regulation No. 13 of 2021 on Free Space and Minimum Clearance of Electricity Transmission Line and Compensation for Land, Building, and/or Vegetation Under Free Space of the Electricity Transmission Line	
Corporate Social Responsibility (CSR)	• Law No. 40 of 2007 on Limited Company • Government Regulation No. 47 of 2012 on Social and Environmental Responsibility of Limited Liability Companies • Regulation of the Minister of State-Owned Enterprises No. PER-08/MBU/2013 of 2013 on the Fourth Amendment to the Minister of State-Owned Enterprises Regulation No. PER-05/MBU/2007 on the Partnership Program of State-Owned Enterprises with Small Businesses and the Community Development Program	Implement CSR programs in line with corporate responsibility obligations.
Human Right	• Law No. 39 of 1999 on Human Rights	Respect human rights principle in all project phases, particularly land and labor.
Labor	• Law No. 1 of 1970 on Occupational Safety • Law No. 12 of 2003 on Labor • Law No. 11 of 2020 on Job Creation (Omnibus Law) • Ministry of Manpower and Transmigrations Regulation No. 19 of 2012 on Conditions for Outsourcing Part of Work Execution to Other Companies • Government Regulation Number 35 of 2021 on Fixed-Term Employment Agreement (PKWT) in Indonesia • Government Regulation Number 36 of 2021 on non-wage income, mandatory THR, optional incentives, bonuses, facility, and service money • Minister of Manpower and Transmigration Regulation Number PER.32/MEN/XII/2008	Ensure fair labor practices, worker protection, and regulatory compliance in employment conditions.

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Aspect	Indonesia Law and Regulation	Key Regulatory Requirements for Project Compliance
	Procedures for the Formation and Membership Structure of Bipartite Cooperation Institutions • Ministry of Manpower and Transmigrations Decree No. 234 of 2003 on Duty Roster in Energy and Mineral Resources Business Sector	
Child Protection	• Law Number 16 of 2019 on Amendments to Law Number 1 of 1974 concerning Marriage. • Law number 35 of 2014 on the child protection law in the context of child marriage	Prohibit child labor and ensure project activities do not negatively affect children's rights.
Occupational, Health and Safety	• Law No. 1 of 1970 on Occupational Health and Safety • Government Regulation No. 50 of 2012 on Implementation of Occupational Health and Safety Management Systems • Ministry of Manpower and Transmigrations Regulation No. 1 of 1980 on Occupational Health and Safety for Construction • Ministry of Manpower Regulation No. 5 of 1996 on Occupational Health and Safety Management System • Ministry of Manpower Regulation No. 5 of 2018 on Occupational Health and Safety of Work Environment	Implement OHSMS and construction safety standards; monitor workplace safety performance.
Cultural Heritage	• Law No.11 of 2010 on Cultural Heritage	Identify and protect cultural heritage sites and intangible assets affected by the project.

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Appendix B Public Consultation Summary

Table B-1 Summary of Public Consultation Undertaken for the Banyuwangi Solar PV Power Plant Development Project

Date & Location	Participant	Information Provided	Stakeholder Feedback (Issue, Concern, Expectation)	Project Response
Banyuwangi Solar PV PP Project				
30th March 2023 – Kalipuro Village Hall	Office of Energy and Mineral Resources of East Java Province. Office of Estate Crop of East Java Province Environmental Office of Banyuwangi Regency Local Development Planning of Banyuwangi Regency Department of Public Work and Spatial Planning of Banyuwangi Regency Office of Workforce, Transmigration, and Industry of Banyuwangi Regency. Department of Transportation of Banyuwangi Regency. Department of Health of Banyuwangi Regency. District Civil Service Police Unit (Satpol PP) of Banyuwangi Regency. Head of Kalipuro Sub-District Head of Military Command of Kalipuro Sub-District Head of Police Command of Kalipuro Sub-District PTPN XII Wangkal Plantation	The planning of developing the Banyuwangi Solar PV Power Plant Project (Project owner, location, timeline, and planned activities)	Does the construction of the Banyuwangi Solar PV Project will have effect on the existing access road located within the plantation area (PTPN XII). Who will be responsibility for the regular maintenance of the power plant facilities? Will the electricity produce by the Project be distributed to the nearby community? If so, how will it be different from PLN scheme? Is there any impact related to radiation? Related to access road, the Project should communicate to the local community regarding potential usage of the same access road for Project and the community.	The Project technical design will consider the input from the community, particularly regarding the community access road. The Project will undertake a consultation to the relevant communities to seek feedback on the access road. The Project is a Solar PV Power Plant, the source of energy is from the Sun. The heat will be absorbed through the Solar module and then converted into electrical energy. Project environmental and social impacts will be addressed under the AMDAL. The Project will consult with relevant community regarding the usage of existing access road.

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Date & Location	Participant	Information Provided	Stakeholder Feedback (Issue, Concern, Expectation)	Project Response
	Local NGOs of Banyuwangi area Head of Kalipuro Village Head of Bulusan Village Head of Klatak Village Representative of Kalipuro Village Residents Representative of Bulusan Village Residents Representative of Klatak Village Residents.			

Source: AFRY, 2023

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Appendix C Biodiversity

Appendix C-1 KBAs within 50 km from Banyuwangi Site

KBA Name	KBA Criteria	Area (Ha)	Distance to The Project	Species Triggered
Bali Barat[81]	IBA & AZE	85,187	± 4 km	Critically Endangered Species Acridotheres tertius, Leucopsar rothschildi Endangered Species Sturnus melanopterus Vulnerable Species Leptoptilos javanicus, Mycteria cinerea, Padda oryzivora Least Concern Species Megalaima armillaris, Seicercus grammiceps, Stachyris melanothorax
Baluran[82]	IBA	25,064	± 24 km	Endangered Species Nisaetus bartelsi, Sturnus melanopterus Vulnerable Species Leptoptilos javanicus, Padda oryzivora, Pavo muticus Least Concern Species Arborophila javanica, Macronous flavicollis, Pycnonotus bimaculatus, Seicercus grammiceps, Stachyris melanothorax
Gunung Ijen[83]	IBA	-	± 20 km	Endangered Species Nisaetus bartelsi Vulnerable Species Arborophila orientalis, Otus angelinae, Pavo muticus Least Concern Species Aethopyga eximia, Arborophila javanica, Ducula lacernulata, Enicurus velatus, Hypsipetes virescens, Lophozosterops javanicus, Macronous flavicollis, Megalaima armillaris, Pericrocotus miniatus, Ptilinopus porphyreus, Pycnonotus bimaculatus, Rhipidura euryura, Seicercus grammiceps, Serinus estherae, Stachyris melanothorax, Stachyris thoracica

[81] Key Biodiversity Areas Partnership. 2023. Key Biodiversity Areas factsheet: Bali Barat. Source: https://www.keybiodiversityareas.org/site/factsheet/15895
[82] Key Biodiversity Areas Partnership. 2023. Key Biodiversity Areas factsheet: Tahura R Soerjo. Source: https://www.keybiodiversityareas.org/site/factsheet/15892
[83] Key Biodiversity Areas Partnership. 2023. Key Biodiversity Areas factsheet: Gunung Kawi- Kelud. Source: *https://www.keybiodiversityareas.org/site/factsheet/15881*

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KBA Name	KBA Criteria	Area (Ha)	Distance to The Project	Species Triggered
Pantai Raung[84]	IBA	113,957	± 24 km	Endangered Species Nisaetus bartelsi Vulnerable Species Arborophila orientalis, Pavo muticus Least Concern Species Ducula lacernulata, Serinus estherae,

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[84] Key Biodiversity Areas Partnership. 2023. Key Biodiversity Areas factsheet: Pantai Timur Surabaya. Source: *https://www.keybiodiversityareas.org/site/factsheet/15884*

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Appendix C-2 List of potential endemic and restricted bird species inhabited within EBA

Common Name	Species Name	IUCN Category	Indonesia Protection
Java and Bali Forest			
Chestnut-bellied Partridge	Arborophila javanica	LC	NP
Pink-headed Fruit-dove	Ptilinopus porphyreus	LC	NP
Javan Scops-owl	Otus angelinae	VU	P
Javan Hawk-eagle	Nisaetus bartelsi	EN	P
Flame-fronted Barbet	Psilopogon armillaris	LC	P
Sunda Minivet	Pericrocotus miniatus	LC	NP
White-bellied Fantail	Rhipidura euryura	LC	P
Rufous-tailed Fantail	Rhipidura phoenicura	LC	P
Javan Tesia	Tesia superciliaris	LC	NP
Pygmy Tit	Psaltria exilis	LC	P
Javan Grey-throated White-eye	Heleia javanica	LC	P
White-breasted Babbler	Stachyris grammiceps	NT	P
Crescent-chested Babbler	Cyanoderma melanothorax	LC	NP
Javan Fulvetta	Alcippe pyrrhoptera	LC	NP
Sunda Forktail	Enicurus velatus	LC	NP
White-flanked Sunbird	Aethopyga eximia	LC	NP
Javan Coastal Zone			
Javan Lapwing	Vanellus macropterus	CR	P
Javan White-eye	Zosterops flavus	EN	P
Javan Coucal	Centropus nigrorufus	VU	P
Javan Plover	Charadrius javanicus	LC	P

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Appendix C-3 List of potential species conservation of significance inhabited Banyuwangi site and vicinity

Common Name	Species Name	Indonesia name	Source			IUCN Category	Indonesia Protection	Remark
			Form KA	IUCN	Scoping visit			
Flora								
Teak	*Tectona grandis*	Jati	v	v	v	EN	NP	introduce
Mammals								
Sunda Pangolin	*Manis javanica*	Trenggiling		v		CR		
Javan Slow Loris	*Nycticebus javanicus*	Kukang jawa		v		CR		Endemic
Long-tailed Macaque	*Macaca fascicularis*	Monyet Ekor Panjang		v	v	EN		
Large Flying-fox	*Pteropus vampyrus*	Kalong Besar		v		EN		Migrant
Thick-tailed Shrew	*Crocidura brunnea*	Celurut ekor tebal		v		LC		Endemic
Canut's Horseshoe Bat	*Rhinolophus canuti*	Kelelawar tapal kuda Canut	v			VU		Endemic
Javan Tailless Fruit Bat	*Megaerops kusnotoi*	Kelelawar buah tak berekor jawa		v		VU		Endemic
Birds								
Javan Blue-banded Kingfisher	*Alcedo euryzona*	Raja-udang kalung-biru		v		CR		Endemic
Javan Pied Starling	*Gracupica jalla*	Jalak Jawa		v		CR		Endemic
Javan Lapwing	*Vanellus macropterus*	Trulek jawa		v		CR		Endemic
Javan White-eye	*Zosterops flavus*	Kacamata Jawa		v		EN		
Greater Green Leafbird	*Chloropsis sonnerati*	Cica-daun Besar		v		EN		
Black-winged Myna	*Acridotheres melanopterus*	Jalak putih		v		EN		
Brown-cheeked Bulbul	*Alophoixus bres*	Empuloh Janggut		v		EN		
Javan Coucal	*Centropus nigrorufus*	Bubut Jawa		v		VU		Endemic
Sunda minivet	*Pericrocotus miniatus*	Sepah gunung		v		LC		Endemic
Zappey's Flycatcher	*Cyanoptila cumatilis*	Sikatan Cina		v		NT		Migrant
Sacred Kingfisher	*Todiramphus sanctus*	Cekakak suci		v		LC		Migrant
Chestnut-headed Bee-eater	*Merops leschenaulti*	Kirik-kirik senja		v		LC		Migrant
Chestnut-winged Cuckoo	*Clamator coromandus*	Bubut-pacar jambul		v		LC		Migrant
Indian Cuckoo	*Cuculus micropterus*	Kangkong India		v		LC		Migrant
Banded Bay Cuckoo	*Cacomantis sonneratii*	Wiwik Lurik		v		LC		Migrant
Plaintive Cuckoo	*Cacomantis merulinus*	Wiwik kelabu		v		LC		Migrant
Horsfield's Bronze-cuckoo	*Chalcites basalis*			v		LC		Migrant

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Common Name	Species Name	Indonesia name	Source		Scoping visit	IUCN Category	Indonesia Protection	Remark
			Form KA	IUCN				
Violet Cuckoo	*Chrysococcyx xanthorhynchus*	Wiwik Ungu		v		LC		Migrant
Western Koel	*Eudynamys scolopaceus*	Tuwur Asia		v		LC		Migrant
Javan Kingfisher	*Halcyon cyanoventris*	Cekakak Jawa	v	v		LC	NP	EJB
Javan Grey-throated White-eye	*Heleia javanica*	Opior Jawa	v			LC		Endemic
Black-banded Barbet	*Psilopogon javensis*	Takur tulung-tumpuk	v			NT		Endemic
Crescent-chested Babbler	*Cyanoderma melanothorax*	Tepus pipi-perak		v		LC		Endemic
Herpetofauna								
Java Flying Frog	*Rhacophorus margaritifer*	Katak Terbang Jawa		v		LC		Endemic
Common Flying Dragon	*Draco volans*	Cekibar		v		LC		EJB
Insect								
Red Glider Dragonfly	*Tramea transmarina*	Capung Merah		v		LC		Migrant
Gossamer Damselfly	*Ischnura aurora*	Capung		v		LC		Migrant
Painted Lady	*Vanessa cardui*	Kupu-kupu warna warni		v		LC		Migrant
Baron Dragonfly	*Anax papuensis*	Capung		v		LC		Migrant

Source: AFRY, 2023

Appendix C-4 List of Invasive species in Indonesia based on GISD

Group	Species	Habitat	Status
Animalia	*Anoplolepis gracilipes*	Terrestrial	Native to Indonesia
Animalia	*Cervus timorensis russa*	Terrestrial	Native to Indonesia
Animalia	*Cipangopaludina chinensis*	Freshwater	Native to Indonesia
Animalia	*Columba livia*	Terrestrial	Native to Indonesia
Animalia	*Oreochromis mossambicus*	Freshwater	Introduced
Animalia	*Pomacea canaliculata*	Freshwater	Introduced
Animalia	*Pterygoplichthys disjunctivus*	Freshwater	Introduced
Animalia	*Pterygoplichthys multiradiatus*	Freshwater	Introduced
Animalia	*Pterygoplichthys pardalis*	Freshwater	Introduced
Animalia	*Pterygoplichthys spp.*	Freshwater	Introduced

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Group	Species	Habitat	Status
Animalia	*Pycnonotus jocosus*	Terrestrial	Native to Indonesia
Animalia	*Python bivittatus*	Terrestrial	Native to Indonesia
Animalia	*Rattus exulans*	Terrestrial	Native southeast Asia
Animalia	*Scyphophorus acupunctatus*	Terrestrial	Introduced
Animalia	*Viverricula indica*	Terrestrial	Native to Indonesia
Animalia	*Xenopus laevis*	Brackish	Introduced
Animalia	*Xylosandrus compactus*	Terrestrial	Native to Indonesia
Animalia	*Xylosandrus mutilatus*	Terrestrial	Native to Asia
Plantae	*Acacia confusa*	Terrestrial	Introduced
Plantae	*Alternanthera philoxeroides*	Terrestrial	Introduced
Plantae	*Angiopteris evecta*	Terrestrial	Native to Indonesia
Plantae	*Austroeupatorium inulifolium*	Terrestrial	Introduced
Plantae	*Chromolaena odorata*	Terrestrial	Introduced
Plantae	*Epipremnum pinnatum*	Terrestrial	Native to Indonesia
Plantae	*Lespedeza cuneata*	Terrestrial	Native to Indonesia
Plantae	*Leucaena leucocephala*	Terrestrial	Introduced
Plantae	*Macfadyena unguis-cati*	Terrestrial	Introduced
Plantae	*Merremia tuberosa*	Terrestrial	Introduced
Plantae	*Mikania micrantha*	Terrestrial	Introduced
Plantae	*Mimosa pigra*	Terrestrial	Introduced
Plantae	*Myriophyllum aquaticum*	Terrestrial	Introduced
Plantae	*Neyraudia reynaudiana*	Terrestrial	Native to Indonesia
Plantae	*Nypa fruticans*	Terrestrial	Native to Indonesia
Plantae	*Psidium guajava*	Terrestrial	Introduced
Plantae	*Syzygium cumini*	Terrestrial	Native to Indonesia
Plantae	*Verbena brasiliensis*	Terrestrial	Introduced

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Appendix C-5 List of observed flora species

No	Family	Scientific Name	English Name	Local Name	Transect				Habitat/Landcover				Conservation status			Endemicity
					TB1	TB2	TB3	TB4	PF	SH	MP	AF	IUCN	CITES	P.106	
1	Anacardiaceae	*Anacardium occidentale*	Cashew nut	jambu monyet			v		v				LC			
2	Anacardiaceae	*Mangifera indica*	Mango	mangga	v		v	v	v				DD			
3	Annonaceae	*Annona muricata*	Soursop	sirsak	v		v		v				LC			
4	Annonaceae	*Polyalthia longifolia*	False ashoka	glodokan tiang			v		v							
5	Apocynaceae	*Calotropis gigantea*	Crown flower	biduri	v	v		v	v	v						
6	Arecaceae	*Arenga pinnata*	Sugar palm	aren				v	v							
7	Arecaceae	*Cocos nucifera*	Coconut tree	kelapa			v	v	v							
8	Bromeliaceae	*Ananas bracteatus*	Pineapple	nanas merah	v				v							
9	Cactaceae	*Hylocereus polyrhizus*	Dragon fruit	Buah naga	v				v							
10	Caricaceae	*Carica papaya*	Papaya	pepaya	v				v				DD			
11	Dioscereaceae	*Dioscera hispida*	Indian three-leaved yam	gadung	v			v	v							
12	Dipterocarpaceae	*Dipterocarpus sp*			v	v			v	v						
13	Muntingiaceae	*Muntingia calabura*	Jamaican cherry	kersen	v				v				LC			
14	Euphorbiaceae	*Manihot esculenta*	Bitter cassava	singkong			v	v	v							
15	Fabaceae	*Albizia chinensis*	Chinese albizia	sengon		v		v		v						
16	Fabaceae	*Gliricidia sepium*	Mexican lilac	gamal	v		v		v				LC			
17	Fabaceae	*Parkia speciosa*	Stink bean	pete				v	v				LC			
18	Fabaceae	*Sesbania grandiflora*	Vegetable hummingbird	turi				v	v							
19	Fabaceae	*Tamarindus indica*	Tamarind	Asam	v				v				LC			
20	Gnetaceae	*Gnetum gnemon*	Gnemon tree	melinjo			v		v				LC			

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No	Family	Scientific Name	English Name	Local Name	Transect			Habitat/Landcover					Conservation status			Endemicity
					TB1	TB2	TB3	TB4	PF	SH	MP	AF	IUCN	CITES	P.106	
21	Lamiaceae	*Gmelina arborea*	White teak	gmelina	v			v	v							
22	Lamiaceae	*Tectona grandis*	Teak	jati				v	v				EN			
23	Lauraceae	*Persea americana*	Avocado	alpukat	v		v		v							
24	Malvaceae	*Ceiba pentandra*	Kapok tree	kapuk	v			v	v				LC			
25	Meliaceae	*Azidirachta indica*	Neem tree	mimba		v				v						
26	Meliaceae	*Swietenia mahagoni*	Mahogany	mahoni	v	v			v	v						
27	Moraceae	*Artocarpus altilis*	Breadfruit	sukun	v				v							
28	Moraceae	*Artocarpus heterophyllus*	Jackfruit	nangka			v		v				LC			
29	Moraceae	*Ficus sp*	Fig			v				v						
30	Moraceae	*Streblus asper*	Siamese rough bush	serut	v				v				LC			
31	Musaceae	*Musa acuminata*	Banana	pisang			v		v							
32	Myrtaceae	*Psidium guajava*	Guava	jambu biji	v		v	v	v				LC			
33	Myrtaceae	*Syzygium cumini*	Plum tree black	Juwet	v			v	v				LC			
34	Nyctaginaceae	*Bougainvillea sp*	Paper flower	Bunga kertas	v				v							
35	Poaceae	*Bambusa sp*	Bamboo tree	Bambu	v		v		v							
36	Poaceae	*Saccharum officinarum*	Sugarcane	tebu	v	v			v	v						
37	Rubiaceae	*Coffea arabica*	Coffee	kopi			v	v	v							
38	Sapotaceae	*Manilkara zapota*	Sapodilla	sawo	v				v				LC			
39	Solanaceae	*Capsicum frutescens*	Bird pepper	cabe rawit				v	v				LC			
40	Solanaceae	*Solanum melongena*	Eggplant	terong ungu	v				v							
41	Verbenaceae	*Lantana camara*	Tickberry	tembelekan	v	v			v	v						

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Note:
- TB1, TB2, TB3 and TB4 are finding location based on survey area
- PF = Plantation Forest, SH = Shrub, MP = Mix Plantation and AF = Agricultural Field
- LC = Least Concern, DD = Data Deficient, VU = Vulnerable, EN = Endangered, and CR = Critically endangered based on IUCN Red List
- P.106 = Protected Species based on Government Regulation Number 106 of 2018 regarding List of Protected Species

Appendix C-6 List of observed flora with bioprospection potential

Family	Scientific Name	Local Name	Uses
Anacardiaceae	*Mangifera indica*	Mangga	Mango is cultivated for the fruit which can be eaten in 3 distinct ways, depending largely on the cultivar: unripe (mature green, very popular in Thailand and the Philippines), ripe (the common way to enjoy mango throughout the world), and processed (at various stages of maturity, in the form of pickles or chutneys, dried slices, canned slices in syrup, juice, puree or paste, etc.). The green fruit is also used to flavour fish and meat dishes in the same way as tamarind and other sour fruits. Seed kernels form a by-product of processing; they can be used as feed for cattle and poultry. In India the kernels are also important as a famine-food, but the astringency must be removed by boiling, roasting or soaking the kernels for a long time. Young leaves are eaten fresh or cooked as a vegetable. Dried flowers or bark and decoctions of the kernels serve as astringents in traditional medicine. Extracts of unripe fruit and of bark, stems and leaves have shown antibiotic activity. The bark can be used as a yellowish-brown dye for silk. The wood is used as machang, e.g. for indoor construction; it is strong, hard and easy to work but it must be treated with preservatives when used in construction and outdoor applications. It makes excellent charcoal and is also used to culture mushrooms.
Anacardiaceae	*Anacardium occidentale*	mete	Fruit - raw or cooked. Juicy and refreshing, though they are a bit acidic and often have an astringency that can leave your mouth feeling furry. They are also somewhat fibrous. They can also be dried or sliced with other fruits. The fruit can also be lightly cooked to get rid of their astringency. A refreshing juice can be extracted from the fruit. Red fruits are superior to yellow fruits. The fruit is about 3cm long. It is about 8cm long. The leaves are febrifuge. They are used in west Africa in the treatment of malaria. In India and Africa, the leaves are used to treat toothache and gum problems. Because it grows well on poor sandy soils and near the coast, it has sometimes planted for erosion control. The fruits contain 45 - 47% oil which has high heat resistance. It is an excellent lubricant and is also used in varnishes, inks, termite proofing wood, insulating coatings etc.
Annonaceae	*Annona muricata*	Sirsak	Fruit - raw or cooked. Juicy and refreshingly acid. The fruit has a pineapple like aroma, but its subacid to acid flavour is unique and the pulp is very juicy and rich in vitamin A and C. Soursop is often used in traditional medicine. Research has shown that it is antimalarial, uterine stimulant, anticrustacean, antiparasitic, cytotoxic (acetogenins), cardiac depressant, antiamoebic, antibacterial, antifungal, hypertensive, spasmogenic, vasodilator, insecticide, smooth muscle relaxant. The plant contains isoquinoline alkaloids including reticuline. The seed contains

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Family	Scientific Name	Local Name	Uses
			galactomannan, sitosterol, stigmasterol and cholesterol. Soursop is suitable for intercropping between larger fruit trees like mango or avocado. When these achieve crown closure the sour sops can be removed. A powder of the dried leaves and sap from fresh ones are useful in destroying vermin.
Annonaceae	*Polyalthia longifolia*	False ashoka	The leaves are used for ornamental decoration during festivals. The tree is a focal point in gardens throughout India. The tree can be pruned into various shapes and maintained in required sizes. The flexible, straight, and light-weight trunks were once used in the making of masts for sailing ships. Thus, the tree is also known as the Mast Tree. Today, its wood is mostly used for manufacturing small articles such as pencils, boxes, matchsticks, etc. The oil of the seed has been confirmed to possess antioxidant, anti-lipooxygenase and antimicrobial (against various microbe strains) activities, among others.
Apocynaceae	*Calotropis gigantea*	biduri	The French name "mercure végétal" refers to its use as an alternative to mercury in the treatment of syphilis. Immigrants from India in South-East Asia use it widely, and the uses have thus spread. The leaves are applied as a poultice for sores, and the juice is dropped into deaf ears and sore eyes. The smoke of the burnt leaves is inhaled to treat ulcerations of the nose. The latex is dropped into teeth with caries and is applied to boils.
Arecaceae	*Arenga pinnata*	Sugar palm	The trees are sometimes planted to mark boundaries or to prevent landslides. In certain regions, dowry is paid in the form of a few sugar palm trees. The trunk consists of a soft starchy core with many tough fibers and a woody cylinder. The attractive black and yellow wood of the trunk is used for flooring, furniture, tool handles, and as a fuel wood of high calorific value. The trunk base is easily hollowed to obtain a durable barrel or a water conduit. The green peel of the unripe fruit is poisonous and causes serious skin reactions on contact because of the calcium oxalate crystals; it is sometimes used to protect fishponds from barefoot intruders. The pulped fruit in water brings fish to the surface. The seeds are favored by pigs and used to bait wild pigs; many toys in the villages used to be carved from the seeds. Other food products are starch, extracted from the pith of the trunk, which may be used to prepare specialty foods such as "bakso" (Indonesia), and the grubs of the palm beetle (Rynchophorus ferrugineus) which are reared on fallen stems and eaten raw, fried, or cooked. Young leaves, still white, are eaten in the same way as palm cabbage. Bees collect excellent honey from the flowers, and sweetmeat ("kolang kaling", Indonesia) is made by boiling the white endosperm of immature seeds with sugar. The production of these secondary foodstuffs is limited where tapping takes precedence. Products from fibrous material take second place after those derived from tapping. Fibers are recovered from the roots, the pith of the trunk and leaf stalks, but most important are the long black grey fibers ("ijuk", Indonesia) surrounding the trunk. The latter, although coarse, are extremely durable even in seawater and have frequently been used for cordage on ships, and as a cover to protect wooden poles in soil and seawater against worms and insects. "Ijuk" mattresses are laid on road beds along the coast to stop burrowing prawns from surfacing with their mud piles. The fiber is also used to make sieves, to construct roofs, to reinforce concrete; heavy duty brushes and brooms the world over bristle with "ijuk" fibers. "Ijuk" paint

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Family	Scientific Name	Local Name	Uses
			brushes clean and paint ship hulls in a single operation. The fine pulp occurring between the leaf sheaths used to be used for tinder and to caulk boats. Short ropes can be used as a portable fire lighter; the rope remains glowing in all weathers. Stout bristles between the thin fibers near the leaf bases have been used as pens and arrows. A bundle of these bristles makes a veritable torch, burning brighter when swung and producing a beam of light as the core burns deeper and glows more intensely. The bristles are sometimes used for burning as scent material. Fibers from the leaf stalks and roots are used for fishing-lines, snares, and fine matting. The roots growing from the base of the stem are sometimes cut into fibrous boards for orchid cultivation. The impressive leaves are also put to many uses. They serve to construct temporary shelters and the unfurling; still white leaves are used as hanging decorations for festivities. The leaflets are used in basketry, their stalks for brooms and sate sticks. Young leaflets may be eaten, but at a somewhat later stage they substitute for cigarette paper and serve as fastening ribbon. The large leaf stalks are used as firewood and to make walking sticks and musical instruments. Walking sticks can also be made from the inflorescence stalks.
Arecaceae	*Cocos nucifera*	Kelapa	For domestic oil extraction the fresh endocarp of mature fruits is grated and squeezed with hot water; for industrial production the endosperm is dried to copra and taken to the mill for oil extraction. High-grade oil is used for cooking or in the manufacture of margarine, shortening, filled milk, ice-cream, and confectioneries. Oil of lower grades is processed into soap, detergents, cosmetics, shampoos, paints, varnishes, and pharmaceutical products. Remnant fatty acids and alcohols and methyl esters find application as components of emulsifiers and surfactants. The presscake or copra meal is a good feed. Coconut milk or cream (Indonesia/Malaysia: "santan"; Philippines: "gata") pressed from freshly grated endosperm mixed with water has been a traditional ingredient in many Asian food and bakery products. It is now also marketed in pasteurized and homogenized canned or powdered form. After preparing coconut milk by boiling grated fresh coconut meat a presscake remains. In Java it is considered a delicacy, named "blondo" or "galendo". Skimmed milk powder, produced after boiling fresh coconut milk and removing the floating oil, contains 25% hydrolyzed starch and can be mixed with water to make a beverage. Protein can be separated by ultrafiltration and spray-dried into a white powder, which is very suitable for infant nutrition. Coconut skim milk is an essential ingredient of a gelatinous delicacy ("nata de coco") in the Philippines used in sweetened desserts, ice-cream, and confectionery. Shredded or thinly sliced and desiccated fresh coconut endosperm is a favourite side-dish and ingredient in many confectionery, bakery, and snack food products. Ball copra is an Indian speciality produced by slow drying, dehusking and shelling of the whole mature nut. It is used to prepare sweets offered during religious and cultural rites and in traditional medicine. The nut cavity is filled with water that tastes sweet when the coconut is young. Coconut water is now commercially preserved without altering its typical flavour. It can also be used in the production of "nata de coco", which is a gelatinous dessert produced by the action of bacteria on coconut water or diluted coconut milk, developed in the Philippines. It is a source of inexpensive growth hormone products for horticulture, such as the Cocogro developed in the Philippines. The tender, jelly-like endosperm of young coconuts is a

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Family	Scientific Name	Local Name	Uses
			delicacy consumed directly or grated and mixed with food. The haustorium or apple of germinating coconuts can be eaten fresh. The shell of the nut can be made into household utensils and decorated pots, converted into shell charcoal (suitable for activation) or used as fuel. Finely ground coconut shell is used as filler for resin glues and moulding powders. Green husks yield white coir (yellow fibres) for making ropes, carpets, mats, and geo-textiles. Brown coir from husks of mature fruits is used in brushes (long bristle fibres), mattresses, upholstery, and particle board (short fibres). Coir dust or coco peat is a component of potting mixtures (water-holding capacity of 700-900%), light building materials, thermal insulation, adhesives, and binders. A sweet sap containing about 15% sucrose is tapped from unopened inflorescences. It is a ERM Laporan Survei Keanekaragaman Hayati Darat – CAP 2 Cilegon 2019 54 refreshing toddy when consumed fresh and it transforms into a light alcoholic wine when fermented. A by-product of palm wine is vinegar. Boiling fresh sap yields palm syrup and sugar. Distillation of palm wine yields a potent arak. The leaves are used to thatch roofs (Indonesia: "atap"); the leaflets are plaited into mats, baskets, bags, and hats; immature leaflets are made into traditional decorations and small bags or containers for food; the midribs of the leaflets are formed into brooms. The palm heart, which consists of the white, tender tissues of the youngest, unopened leaves at the stem apex, is considered a delicacy. Young palms (3-4 years) have the heaviest palm heart, weighing 6-12 kg. The wood of old palms is very hard, but a freshly felled trunk can be sawn with a special tungsten carbide-tipped saw blade. Preservative treatment of sawn lumber is needed if it is to be used for construction or any outdoor use. Coconut wood is also suitable for furniture, household utensils and tool handles. Medicinal uses have been attributed to coconut. The roots are considered anti-pyretic and diuretic. Its decoctions are used against venereal diseases in Malay Peninsula while an infusion is used in Indonesia to treat dysentery. Milk of young coconut is diuretic, laxative, anti-diarrheic and counteracts the effects of poison. The oil is used to treat diseased skin and teeth and mixed with other medicines to make embrocation. The kernel of young fruit is mixed with other ingredients and rubbed on the stomach against diarrhoea. The kernel is prepared in Indo-China as a potion to treat ulcers of the skin and the nasal mucous membrane. Coconut palm has also an ornamental value. The palms' often slanting stems and graceful crowns bordering a white beach along a blue sea are hallmarks of the tropics which attract tourists.
Bromeliaceae	*Ananas comosus*	Nanas	The pineapple is best eaten fresh, although it can be cooked in a number of dishes. The fruits were canned as early as the end of the 19th Century in Hawaii and Singapore and to date the bulk of the crop is grown for canning and exported all over the world. The fruits are canned as slices, spirals, chunks, spears, titbits and cubes. The flesh adhering to the shell after peeling is scraped and made into pineapple crush or juice. The latter is also made by crushing the shell, core and bits ERM Laporan Survei Keanekaragaman Hayati Darat – CAP 2 Cilegon 2019 60 and pieces of flesh which could not be used as specified cuts. Pieces may be canned mixed with other fruits, e.g. rambutan in Thailand. The fruits are also made into jam or used for crystallized and glacé fruit. The by-products of canning can be used as cattle feed or to produce pineapple wine or vinegar. Organic acids such as citric, malic and ascorbic can be obtained from the fruit as well as from the plants. Pineapple

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Family	Scientific Name	Local Name	Uses
			proteases, used to tenderize meat, are obtained from the stems and fruits. In the Philippines and Taiwan the fibres from the leaves are woven into a fine pina cloth.
Cactaceae	*Hylocereus polyrhizus*	Dragon fruit	The fruit's texture is sometimes likened to that of the kiwifruit because of its black, crunchy seeds. The seed oil contains the fatty acids linoleic acid and linolenic acid.[14] Dragon fruit is used to flavor and color juices and alcoholic beverages, such as "Dragon's Blood Punch" and the "Dragotini".[15] The flowers can be eaten or steeped as tea.
Caricaceae	*Carica papaya*	Pepaya	The unripe green fruit is often eaten cooked due to its latex content. It is commonly eaten raw in Vietnam and Thailand. The ripe fruit of the papaya is usually eaten raw, without skin or seeds.[6] The black seeds of the papaya are edible and have a sharp, spicy taste.
Dioscoreaceae	*Dioscorea hispida*	Gadung	The tuber of *D. hispida* is the chief famine food of tropical Asia, as is *D. dumetorum* (Kunth) Pax for Africa. The tuber is poisonous because of a high content of the alkaloid dioscorine. Its preparation for food requires much time and skill and includes slicing, washing the fresh or boiled tuber in several changes of salt water, or in running water, and a final check on whether all poison has been removed. Starch extracted from the tubers can be used for culinary or industrial purposes, notably the manufacture of glucose. The poison in the tubers is often extracted and used as bait for animals or other devious purposes. It is also used for eliminating fish from shrimp pond cultures. The pounded tubers are sometimes used externally as an antiseptic, and a decoction is drunk to alleviate chronic rheumatism.
Euphorbiaceae	*Manihot esculenta*	singkong	Of the world production of cassava, 65% is used directly for human consumption, 20% for animal feed and the remaining 15% for starch and industrial uses. For human consumption, the storage roots are peeled and chopped and then boiled, steamed, fried or roasted, directly or after drying or fermenting. In SouthEast Asia, the use differs considerably between different countries. In Thailand, local use for human consumption is unimportant. Ninety-five per cent is exported, mainly for animal feed in European countries. The remainder is for local human consumption and industrial uses. In Indonesia, 60% of production is used for direct human consumption, 25% fresh and 35% after drying; 25% is used for starch production, most of which is for human food as kerupuk, cookies and other snacks. The remaining 15% is exported. In Malaysia, the starch industry uses about 90% of all cassava produced. The remaining 10% is used for animal feed. Only a very small proportion of local production is used directly for human consumption in Malaysia. The cassava produced in the Philippines is split equally between human consumption, animal consumption and starch production. In China, cassava is presently used mainly for industrial processing. Starch and monosodium glutamate are the traditional industrial products. With the improvement of cassava industrial technology, other products such as alcohol and starch-based sweeteners, e.g. glucose and fructose, have become more important. In Vietnam, the use of cassava for human consumption (actually 80% of the production) is decreasing because of the improvement of the rice supply. Presently about 10% of cassava production is processed into starch, the remaining 10% is for animal consumption. Throughout the region cassava leaves are used for human or animal consumption.

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Family	Scientific Name	Local Name	Uses
Fabaceae	*Albizia chinensis*	Sengon	The tree has an extensive root system and is planted for slope stabilization. As a fast growing, nitrogen-fixing tree legume, it is planted for soil improvement and remains important in the reforestation of degraded land. A gum of low quality is extracted from the bark. This has been mixed with other gums and used as an extender. The bark contains triterpenes which have spermicidal activity. An extract of the wood has repellent property to subterranean termites. The sapwood is white, the heartwood light to dark brown. The wood is light in weight, soft and not very durable. It is resistant to termite and other insects attack. Its use is limited to house building, light furniture, tea chests and veneers. In India, it is used for boat building. The tree produces low quality firewood.
Fabaceae	*Gliricidia sepium*	Gamal	Gliricidia is considered to be the most widely cultivated multipurpose tree after leucaena (Leucaena leucocephala (Lamk) de Wit). In former times it was mainly used as a shade tree in plantation crops, but more recently it has become a widely cultivated multipurpose tree integrated into several cropping systems, e.g. as a shade tree in tea, cocoa or coffee plantations, as live stakes to support black pepper, vanilla and yam (in West Africa), as a hedge and green manure crop in intercropping systems such as alley-cropping systems. It has also been planted to stabilize soil, to prevent erosion and to reclaim denuded land or land infested with Imperata cylindrica (L.) Raeuschel. In this last respect gliricidia has been found to be more effective than leucaena. The wood is often utilized as firewood, for charcoal production or as posts and farm implements, and locally for furniture, construction and railway sleepers. Gliricidia provides useful forage in the form of leaves, green stem and bark, and is commonly used to supplement poor quality, low protein roughage, especially in dry seasons when it may become a major source of feed for goats and cattle in dryland cropping areas. Its forage has been reported to be toxic to horses, but clear confirmation is lacking. Leaf meal can also be fed to poultry and rabbits. Flowers are a source of nectar for bees. Seeds, bark, leaves and roots may be used as a rodenticide and pesticide after fermentation. Gliricidia is often planted as an ornamental. The juice of the leaves, bark and roots is used as a traditional anti-dermatophyte to control eczema and to alleviate itches and wounds.
Fabaceae	*Parkia speciosa*	Stink bean	Parkia speciosa is a plant found abundantly in Southeast Asia. Its seeds and roots have long been used as a traditional medicine in the region to treat hypertension, diabetes, kidney pain, cancer, hepatalgia, oedema, nephritis, colic, cholera, and as an anthelmintic. Studies have shown its numerous beneficial pharmacological properties.
Fabaceae	*Sesbania grandiflora*	Turi	Flowers - raw or cooked. Added to salads, boiled as a potherb, fried or used in curries. Considered a delicacy in India. Rich in sugar and iron, with a flavour like mushrooms. The centre part of the flower is usually removed because it is very bitter. White flowers are generally preferred to red ones. The leaves are aperient and diuretic. Crushed leaves are applied as a poultice to sprains and bruises of all kinds, swellings, rheumatism, itching etc. A tea made from the leaves is believed to have antibiotic, anthelmintic, antitumor and contraceptive properties.Very fast growing, with an extensive root system that fixes atmospheric nitrogen, the plant is ideal for rehabilitating eroded hills. A gum is obtained from the seed endosperm. A clear, garnet-red, astringent gum that turns black upon exposure to the air is obtained from the trunk. Used in adhesives, the gum qualities are similar to

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Family	Scientific Name	Local Name	Uses
			those of gum arabic (Senegalia senegal). The white wood is soft and rather light. The density of the wood increases with age, however, and the timber from 5 to 8 year-old trees can be used in house construction or as craft wood. The trunk has been used for poles but may not last long due to rot and insect infestation. The light wood is used in floating fishing nets. The wood is a major source of pulp for use in making paper. The fibres are short and they can also be blended with long-fibred bamboo pulp in suitable proportions in order to give good strength.
Fabaceae	*Tamarindus indica*	Asam jawa	The green fruits and flowers may be used for souring soupy dishes of fish and meat. The ripe fruit of the sweet type is usually eaten fresh, whereas the fruits of sour types are made into juice, jam, syrup and candy. Tamarind seeds are also edible after soaking in water and boiling to remove the seed-coat. Flour from the seed may be made into cake and bread. Roasted seeds are claimed to be superior to groundnuts in flavour. The seed oil — which resembles linseed oil — is suitable for making paint and varnish.|The bark is astringent and tonic and its ash may be given internally as a digestive. Incorporated into lotions or poultices, the bark may be used to relieve sores, ulcers, boils and rashes. It may also be administered as a decoction against asthma and amenorrhea and as a febrifuge. Young leaves may be used in fomentation for rheumatism, applied to sores and wounds, or administered as a poultice for inflammation of joints to reduce swelling and relieve pain. A sweetened decoction of leaves is good against cough and fever. Filtered hot juice of young leaves and a poultice of the flowers are used for conjunctivitis. The pulp may be used as an acid refrigerant, a mild laxative and also to treat scurvy. Powdered seeds may be given to cure dysentery and diarrhoea.
Gnetaceae	*Gnetum gnemon*	Melinjo	The young leaves, inflorescences, and the young and ripe fruits are cooked in vegetable dishes. The seed is the most important part; the fruit is nothing more than a seed covered by a tough husk (the seed coat) and a thin, edible rind. It can be eaten raw but is usually cooked or preserved as flat cakes from which crisps are made. This is an important home industry in Java. After removal of the rind, the seed is heated carefully, the husk is broken and the hot kernel is pounded into a flat cake. The cakes are sun-dried, graded and packed for sale. A crisp snack ("emping") is prepared by puffing up the cakes in boiling oil. A high quality fibre is extracted from the inner bark; it is used for the famous Sumba bow string, and for fishing lines and nets because the fibre is durable in sea water. The wood is of no particular value, partly because additional cambia lead to an anomalous stem structure. G. gnemon var. tenerum is an important leafy vegetable in southern Thailand.
Lamiaceae	*Gmelina arborea*	White teak	The wood is used mainly for light construction and for pulping. Several parts of the plant are used medicinally. Leaves are good cattle fodder.
Lamiaceae	*Tectona grandis*	Jati	The leaves are added to the water in which unripe jackfruit is boiled prior to making the Javanese dish 'Gudeg'. This adds a fresh, reddish colour to the jackfruit. A red dye obtained from boiling the wood shavings of the tree has been used to colour Easter Eggs. The leaves act as a host for Rhizopus spores in Tempeh manufacture. A wood tar paste is made from the powdered wood by putting it into hot water. It is vermifuge; promotes digestion; is effective in relieving bilious headaches and tooth aches; reduces inflammations or eruptions of the skin. Teak is a pioneer species, but with a

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Family	Scientific Name	Local Name	Uses
			long life span. In contrast to other pioneer species, it is able to persist and dominate and to naturally regenerate towards the climax phase of succession in most parts of its natural range. Both the root bark and the young leaves produce a yellowish-brown or reddish dye, which is used for paper, clothes and matting. It requires a mordant. The dye from the leaves prevents the blackening of yama after thay are cooked. The leaves are used for packing food products in the markets. An oil extracted from the seeds promotes hair growth. Sawdust from teakwood is used as incense in Java; the dust, however, may irritate the skin. The sawdust is also used to produce active carbon. The heartwood is often dull yellowish when freshly cut but turns golden brown or sometimes dark greyish-brown after exposure, often streaked grey or black; it is distinctly demarcated from the up to 50mm thick band of yellowish-white or pale yellowish-brown sapwood.
Lauraceae	*Persea americana*	Avocado	The tree is grown for its nutritious fruit that has long been important in the diets of the people of Central America. Consumption is most often as an uncooked savoury dish mixed with herbs and/or spices, as an ingredient of vegetable salads, or as a sweetened dessert (Indonesia, the Philippines). However, its texture and colour can be used to enhance the presentation and consumption of many foods. The oil is used by the cosmetic industry in soaps and skin moisturizer products. The flesh is also used in traditional medicine.
Malvaceae	*Ceiba pentandra*	Kapok tree	The fruits of C. pentandra are the source of the kapok fibre used for stuffing (e.g. mattresses, pillows, upholstery, protective clothing), and for thermal and acoustic insulation. Lifebelts and life-jackets used to be made from kapok fibre, but were only effective in the days of sail and steam, when there was no danger of oil in the water. During the Second World War many people drowned because their kapok life-jackets had lost buoyancy; nowadays synthetic material is used. In Java the placenta is crushed to produce a secondary quality kapok fibre for cheaper mattresses and for use as an absorbent for oil-contaminated sea water. Placental material is also used for culturing fungi. The shells of the fruits serve as a substitute for pulp material for paper making in Java. The shells are rich in potash and the ash can be used as fertilizer. They are also used to make baking soda and soap. Dry shells are used as fuel. The seeds contain an oil which is used for soap manufacture, as a lubricant and as lamp oil. The oil has also been used for culinary purposes, but this is not advisable for health reasons. The residual presscake is used as animal feed. In Indonesia and Malaysia the seeds are eaten, but only in small quantities as they upset the digestion. Young leaves are eaten as a leaf vegetable in the Philippines, young flowers and fruits are eaten in Thailand, and very young pods are eaten in Java. The leaves are used as fodder for cattle and as a soil improver. The wood is used for paper making and for making canoes, carvings, doors, furniture, boxes and toys. The flowers are a good source of nectar for honeybees. In various locations kapok is planted for reforestation, watershed conservation and for supplying fuelwood and fence posts. In traditional medicine throughout South-East Asia preparations of the leaves are taken against fever, cough, hoarseness and venereal diseases. The bark is considered diuretic and astringent and also serves to treat fever, asthma, gonorrhoea and diarrhoea. The root is considered a diuretic and febrifuge as well. In India root decoctions are used against chronic dysentery and ascites. The Mayan and Aztec people in Central and South America regarded the kapok tree as sacred: its size and

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Family	Scientific Name	Local Name	Uses
			stature led them to regard it as a link between the earth and the universe. The kapok tree still has sacred significance for local peoples in many parts of the world.
Meliaceae	*Azidirachta indica*	Neem tree	The tender shoots and flowers of the margosa tree are eaten as a vegetable in India. Products made from margosa trees have been used in the traditional medicine of India for centuries, for treating skin troubles and rheumatism, but there is insufficient clinical evidence to indicate any benefits of using margosa for medicinal purposes. Margosa is a key ingredient in non-pesticidal management (NPM), providing a natural alternative to synthetic pesticides. Margosa seeds are ground into powder that is soaked overnight in water and sprayed on the crop.
Meliaceae	*Swietenia mahagoni*	Mahoni	plywood, blockboard, pulp and paper. It is used in the construction of traditional houses and boats.
Moraceae	*Artocarpus altilis*	Breadfruit	The trees are integrated into mixed cropping systems with yams and other root crops, Piper methysticum, bananas and some cash crops, especially black pepper and coffee .
Moraceae	*Artocarpus heterophyllus*	Nangka	The pulp of young fruit is cooked as a vegetable, pickled or canned in brine or curry; pulp of ripe fruit is eaten fresh or made into various local delicacies (e.g. 'dodol' and 'kolak' in Java), chutney, jam, jelly and paste, or preserved as candies by drying or mixing with sugar, honey or syrup. The pulp is also used to flavour ice-cream and beverages, or made into jackfruit honey, or reduced to a concentrate or powder and used for preparing drinks. Addition of synthetic flavours such as esters of 4-hydroxybutyric acid greatly improves the flavour of canned fruit and nectar. The seeds are eaten after boiling or roasting, or dried and salted as table nuts, or ground to make flour which is blended with wheat flour for baking. Young leaves are readily eaten by cattle and other livestock. The bark contains ca 3.3% tannin, and is occasionally used in making cordage or cloth. A yellow dye extracted from wood particles is used to dye silk and the cotton robes of Buddhist priests. The ERM Laporan Survei Keanekaragaman Hayati Darat – CAP 2 Cilegon 2019 82 latex serves as birdlime and is employed as a household cement for mending china and for caulking boats. The timber is classified as medium hardwood; it is resistant to termite attack, fungal and bacterial decay, easy to season and takes polish beautifully. Thus, though not as strong as teak, jackfruit wood is considered superior to teak for furniture, construction, turnery, masts, oars, implements and musical instruments. The wood is widely used in Sri Lanka and India, and is exported to Europe. Roots of older trees are highly prized for carving and pictureframing. The jackfruit tree is also renowned for its medicinal properties. In China, jackfruit pulp and seeds are considered as a cooling and nutritious tonic, useful in overcoming the effects of alcohol. In South-East Asia, the seed starch is used to relieve biliousness and the roasted seeds are regarded as an aphrodisiac. Heated leaves are placed on wounds, and the ash of the leaves burned with maize and coconut shells is used to heal ulcers. Mixed with vinegar, the latex promotes healing of abscesses, snakebite and glandular swellings. The bark is made into a poultice. The wood has sedative properties and its pith is said to induce abortion. The root is used as a remedy against skin diseases and asthma, and its extract is taken in cases of fever and diarrhoea.
Moraceae	*Streblus asper*	Serut	The tree has a number of uses. It has been important in papermaking in Thailand for seven hundred years. In Vietnam traditional woodworking uses the coarse texture of the leaves as natural

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Family	Scientific Name	Local Name	Uses
			sandpaper. It has been used in the past as an oral hygiene product and for this reason it is also known as the toothbrush tree. A twig or stick about eight inches long with a frayed or mashed end to increase the cleaning surface was used as a tooth cleaning aid up until the middle of the twentieth century.
Muntingiaceae	*Muntingia calabura*	Kersen	School children compete with bats and birds for the sweet berries, which can also be preserved, as indicated by the Sri Lankan name "jam fruit". Old sources in the Philippines mention the use of flowers to prepare an infusion against headaches, colds, etc. The pliable bark can be used as rough cordage. The tree serves as a roadside shade tree; the wood is soft and is valued mostly as fuel.
Myrtaceae	*Psidium guajava*	Jambu biji	Fruit - raw or cooked. The flavour can range from sweet to acidic. A soft fleshy pulp with a delicious aromatic flavour. Very high in vitamin C, it is also a good source of vitamin A and pectin. The fruit makes a very nice jam and can also be pureed then added to a range of desserts. The yellow-skinned fruit can be ovoid or pear shaped, is 4 - 12cm in diameter and can weigh up to 500g. A decoction of the plant is antispasmodic, astringent, febrifuge and vulnerary. Guava exhibits antibacterial action against intestinal pathogens such as Staphylococcus. A popular fruit crop with many other uses, the plant succeeds in full sun and quickly establishes itself in pastures etc; it is an excellent pioneer species for use in permaculture when establishing woodland gardens. The plant has been identified as useful for bio-indication and as a bio-accumulator in India. It is sensitive to sulphur dioxide. The leaves and bark may be used for dyeing and tanning. The leaves are pounded with coconut milk and other substances to make a dye that turns silk black.
Myrtaceae	*Syzygium cumini*	Plum tree black	Jambolan fruits have a sweet or slightly acidic flavor, are eaten raw, and may be made into sauces or jam. Fruits may be made into juice, jelly, sorbet, syrup (e.g., *kala khatta*), or fruit salad.
Poaceae	*Saccharum officinarum*	Sugarcane	Saccharum officinarum and its hybrids are grown for the production of sugar, ethanol, and other industrial uses in tropical and subtropical regions around the world. The stems and the byproducts of the sugar industry are used for feeding to livestock. Pigs fed on sugarcane juice and a soy-based protein supplement produced stronger piglets that grew faster than those on a more conventional diet.
Rubiaceae	*Coffea arabica*	Coffee	The stimulating effect of the coffee beverage is largely derived from the alkaloid caffeine, but cured beans have to be roasted and finely ground to bring out the characteristic coffee aroma. The habit of drinking coffee as a hot watery extract from roast and ground beans is still prevalent in many countries. Vacuum-sealed packets of whole roast beans or ground coffee prepared from top quality arabicas, or various blends of arabica with robusta coffee are available, especially to the European consumer. In some producer countries it is very common to roast locally available coffee in the home and to prepare the brew (called "kopi tubruk" in Indonesia) by pouring hot water over freshly roast and ground coffee. Over the last 40 years, instant coffee as soluble powder, prepared by dehydrating extracts of roast and ground coffee, has become a very important commodity. Globally about 20% of all coffees are consumed as instant coffee. Higher rates are found in the United Kingdom (80%), Japan (40%) and the United States (30%). Although arabica coffee gives a beverage of better quality, robustas are in great demand by the instant coffee industry because of

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Family	Scientific Name	Local Name	Uses
			the higher yields of soluble solids. About 10% of the world's exportable coffee is decaffeinated. Roast and ground coffee is a constituent of traditional medicines in South-East Asia, e.g. to alleviate stomachache and diarrhoea, to increase blood pressure, and as a diuretic and antidote. It is extensively used to flavour candies. In Java, it is often used to mask the odour of a corpse before funeral. Coffee pulp and parchment are applied as manure and mulch.
Sapotaceae	*Manilkara zapota*	Sapodilla	Sapodilla is used medicinally for the treatment of fever, hemorrhage, wounds, ulcers, neuralgia, diarrhea, indigestion, gallstones, and thrush in babies. It yields a white latex which is made into chewing gum, and is also used in transmission belts, dental surgery, etc. Sapodilla trees provide food and habitat for native wildlife, support pollinators like bees and butterflies, and contribute to the overall health of the ecosystem
Solanaceae	*Capsicum frutescens*	Cabai rawit	Capsicum pepper is the most popular and most widely used condiment all over the world. Its fruits are consumed in fresh, dried or processed form as table vegetable or spice. Capsicum peppers are extensively pickled in salt and vinegar. Colour and flavour extracts are used in both the food and feed industries, e.g. ginger beer, hot sauces and poultry feed, as well as for some pharmaceutical products. In the Philippines and Indonesia, the shoot tips are cooked and used as condiment or vegetable. Sweet, non-pungent capsicum peppers are widely used in the immature, green-mature or mature-mixed-colours stage as a vegetable, especially in the temperate zones.
Solanaceae	*Solanum melongena*	Eggplant	Solanum melongena L. First published in Sp. Pl.: 186 (1753) This species is accepted The native range of this species is W. Indian Ocean, Tropical & Subtropical Asia. It is a shrub and grows primarily in the wet tropical biome. It is used as a poison and a medicine and for food.
Verbenaceae	*Lantana camara*	Tembelekan	The aromatic leaves are used to make a tea. The ripe black fruits are eaten in handfuls, especially by children as a snack. The sweet tasting drupaceous, fleshy, ovoid fruits are purple or black when fully ripe and about 5 mm long. Some reports mention the toxicity of the unripe fruits. In South-East Asia the leaves (and sometimes the wet, ground roots) are applied to cuts, ulcers, swellings and to treat rheumatism, a decoction of the leaves and flowers is used to treat constipation, as a febrifuge, diaphoretic and stimulant, and to relieve catarrh and bronchitis. A decoction of the roots is used to treat toothache, headache, inflammation, gonorrhoea and leucorrhoea. L. camara is used as an ornamental and in hedges.

Appendix C-7 VP Survey Data Sheet of 2nd Biodiversity Study

Site	Round	Map Ref.	Code	Species	Count	Start Time	Seconds observed	Flight direction	Height Band
VP1	1p	Bwi-1		*Apus nipalensis*	9	09:11	60	Circling	2
VP1	1p	Bwi-1	1	*Artamus leucorynchus*	2	09:37	120	Circling and N to W	1
VP1	1p	Bwi-1	2	*NA*	2	09:38	240	N to S	1
VP1	1p	Bwi-1	3	*Pycnonotus aurigaster*	3	09:40	12	SW to NE ; S to N	1

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Site	Round	Map Ref.	Code	Species	Count	Start Time	Seconds observed	Flight direction	Height Band
VP1	1p	Bwi-1	4	*Geopelia striata*	1	09:58	10	N to W	1
VP1	1p	Bwi-1	5	*Lonchura leucogastroides*	2	10:07	5	N to SW	1
VP1	1p	Bwi-1	6	*Pycnonotus aurigaster*	31	10:14	20	SW to NE ; S to N	1
VP1	1p	Bwi-1	7	*Pernis ptilorhynchus*	1	10:20	30	N to E	2
VP1	1p	Bwi-1	8	*Lonchura punctulata*	2	10:30	7	W to E	1
VP1	1p	Bwi-1	9	*Cinnyris jugularis*	1	10:31	12	W to S	1
VP1	1p	Bwi-1	10	*Cisticola exilis*	1	10:46	60	S to N	1
VP1	1p	Bwi-1	11	*Dicaeum trochileum*	1	10:55	15	N to S	1
VP1	1p	Bwi-1	12	*Artamus leucorynchus*	1	11:20	30	Circling and N to W	1
VP1	1p	Bwi-1	13	*Hemiprocne longipennis*	3	11:58	8	W to S	1
VP1	1s	Bwi-2		*Apus nipalensis*	14	13:04	20	Circling	2
VP1	1s	Bwi-2	1	*Artamus leucorynchus*	2	13:06	10	N to S	1
VP1	1s	Bwi-2	2	*Dendrocopos analis*	2	13:12	240	E to W	1
VP1	1s	Bwi-2	3	*Prinia inornata*	1	13:24	60	W to E	1
VP1	1s	Bwi-2	4	*Cisticola exilis*	1	13:26	12	N to W	1
VP1	1s	Bwi-2	5	*Lonchura punctulata*	1	13:30	5	S to N	1
VP1	1s	Bwi-2	6	*Aplonis panayensis*	1	13:43	50	SE to N	1
VP1	1s	Bwi-2	7	*Spilopelia chinensis*	2	15:04	8	W to E	1
VP1	1s	Bwi-2	8	*Prinia inornata*	2	15:08	30	E to W	1
VP1	1s	Bwi-2	9	*Pycnonotus aurigaster*	4	15:08	15	N to S	1
VP1	1s	Bwi-2	10	*Aegithina tiphia*	6	15:12	6	S to N	1
VP1	1s	Bwi-2	11	*Geopelia striata*	2	15:12	10	S to E	1
VP1	1s	Bwi-2	12	*Pycnonotus goiavier*	1	15:15	7	E to W	1
VP1	1s	Bwi-2	13	*Todiramphus chloris*	1	15:24	8	S to N	1
VP1	1s	Bwi-2	14	*Cisticola juncidis*	2	15:41	12	S to N	1

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Site	Round	Map Ref.	Code	Species	Count	Start Time	Seconds observed	Flight direction	Height Band
VP1	1s	Bwi-2		*Aerodramus maximus*	6	15:46	60	Circling	2
VP1	1s	Bwi-2	15	*Lalage nigra*	1	15:51	60	N to E	1
VP1	1s	Bwi-2	16	*Turnix sylvaticus*	1	15:58	7	W to E	1
VP1	1s	Bwi-2	17	*NA*	1	16:02	30	N to S	1
VP1	2p	Bwi-3	1	*Turnix suscitator*	1	07:21	7	S to NE	1
VP1	2p	Bwi-3		*Apus nipalensis*	6	07:32	120	Circling	2
VP1	2p	Bwi-3	2	*Pycnonotus aurigaster*	6	07:32	5	E to NW	1
VP1	2p	Bwi-3	3	*Lonchura leucogastroides*	8	07:36	10	E to W	1
VP1	2p	Bwi-3	4	*Gallus varius*	3	07:42	12	W to E	1
VP1	2p	Bwi-3	5	*Cisticola exilis*	2	07:51	60	W to NE	1
VP1	2p	Bwi-3	6	*NA*	1	08:09	30	W to E	1
VP1	2p	Bwi-3	7	*Centropus bengalensis*	1	08:31	8	W to E	1
VP1	2p	Bwi-3		*Hirundo javanica*	2	08:42	40	Circling	2
VP1	2p	Bwi-3	8	*Lalage nigra*	1	09:05	7	W to N	1
VP1	2p	Bwi-3	9	*Todiramphus chloris*	1	09:38	3	E to W	1
VP1	2p	Bwi-3	10	*Artamus leucorynchus*	1	09:42	20	E to S	1
VP1	2p	Bwi-3	12	*Aegithina tiphia*	1	09:51	30	N to S	1
VP1	2p	Bwi-3	11	*Cinnyris jugularis*	1	09:51	20	E to W	1
VP1	2p	Bwi-3	13	*Geopelia striata*	1	10:24	60	N toW	1
Vp1	2s1	Bwi-4		*Apus nipalensis*	2	10:42	120	Circling	2
Vp1	2s1	Bwi-4	1	*Pycnonotus aurigaster*	3	10:51	15	E to W	1
Vp1	2s1	Bwi-4	2	*Geopelia striata*	1	10:55	8	S to N	1
Vp1	2s1	Bwi-4	3	*Cisticola exilis*	2	11:31	120	E to W	1
Vp1	2s1	Bwi-4	4	*Todiramphus chloris*	1	12:17	5	W to E	1
Vp1	2s1	Bwi-4	5	*Artamus leucorynchus*	2	12:31	30	W to E	1

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Site	Round	Map Ref.	Code	Species	Count	Start Time	Seconds observed	Flight direction	Height Band
Vp1	2s1	Bwi-4	6	*Acridotheres javanicus*	1	13:19	7	E to W	1
VP1	2s2	Bwi-5	1	*Lalage nigra*	3	13:42	20	E to w	1
VP1	2s2	Bwi-5		*Apus nipalensis*	8	13:48	120	Circling	2
VP1	2s2	Bwi-5	2	*Lonchura leucogastroides*	2	13:52	8	W to E	1
VP1	2s2	Bwi-5	3	*Lonchura punctulata*	6	13:53	20	N to S	1
VP1	2s2	Bwi-5	5	*Cisticola exilis*	4	13:54	120	E to W	1
VP1	2s2	Bwi-5	4	*Geopelia striata*	3	13:54	60	N to S	1
VP1	2s2	Bwi-5	6	*Cinnyris jugularis*	1	13:59	30	S to N	1
VP1	2s2	Bwi-5	7	*Pycnonotus aurigaster*	4	14:00	12	N to S	1
VP1	2s2	Bwi-5	9	*Anthreptes malacensis*	2	14:02	8	S to N	1
VP1	2s2	Bwi-5	8	*Artamus leucorynchus*	1	14:02	10	E to W	1
VP1	2s2	Bwi-5	10	*Merops leschenaulti*	2	14:05	10	E to W	1
VP1	2s2	Bwi-5	11	*Pycnonotus goiavier*	1	14:12	20	S to N	1
VP1	2s2	Bwi-5	12	*NA*	1	16:00	6	W to E	1
VP1	2s2	Bwi-5	13	*Turnix suscitator*	2	16:10	60	E to W	1
VP1	2s2	Bwi-5	14	*Hemiprocne longipennis*	1	16:16	15	N back N	1
VP1	3p	Bwi-6		*Apus nipalensis*	12	08:00	60	Circling	2
VP1	3p	Bwi-6		*Hirundo javanica*	2	08:09	10	Circling	1
VP1	3p	Bwi-6	1	*Pycnonotus aurigaster*	6	08:10	20	N to S	1
VP1	3p	Bwi-6	2	*Pycnonotus goiavier*	1	08:14	20	E to W	1
VP1	3p	Bwi-6	3	*Artamus leucorynchus*	3	08:19	60	S to N	1
VP1	3p	Bwi-6	4	*Todiramphus chloris*	2	08:22	8	W back W	1
VP1	3p	Bwi-6	5	*Lalage nigra*	1	08:25	30	S to N	1
VP1	3p	Bwi-6	6	*NA*	2	08:48	120	N to S	1
VP1	3p	Bwi-6	7	*Lonchura punctulata*	4	09:10	15	E to W	1

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Site	Round	Map Ref.	Code	Species	Count	Start Time	Seconds observed	Flight direction	Height Band
VP1	3p	Bwi-6	8	*Pernis ptilorhynchus*	1	09:55	240	N to W	3
VP1	3p	Bwi-6	9	*Pernis ptilorhynchus*	1	09:58	240	E to W	2
VP1	3p	Bwi-6	10	*Turnix suscitator*	1	10:39	5	S to N	1
VP1	3s	Bwi-7		*Apus nipalensis*	22	14:08	60	Circling	2
VP1	3s	Bwi-7	1	*Artamus leucorynchus*	1	14:10	20	NE to S	1
VP1	3s	Bwi-7	2	*Cisticola exilis*	3	14:12	15	E to W	1
VP1	3s	Bwi-7	3	*Geopelia striata*	2	14:13	8	W to E	1
VP1	3s	Bwi-7	4	*Lalage nigra*	2	14:23	20	E to W	1
VP1	3s	Bwi-7	5	*Orthotomus sepium*	11	14:26	5	S to W	1
VP1	3s	Bwi-7	6	*Pycnonotus aurigaster*	3	14:31	7	N to S	1
VP1	3s	Bwi-7	7	*Lonchura punctulata*	4	14:47	5	W to E	1
VP1	3s	Bwi-7	8	*Halcyon cyanoventris*	2	15:21	10	W to N	1
VP1	3s	Bwi-7	9	*Todiramphus chloris*	1	15:27	10	S to W	1
VP1	3s	Bwi-7	10	*Prinia inornata*	1	15:37	8	W to S	1
VP1	3s	Bwi-7	11	*NA*	2	15:53	30	E to S	1
VP1	3s	Bwi-7	12	*Hemiprocne longipennis*	1	16:02	50	E back E	1
VP1	3s	Bwi-7	13	*NA*	1	16:34	60	W to E	1
VP1	3s	Bwi-7		*Aerodramus maximus*	3	16:36	15	Circling	1
VP2	1p	BAW-1	1	*Collocalia linchi*	10	09:30	90	Circling E to W, N to W	2
VP2	1p	BAW-1	2	*Todiramphus chloris*	2	09:33	30	NE to S	1
VP2	1p	BAW-1	3	*Dicaeum trochileum*	1	09:34	15	N to SE	2
VP2	1p	BAW-1	4	*Halcyon cyanoventris*	2	09:35	15	N to S	2
VP2	1p	BAW-1	6	*Alcedo meninting*	1	09:44	15	NE to SW	1
VP2	1p	BAW-1	5	*Lonchura punctulata*	5	09:44	10	E to S	2
VP2	1p	BAW-1	7	*Falco peregrinus*	1	09:55	15	N to S	2

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Site	Round	Map Ref.	Code	Species	Count	Start Time	Seconds observed	Flight direction	Height Band
VP2	1p	BAW-1	8	*Ardeola speciosa*	1	10:42	10	W to E	2
VP2	1p	BAW-1	9	*Dendrocopos analis*	1	11:06	15	N to S	1
VP2	1p	BAW-1	10	*Spilopelia chinensis*	1	11:30	15	E to W	1
VP2	1p	BAW-1	11	*Hirundo javanica*	1	12:01	30	N to SW	2
VP2	1s	BAW-2	1	*Collocalia linchi*	5	12:07	30	Circling N to SW	2
VP2	1s	BAW-2	2	*Halcyon cyanoventris*	2	12:15	15	E to W	2
VP2	1s	BAW-2	3	*Todiramphus chloris*	1	12:47	20	N to S	1
VP2	1s	BAW-2	4	*Pycnonotus aurigaster*	2	13:05	10	E to W	1
VP2	1s	BAW-2	5	*Lonchura leucogastroides*	1	13:42	10	NE to SW	1
VP2	1s	BAW-2	6	*Spilopelia chinensis*	1	14:38	15	N to S	2
VP2	1s	BAW-2	7	*Lonchura punctulata*	12	14:45	30	NE to SW	2
VP2	1s	BAW-2	8	*Geopelia striata*	1	15:01	15	S to N	1
VP2	2p	BAW-3	1	*Halcyon cyanoventris*	1	07:27	45	S to N, N to E	1
VP2	2p	BAW-3	2	*Collocalia linchi*	15	07:34	60	Circling S to N	2
VP2	2p	BAW-3	3	*Lalage nigra*	1	07:42	30	W to SE	1
VP2	2p	BAW-3	4	*Merops philippinus*	1	07:46	20	N to S	2
VP2	2p	BAW-3	5	*Accipiter soloensis*	1	07:50	45	Circling N to S	3
VP2	2p	BAW-3	6	*Artamus leucoryn*	1	07:54	30	Circling N to S	2
VP2	2p	BAW-3	7	*Aegithina tiphia*	2	07:55	30	N to S	1
VP2	2p	BAW-3	9	*Lonchura punctulata*	5	07:56	20	W to E	1
VP2	2p	BAW-3	8	*Spilopelia chinensis*	1	07:56	15	E to W	1
VP2	2p	BAW-3	10	*Apus nipalensis*	3	07:58	45	Circling N to S	3
VP2	2p	BAW-3	11	*Geopelia striata*	2	08:05	30	E to W	2
VP2	2p	BAW-3	12	*Todiramphus chloris*	1	08:10	30	S to N	1
VP2	2p	BAW-3	13	*Lonchura leucogastroides*	3	08:12	20	E to W	1

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Site	Round	Map Ref.	Code	Species	Count	Start Time	Seconds observed	Flight direction	Height Band
VP2	2p	BAW-3	14	*Pycnonotus aurigaster*	1	08:16	20	W to E	1
VP2	2p	BAW-3	15	*Aerodramus maximus*	5	08:36	60	Circling N to S	2
VP2	2p	BAW-3	16	*Dendrocopos analis*	1	09:52	30	S to N	2
VP2	2s1	BAW-4	1	*Dicaeum trochileum*	1	10:28	30	S to N	1
VP2	2s1	BAW-4	2	*Collocalia linchi*	3	10:37	60	Circling S to N	2
VP2	2s1	BAW-4	3	*Lonchura punctulata*	5	10:48	15	NE to S	2
VP2	2s1	BAW-4	4	*Anthreptes malacensis*	2	11:03	15	S to N	1
VP2	2s1	BAW-4	5	*Lonchura leucogastroides*	2	11:15	20	N to S	1
VP2	2s1	BAW-4	6	*Artamus leucoryn*	1	11:18	60	Circling S to N	2
VP2	2s1	BAW-4	7	*Spilopelia chinensis*	1	12:38	15	SW to NE	1
VP2	2s1	BAW-4	8	*Dendrocopos analis*	1	12:42	25	N to S	1
VP2	2s1	BAW-4	9	*Todiramphus chloris*	1	12:45	15	W to E	1
VP2	2s2	BAW-5	1	*Lonchura leucogastroides*	3	13:34	15	N to S	2
VP2	2s2	BAW-5	2	*Collocalia linchi*	7	13:36	60	Circling N to S	2
VP2	2s2	BAW-5	3	*Dendrocopos analis*	2	13:37	45	N to S	1
VP2	2s2	BAW-5	4	*Lonchura punctulata*	4	14:03	30	N to S	2
VP2	2s2	BAW-5	5	*Artamus leucoryn*	1	14:04	45	Circling N to S	2
VP2	2s2	BAW-5	6	*Anthreptes malacensis*	1	14:18	15	S to N	1
VP2	2s2	BAW-5	7	*Apus nipalensis*	3	14:24	30	Circling E to W	3
VP2	2s2	BAW-5	8	*Lalage nigra*	1	14:30	15	S to NE	1
VP2	2s2	BAW-5	9	*Lonchura maja*	2	14:39	15	E to W	1
VP2	2s2	BAW-5	10	*Geopelia striata*	2	14:47	60	N to S	1
VP2	2s2	BAW-5	11	*Hirundo javanica*	2	15:01	30	NE to SW	2
VP2	2s2	BAW-5	12	*Aerodramus maximus*	5	16:23	60	Circling NE to SW	2
VP2	3p	BAW-6	1	*Todiramphus chloris*	2	07:50	30	NW to SE	1

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Site	Round	Map Ref.	Code	Species	Count	Start Time	Seconds observed	Flight direction	Height Band
VP2	3p	BAW-6	2	*Merops philippinus*	2	08:06	30	E to W	2
VP2	3p	BAW-6	3	*Collocalia linchi*	2	08:10	60	Circling E to W	2
VP2	3p	BAW-6	4	*Artamus leucoryn*	1	08:12	60	S to N	2
VP2	3p	BAW-6	5	*Lonchura punctulata*	3	08:15	120	NE to SW, SW to NE	2
VP2	3p	BAW-6	6	*Spilopelia chinensis*	3	08:18	60	N to S	1
VP2	3p	BAW-6	7	*Anthreptes malacensis*	1	08:19	30	S to N	1
VP2	3p	BAW-6	8	*Geopelia striata*	1	08:23	15	N to S	1
VP2	3p	BAW-6	9	*Halcyon cyanoventris*	2	09:02	30	N to S	1
VP2	3p	BAW-6	10	*Turnix suscitator*	2	09:17	15	W to E	1
VP2	3p	BAW-6	11	*Dendrocopos analis*	2	09:38	60	N to S	1
VP2	3p	BAW-6	12	*Aegithina tiphia*	2	10:15	30	S to N	1
VP2	3p	BAW-6	13	*Dicaeum trochileum*	1	10:24	15	E to W	1
VP2	3p	BAW-6	14	*Pycnonotus aurigaster*	1	10:27	15	N to S	1
VP2	3s	BAW-7	1	*Collocalia linchi*	3	14:05	30	N to S	2
VP2	3s	BAW-7	2	*Lonchura punctulata*	5	14:13	30	NE to SW	2
VP2	3s	BAW-7	3	*Lonchura leucogastroides*	3	14:14	45	E to W	2
VP2	3s	BAW-7	4	*Ardeola speciosa*	1	14:40	15	W to E	2
VP2	3s	BAW-7	5	*Apus nipalensis*	2	14:57	45	Circling N to S	2
VP2	3s	BAW-7	6	*Falco peregrinus*	1	15:02	15	N to S	2
VP2	3s	BAW-7	7	*Hemiprocne longipennis*	1	15:09	30	Circling N to S	2
VP2	3s	BAW-7	8	*Artamus leucoryn*	1	15:13	15	E to W	2
VP2	3s	BAW-7	9	*Todiramphus chloris*	2	15:48	30	N to SE	1
VP2	3s	BAW-7	10	*Halcyon cyanoventris*	1	16:03	15	E to W	1

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Appendix D Surface Water Analysis Report

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Appendix E Ambient Air Quality Analysis Report

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Appendix F Noise and Vibration Measurement Report

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Appendix G Social Methodology and Approach

Methodology and Approach

In social Baseline Studies, appropriate methodology and approach are crucial for understanding the social context of the involved communities. This methodology typically involves field research, surveys, and interviews with local communities. A participatory approach is often applied, involving active engagement of the community in the data collection and analysis. Adopting this approach, the research can encompass various social dimensions, such as social structures, value systems, and local governance. Identifying key stakeholders and accommodating diverse perspectives and experiences of the community are integral parts of this approach. Comprehensively understanding the social framework, and the results of the social baseline can provide a solid foundation for developing projects and implementing sustainable programs that positively impact the local community.

Social Baseline Studies were conducted in three villages: Kalipuro Village, Giri, and Kelir. The selection of these locations was based on the Project Component's location, as outlined in the preceding section. The execution of Social Baseline Studies adhered to the schedule outlined in the **Table 1**.

Table 1 *Study Activities for Social Baseline*

Activity	Time
Preparation	December 19 - 23, 2023
Field Visit	December 26, 2023 - January 3, 2024
Data analysis	January 3 - 5, 2024
Reporting	January 3 - 19, 2024

1. Methodology

The methodology in this study incorporates quantitative and qualitative approaches. These methods complement each other, comprehensively understanding the community's socio-economic-cultural aspects and public health. Quantitative methods involve household surveys using questionnaires (primary data collection) and literature reviews for secondary data from relevant institutions. Qualitative methods include in-depth interviews and field observations (primary data collection), along with literature reviews (secondary data).

Table 2 *Data Collection for Social Baseline Study*

Parameter	Quantitative		Qualitative		
	Literature Review	Survey	Observation	In-depth-Interview	Literature Review
Demography					
Population distribution and density	√				
Population Growth	√				
Population Composition	√	√			
Labour force	√				

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Parameter	Quantitative		Qualitative		
	Literature Review	Survey	Observation	In-depth-Interview	Literature Review
Mobility	√	√		√	
Social-economic					
Regional Indicator econonomic growth (GRDP, pekerjaan)	√				
Livelihood	√	√		√	
Land ownership		√		√	
Agriculture	√	√		√	
Fisheries		√		√	
Household income and expenses		√		√	
Economic amenity	√		√		
Society welfare	√	√			
Social culture					
Religion and ethnic	√	√		√	√
Education	√	√			
Social Organization including customary law and implementation			√	√	√
Tradition			√	√	√
Cultural Heritage			√	√	√
Perception about the Solar PV Project		√		√	
Community health					
Disease Prevalence	√	√		√	
Healthcare infrastructure and workers	√		√	√	
Healthcare condition	√	√			
Environmental healthcare					
Sanitation		√	√	√	
Access to clean water		√	√		
House condition		√	√	√	

2. Data Collection

The data collection conducted in this study consists of (1) Household Surveys, (2) In-depth Interviews, (3) Field Observations, and (4) Literature Review. The explanations for each data collection technique are as follows:

Household Survey

Household surveys are conducted to collect quantitative data. The selection of respondents (informants) is done through probability sampling using the stratified random sampling technique. If the expected sample or respondent, who is the head of the household, cannot be found during the survey, the sample or respondent can be

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replaced by another family member who represents the household (such as the wife or an adult child).

The target sampling size is using the ***Taherdoost method*** with a confidence level of 80% and a margin of error of 5% of the total 10,261 population heads of households in the study area. Based on these assumptions, the sample size is calculated to be 162 respondents as follows:

$$n = 1 + \frac{Z^2 \, x \, p \, (1-p)}{\varepsilon^2 N}$$

$$= 1 + \frac{1{,}28^2 \, x \, 0{,}5 \, (1-0{,}5)}{0{,}5^2 x \, 10{,}261}$$

$$n = 1 + 161$$

$$n = 162$$

n = Sample size (required respondents)

z = z score

p = Population Proportion

ε = Margin of Error

N = Population

In the implementation of household surveys, enumerators conduct interviews with each head of the family one by one. In this household survey, all family heads have an equal opportunity to be interviewed, if they can answer questions and are willing to participate. To obtain more representative data, optimal participation of female respondents will also be encouraged.

Interviews are conducted at the family level, the smallest economic unit, to depict the demographic and economic conditions of the population affected by the activities. Some aspects included in the list of questions are demographic data (number of family members, gender, age, and education level), income level, average expenditures, types of livelihoods, land ownership, as well as other information related to socioeconomic, socio-cultural, and public health aspects.

In-depth Interview

Qualitative data collection is conducted through in-depth interviews with key informants in each village of the study. The selection of informants is determined using purposive sampling, where the researcher decides based on the depth and relevance of the information needed for the study. The informants include the Village Head, Religious Leaders, Youth Group Leaders, Women's Group Leaders, Vulnerable Groups, and other Community Leaders (Traditional Leaders, Head of the Village Consultative Body, etc.). The information gathered from in-depth interviews complements and confirms the quantitative data from household survey results. Detailed data on the informants interviewed in the study area can be seen in the table below.

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Table 3 *Key Informants List*

No	Villages	Representative
1	Kalipuro	Head Village
2	Kalipuro	Hamlet Representative
3	Kalipuro	Farmer Groups
4	Kalipuro	Education Representative and Affected Group
5	Kalipuro	Education Representative and Affected Group
6	Kalipuro	Tourism and Affected Group
7	Kalipuro	Tourism
8	Kalipuro	Affected Breeder
9	Kalipuro	Affected Breeder and Affected Labourer
10	Kalipuro	CH Representative
11	Kalipuro	Youth Representative and Community Social
12	Kalipuro	Youth and Access Road
13	Kalipuro	Access Road
14	Kalipuro	Hunter and Affected Group
15	Kalipuro	Affected Labourer and Affected Group
16	Kalipuro	Public Health Center
17	Kalipuro	Youth Representative
18	Kalipuro	PTPN and Affected Labourer
19	Kalipuro	Affected Labourer
20	Kalipuro	Education Community
21	Kalipuro	Affected Transmission Line
22	Kalipuro	CH Representative
23	Kalipuro	Affected Labourer
24	Kalipuro	Affected Breeder
25	Kalipuro	Affected Breeder
26	Kalipuro	Public Health Center
27	Kalipro	PTPN and Affected Labourer
28	Kalipuro	PTPN and Affected Labourer
29	Kalipuro	Youth Representative
30	Kalipuro	Education Representative
31	Kalipuro	Public Health Center
32	Kalipuro	Public Health Center
33	Kalipuro	Affected Land Acquisition Affected Transmission Line
34	Kalipuro	Affected Land Acquisition Affected Transmission Line
35	Kalipuro	Tourism
36	Giri	Head Village
37	Giri	Youth Representative
38	Giri	Education Representative
39	Giri	Public Health Center
40	Giri	Community Social
41	Giri	Community Social
42	Kelir	Head Village
43	Kelir	Village Goverment
44	Kelir	Village Goverment
45	Kelir	Affected Farmer and Affected Transmission Line
46	Kelir	Education Representative and Affected Transmission Line
47	Kelir	Education Representative and Affected Transmission Line
48	Kelir	Farmer Groups
49	Bulusan	Hamlet Representative

Source: Primary Data, 2023

Observation

Observations are conducted to obtain a visual representation of the existing conditions of the local community, supporting the results of household surveys and in-depth interviews. The documentation from field observations is expected to reveal, among other things, the settlement conditions, types of residential buildings (permanent/non-permanent), the existing environment around the residences, socio-economic activities of the population (an overview of economic activities scale), environmental sanitation

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conditions (clean water sources, waste management, and liquid waste), socio-cultural activities of the population, and more.

Indigenous People and Cultural Heritage Survey

The Indigenous People survey aims to observe the presence of indigenous people around the project area and screen the impact of the project on the community. The survey process begins with screening using a data list of indigenous people that have been registered by the Ministry of Environment and Forestry (Customary Law Communities), the Ministry of Social Affairs (Remote Indigenous Communities), and the Indigenous Peoples Alliance (Customary Area Restoration Agency), and references from the Anthropological perspective. In addition, screening is also carried out through surveys at the project location, by conducting interviews with the community and local government regarding the presence of indigenous people. Based on the results, there was no potential for indigenous people in the project area.

Meanwhile, the cultural heritage survey is carried out using the archaeological survey method by identifying cultural heritage findings located around the project area. Including findings of archaeological heritage, cultural heritage belonging to the community, and intangible cultural heritage. The screening is also carried out through cultural heritage data lists registered by national government and local government entities. Screening in the field is carried out by observing findings on community sites and assessing potential impacts and mitigation plans.

Desk Study

The desk study complements the survey results or primary data collection with secondary data available from various sources. The secondary data from desk study typically comes from reports, village monographs, statistical data, journals, and other valid and relevant data sources. In addition to the central and regional statistical agencies, secondary data can also be obtained from various other institutions, such as village offices and community health centres. The list below gives the specific information related to name of secondary data, categories, and source of secondary data as utilised for this study.

Secondary data collection for this study includes, among other sources, the 2022 village profile data from all villages in the social area of influence (SAoI). Additionally, statistical data from Kalipuro District, Giri District, and Banyuwangi Regency for 2023 is utilized. In addition to the district-level statistical data, secondary data also includes data at the regency level, namely Banyuwangi Regency in Figures (2022), To address specific issues, secondary data such as the number of plantation workers from PT PN XII and Livestock of the Regency, as well as data on the prevalence of 10 conditions from Kalipuro-Klatak, Giri, and Kelir Community Health Centers, is also incorporated. Besides the mentioned secondary data, relevant literature is also included, especially regarding regional policies and social welfare.

3. Approach

Participatory approaches involve communities directly in the data collection, ensuring that their views and experiences are accurately reflected. By detailing behaviour, ideas, and social structures, basic studies form an essential basis for planning future programs, policies, or projects and providing in-depth contextual understanding for researchers or parties involved.

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Assumption and Limitation

In the context of the social aspects of a solar PV project, certain assumptions are integral to the National Strategy Project for Renewable Energy. First, the project assumes a positive reception and support from the local community, expecting that residents will view the implementation of solar energy positively and appreciate its long-term benefits. It is also assumed that community engagement strategies will effectively communicate the advantages of the project, fostering understanding and cooperation among residents. Another key assumption is that the community's social fabric will remain stable, with minimal social disruptions or conflicts arising from the project. The project further assumes that local educational initiatives will enhance awareness about solar energy and promote sustainable practices within the community.

The baseline studies were prepared using household surveys, in-depth interviews, and secondary data. This research also used secondary data from publicly available information during writing or provided by PT PLN Indonesia Power. In conducting a social baseline study for a solar PV project, certain limitations are inherent in the process. One important limitation lies in the potential challenges of obtaining comprehensive and unbiased data, as social dynamics are complex and diverse. These studies may face challenges in capturing the full spectrum of community perspectives and needs, especially if certain demographic groups or marginalized voices are underrepresented. Apart from that, the limitations in this activity study are limited by the scooping area at each site. We also limit the area in the villages that are predicted to be affected by the Solar PV Project. The Baseline report is restricted to data collected from the client until the time of the submitted report.

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Appendix H Indigenous People Screening Memo

Indonesia Power Hijaunesia Project
Memo on Indigenous Peoples Screening

This memo summarizes the results of an Indigenous Peoples screening conducted for the Indonesia Power Hijaunesia Project, which includes five sub-projects located in Banyuwangi, Pasuruan, Kedungombo, Jatigede, and Gajahmungkur. The Indigenous Peoples screening process was conducted through a desktop study, consultations with community members residing within the sub-project areas during the ESIA scoping, and discussions with an Indigenous Peoples expert from the Indigenous Peoples Alliance of the Archipelago (locally known as AMAN). AMAN is an independent, non-governmental organization in Indonesia that advocates for the rights and interests of Indigenous Peoples across the archipelago.

The following section presents the results of the Indigenous Peoples screening for each of the sub-project.

Indigenous Screening of Indonesia Power Hijaunesia Project

Regarding the project's impact on Indigenous Peoples (IP), as outlined in the screening table (ADB IP Screening checklist) provided in **Annex A** of this memo, no IPs have been identified in the five sub-project development areas. Consequently, the Pasuruan, Kedungombo, Gajahmungkur, Banyuwangi and Jatigede Sub-Projects are classified as **Category C** - No Impact, as the proposed sub-project locations are not expected to affect Indigenous Peoples.

Presence of "Oseng Kemiren" Indigenous Community in the Banyuwangi Regency Area

<u>Overview of Oseng Kemiren Community</u>

The Osing Kemiren community is a key Indigenous group residing in Kemiren Village, located in the Banyuwangi Regency of East Java, Indonesia. This community is a subset of the broader Osing people (Osing as ethnic), the original inhabitants of the Banyuwangi region. The Osing Kemiren community is particularly notable for its strong preservation of traditional Osing culture, language, and customs. Kemiren Village is recognized as the cultural heart of the Osing people, where traditional practices and the Osing language are actively maintained. The village has become a cultural heritage site that attracts both local and international visitors interested in learning about Osing customs.

<u>Osing Kemiren Community According to National Provisions on Indigenous People</u>

The following are the relevant Indonesian Regulations on Indigenous Peoples and the Osing Kemiren community in particular:

- *Indigenous Peoples' Rights in Indonesia*: Indonesia's legal framework regarding Indigenous Peoples is shaped by multiple regulations and policies, notably including the Constitution of 1945 and the Law on Forestry (Law No. 41/1999),

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which acknowledges customary law communities (*masyarakat hukum adat*). These laws have been evolving to better recognize and protect the rights of Indigenous Peoples, including the Osing Kemiren community.

- *Law No. 6 of 2014 on Villages (UU Desa)*: This law emphasizes the importance of Indigenous Peoples and their customs in the management of village governance. Under this law, the Osing Kemiren community is recognized as a part of Banyuwangi's local cultural heritage, promoting their participation in community development and preservation of Indigenous knowledge and traditions.
- *Minister of Environment and Forestry Regulation No. P.83/MenLHK-Setjen/2018*: This regulation formally recognizes the concept of customary forest (*hutan adat*), allowing Indigenous communities, such as the Osing people in Kemiren, to claim management and protection rights over their traditional territories, which include land-use and conservation practices unique to their cultural identity.
- The local regulations in Banyuwangi provide specific recognition of the Osing Kemiren community, supporting their rights to cultural preservation, land use, and the continuation of their traditions. These regulations also enable the community to participate in local tourism initiatives that showcase their heritage.

Osing Kemiren Community According to ADB's Safeguard Policy Statement (2009) Criteria/Attributes on Indigenous People

The Asian Development Bank (ADB) uses the term "Indigenous Peoples" as a general referencefor distinct, vulnerable social and cultural groups that possess specific characteristics in varying degrees. According to ADB's Safeguard Policy Statement (2009), Indigenous Peoples are identified by these key attributes:

- Self-Identification
- Collective Attachment
- Distinct Institutions
- Distinct Language

The ADB SPS SR2 policy identifies Indigenous Peoples as distinct social and cultural groups that share a collective attachment to ancestral territories, exhibit unique cultural practices, and are often characterized by specific languages, customs, and governance structures. The Osing Kemiren community also maintain a deep cultural connection to their ancestral lands, as evidenced by their traditional agricultural practices, ceremonies, and rituals tied to the land and environment. Furthermore, the community preserves a unique linguistic heritage, speaking the Osing language, which distinguishes them from other Javanese groups. Their social organization, which includes traditional leadership structures and adherence to customary laws (adat), further underscores their indigenous identity.

Table A provide a summary of assessment of Osing Kemiren community characteristic against the ADB SPS key attributes on Indigenous People. The assessment was conducted based on desktop research and consultation with a local Indigenous People expert.

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Table A *Assessment of Osing Kemiren community characteristic against the ADB's attributes on Indigenous People*

No	IP Criteria	Characteristic of Oseng Kemiren Community	Applicability
1.	**Self-Identification**: Self-identify as members of a distinct indigenous cultural group, and this identity is also recognized by others.	The Osing Kemiren community in Banyuwangi identifies as a distinct indigenous cultural group, and their identity is recognized by others. The Osing people are known for their unique traditions, language, and cultural practices, such as the Seblang dance ritual, which underscores their heritage. They are considered the original inhabitants of Banyuwangi, with their cultural identity deeply tied to their rituals, traditional architecture, and community life. Recognition of their identity is evident both within their community and externally, as their practices are often studied and celebrated as part of Indonesia's diverse cultural fabric Reference: ▪ https://www.researchgate.net/publication/372806752_The_Cultural_Meaning_in_Ritual_Traditions_for_the_Character_of_Osing_People_Banyuwangi_Indonesia ▪ https://ijmmu.com/index.php/ijmmu/article/view/5986 ▪ https://kneopen.com/KnE-Social/article/view/16517/	Applicable
2.	**Collective Attachment**: Have a collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these areas	The Osing Kemiren community in Banyuwangi demonstrates a strong collective attachment to their territorial and customary areas, particularly in the village of Kemiren. This attachment is reflected in their adherence to traditional practices, such as rituals and customary laws, as well as their sustainable agricultural methods that align with local wisdom. Their cultural identity is deeply tied to their land and practices, including rituals like "Barong Ider Bumi," which are performed to honor their ancestral spirits and maintain a connection to the environment. Furthermore, the community's agrarian lifestyle, rooted in traditional land management and farming knowledge based on the Javanese calendar, underscores their relationship with their customary area. These practices highlight the integration of cultural values with their environment and reflect a sustainable approach to resource use Reference: ▪ https://lex-localis.org/index.php/LexLocalis/article/view/2066 ▪ https://kneopen.com/KnE-Social/article/view/16517/ ▪ https://media.neliti.com/media/publications/541877-traditional-wisdom-and-conservation-of-t-5132d1fb.pdf	Applicable
3.	**Distinct Institutions**: They maintain cultural, economic, social, or political	The Osing Kemiren community in Banyuwangi maintains distinct cultural, economic, social, and political practices that set them apart from dominant societal influences. For example, they preserve unique cultural traditions such as the Barong Ider Bumi ritual, which reflects a spiritual	Applicable

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No	IP Criteria	Characteristic of Oseng Kemiren Community	Applicability
	institutions that are separate from those of the dominant society or culture	and social heritage tied to natural balance and community cooperation. These practices also help maintain their identity as an indigenous group. The community's traditions, like Seblang and Keboan ceremonies, further demonstrate their commitment to preserving ancestral rituals and maintaining social cohesion. These ceremonies often involve cooperation among residents and are deeply rooted in their worldview, which connects them to their ancestors and the natural environment. Additionally, their social organization, particularly in village governance and ritual roles, emphasizes their separation from mainstream cultural influences Reference: ▪ https://discovery.researcher.life/article/the-revival-of-the-past-privatizing-cultural-practices-in-the-festival-era/7fdd859616203b7395be1de63d4f72e4 ▪ https://www.researchgate.net/publication/382011810_Cultural_Resilience_among_Indigenous_Community_Exploring_the_Local_Life_of_Barong_Ider_Bumi_in_the_Osing_Community_Banyuwangi	
4.	**Distinct Language**: They often use a language distinct from the official language of the country or region.	The Osing Kemiren community in Banyuwangi often uses a distinct language, known as the Osing language, which sets them apart from the official language, Bahasa Indonesia, and even from the more commonly spoken Javanese dialects. The Osing language is a variant of ancient Javanese, influenced slightly by Balinese. While it is considered a dialect of Javanese, it is unique enough to serve as a marker of the Osing people's cultural identity, with some linguistic features not found in other Javanese dialects Reference: ▪ https://ejournal.undip.ac.id/index.php/parole/article/view/28407 ▪ https://www.researchgate.net/publication/349765674_Looking_into_the_Language_Status_of_Osing_with_a_Contrastive_Analysis_of_the_Basic_Vocabulary_of_Osing_and_Malang_Javanese	Applicable

Based on the results of the assessment against the ADB SPS SR2 attributes on Indigenous Peoples, as presented in the table above, the characteristics of the Osing Kemiren community closely aligns with the ADB SPS SR2 criteria on Indigenous People, thereby possessing the spectrum of an indigenous community.

Osing Kemiren Community and the Indonesia Power Solar PV Project in Banyuwangi

The area of influence of the proposed Banyuwangi Ground-mounted Solar PV Project encompasses three villages—Giri, Kalipuro, and Kelir—located within the two sub-districts of Kalipuro and Giri. Based on surveys conducted during the ESIA and LARAP studies, no Indigenous Peoples are present in the vicinity of the project area including the Osing Kemiren community.

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The Badan Registrasi Wilayah Adat (BRWA), or the Indigenous Territory Registration Agency, is an organization in Indonesia focused on documenting and registering the traditional territories of Indigenous Peoples (masyarakat adat). It has published a map of the settlement location and customary area of the Osing Kemiren community, which is located approximately 6.5 km from the proposed Banyuwangi Solar PV Project area. (**Figure A**). The Osing Kemiren community resides specifically within Kemiren Village, Glagah Sub-district, Banyuwangi Regency. This location is well outside the Project Area of Influence.

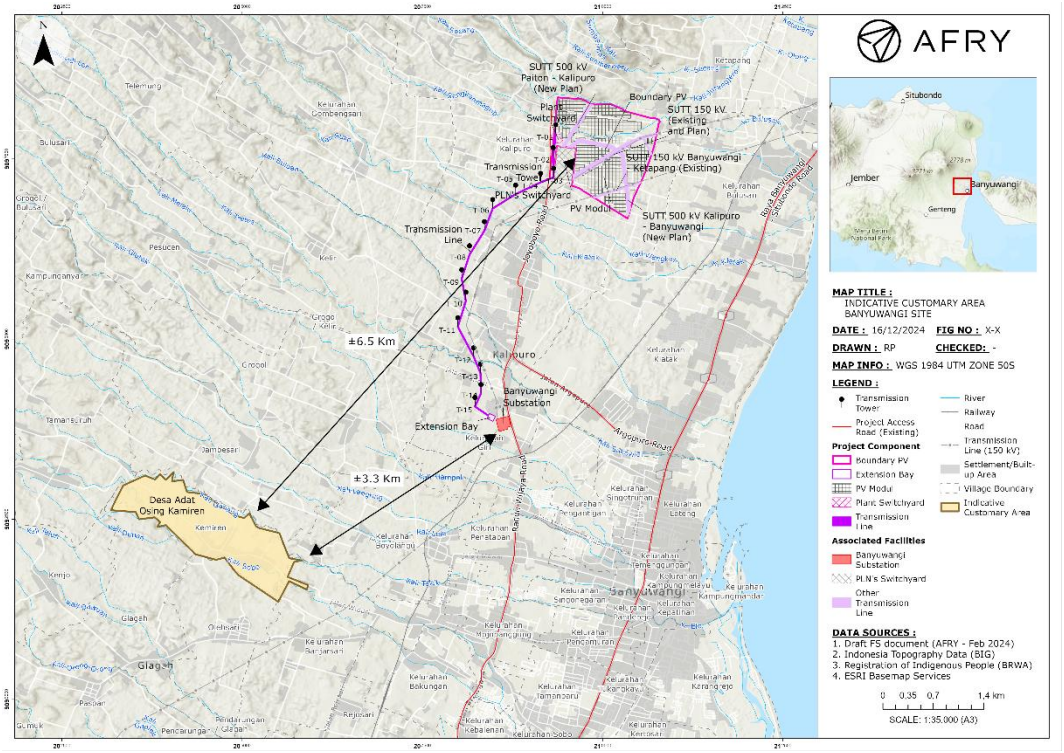


Figure A Location of the registered Osing Kemiren customary area in relation to the Solar PV Project area.

Based on desktop research, field surveys, and stakeholder consultations at the project site level conducted as part of the Pre-ESIA study, ESIA Baseline study, LARP study, and discussions with an Indigenous Peoples specialist (a member of the AMAN organization residing and working in the Banyuwangi area, as well as with the IP specialist supporting AFRY for the ESIA study), the following findings are related to the Osing Kemiren community:

1. No members of the Osing Kemiren community are present within the project's area of influence. Consultation with a member of the AMAN organization revealed that some communities living near the area are identified as part of the general Osing community. However, this community is distinct from the Osing Kemiren community. According to the AMAN representative, the general Osing community is not recognized as having the attributes of Indigenous Peoples as per the ADB's criteria on Indigenous Peoples. Instead, they are classified as an ethnic group.
2. Based on the participatory mapping conducted by AMAN, which has been publicly published on the BRWA website, there is no indication of customary areas or

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territories belonging to any Indigenous Peoples within the project area of influence, nor is there evidence of any significant cultural heritage sites associated with specific Indigenous Peoples. (see **Figure A** for an overview of the location of the Osing Kemiren settlement and the customary area mapped by AMAN in relation to the Banyuwangi Solar PV project area).

3. The Osing Kemiren community is not universally classified as a vulnerable group due to their access to abundant natural resources, and secure land ownership.[85] Kemiren Village itself has been designated as a cultural tourism area, highlighting the Osing community's traditional values and practices. This designation aims to preserve their cultural heritage and promote tourism[86]. The development of tourism in Kemiren Village has led to economic opportunities for the Osing community. However, challenges such as the commodification of cultural practices and potential marginalization in tourism management have been noted[87]

4. According to data from the Central Bureau of Statistics of Glagah Sub-district, the majority of the Osing Kemiren workforce is no longer engaged solely in the agricultural sector. Instead, most community members are also employed in industrial labor, particularly in sectors such as food, beverages, and tobacco; textiles, leather goods, and footwear; and wood and forest product processing[88]. This shift indicates a significant economic transition, reflecting the community's integration into modern industrial activities and its departure from traditional agrarian livelihoods. The data underscores the Osing Kemiren community's adaptation to contemporary economic structures, suggesting broader influences of urbanization, industrialization, and globalization. With the Oseng Kemiren's rich cultural heritage and natural beauty attracting more visitors, some Osing Kemiren people are now finding employment in tourism-related activities, including guiding tours, managing homestays, and selling traditional handicrafts. However, challenges about the preservation of cultural traditions and the socio-economic implications of moving away from agriculture-based livelihoods will be noted.

5. Based on the LARAP study of the Banyuwangi Solar PV Project, particularly referring to the results of the census process of the project-affected people, no individuals identified as belonging to the Osing Kemiren community were found. In general, the project-affected people consist of populations originating from various ethnic groups, such as Javanese, Madurese, and the broader Osing ethnic group, which is distinct from the 'Osing Kemiren' community. Although the broader Osing ethnic group possesses cultural traits, it is not widely recognized as Indigenous Peoples and was also not recognized by AMAN, based on consultations with the AMAN IP specialist.

6. However, initiative such as the Banyuwangi Solar PV project may introduce new employment opportunities for the Osing Kemiren community, particularly in construction, maintenance, and other roles associated with Solar PV infrastructure. The local government and private companies, such as Indonesia Power have emphasized providing equal employment opportunities to individuals from nearby communities, which may include the Oseng Kemiren community, potentially leading to more diverse job opportunities in the region.

[85] Badan Registrasi Wilayah Adat
[86] https://ijsr.internationaljournallabs.com/index.php/ijsr/article/download/606/670?utm_source=chatgpt.com
[87] https://iccd.asia/ojs/index.php/iccd/article/download/542/486?utm_source=chatgpt.com
[88] Kecamatan Glagah Dalam Angka 2024 - Badan Pusat Statistik Kabupaten Banyuwangi

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INTERNAL.

The Presence of Osing Community in Banyuwangi Regency Area

Overview of the General Osing Community and Assessment Against the ADB SPS Attributes for Indigenous People

While the Osing Kemiren community within Banyuwangi aligns with the ADB's characteristics of Indigenous People as described in the previous section, the broader Banyuwangi population, or the Osing community in general, which also resides within the project's area of influence, does not collectively meet the Indigenous People criteria.

The Indigenous People screening of the general Osing community againts the ADB's criteria for Indigenous People was conducted through desktop research as well as consultation with an IP expert from AMAN.

Error! Reference source not found. **B** provide a summary of assessment of General Osing community characteristic against the ADB SPS key attributes on Indigenous People. The assessment was conducted based on desktop research and consultation with a local Indigenous People expert.

Table B Assessment of Osing Ethnic characteristic against the ADB's attributes on Indigenous People

No	IP Criteria	Characteristic of Oseng Kemiren Community	Applicability
1.	**Self-Identification**: Self-identify as members of a distinct indigenous cultural group, and this identity is also recognized by others.	The general population of Banyuwangi comprises various ethnic groups, including Javanese, Madurese, Balinese, and the Osing people. While the Osing identify as a distinct indigenous group, the broader Banyuwangi population does not collectively self-identify as an indigenous cultural group. Based on the discussion with Indigenous Peoples Alliance of the Archipelago (locally known as AMAN), the people of Banyuwangi typically refer to themselves as Osing. However, this self-identification is similar to the Javanese people living in other part of central and east Jawa area who identified themselves as Javanese. These communities identify themselves as a Javanese or Osing ethnically, not as an indigenous cultural group. Reference: ▪ Bruinessen, Martin van. (1994). Ethnicity and the State in Indonesia: The Case of East Java. Edited by Thomas Reuter	Not applicable
2.	**Collective Attachment**: Have a collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these areas.	As a community living in an urban area, the Osing ethnic group does not have ancestral territories or geographical distinct habitats. However, similar to the Javanese community, the Osing community maintains cultural practices such as *Barong Ider Bumi*, a ritual aimed at warding off evil spirits and ensuring a good harvest. This cultural practice is comparable to the Javanese tradition of *Sedekah Bumi*. Reference: ▪ Klinken, Gerry Van. "Ethnicity and the Politics of Identity in Banyuwangi, East Java". Journal Asian Ethnicity 3 (2) 2002, 241-262.	Not applicable
3.	**Distinct Institutions**: They maintain cultural,	The Osing, as an ethnic do not have distinct institutions. Their political systems is the same as in other area consisting of village head and staff, sub-district head, and regeant. Even though they	Not applicable

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No	IP Criteria	Characteristic of Oseng Kemiren Community	Applicability
	economic, social, or political institutions that are separate from those of the dominant society or culture.	have a religious practices or cultural practices, these role operates within the existing government system. They do not have distinct political institutions. Regarding the social structure, as a community living in the Java island they practice strong mutual cooperation, known as (*Gotong Royong*). Reference: ▪ Sutarto. "The Osing Community: A Study of Ethnic Identity in Banyuwangi, East Java". Journal of Indonesian Social Sciences and Humanities 5 2012, 1-15.	
4.	**Distinct Language**: They often use a language distinct from the official language of the country or region.	The Osing, within the broader Banyuwangi region speak the Javanese language, This is a key distinction between the Osinga s an ethnic group and the Osing as an Indigenous People. The osing language originates from the Javanese language, and is considered a dialect of javanese. Reference: ▪ Wittke, J. (2019). Status Planning and Regional Identity: The Case of Osing in Banyuwangi, Indonesia.	Not applicable

Based on the results of the screening, AFRY asserts that the Osing community in general is not classified as an indigenous people, but rather as an ethnic group, comparable to other ethnic groups such as the Javanese, Madurese, and Balinese.

Within the classification of ethnic groups, an ethnic group can be categorized into four tiers: ethnicities, sub-ethnic groups, small ethnic groups, and cultural entities. Ethnicities cannot be classified as indigenous peoples due to the absence of defining characteristics typically associated with indigenous peoples.

Osing Ethnic Community and the Indonesia Power Solar PV Project in Banyuwangi

Based on the results of the LALRP study, seven households (comprising thirteen individuals) from the Osing ethnic community are affected by land acquisition for the Banyuwangi Solar PV Project. They are impacted by the development of the project's transmission line (TL tower footing and ROW). The LALRP study also identified that the average income of the Osing ethnic community within the project area of influence ranges from IDR 448,928 to IDR 2,638,628 which is considered to be within the porverty line for the region. This indicates a high level of vulnerability to economic challenges. Three out of the seven affected Osing households as described above were identified as recipients of social assistance programs from the government.

According to the LALRP study, the sources of livelihood and income for the affected Osing community com various sectors, with most of them being farmers. During the implementation. During the implementation of the Banyuwangi Solar PV Project, the Indonesia Power has confirmed that equal employment opportunities will be provided to individuals from the affected communities, including the Osing ethnic communities residing within the Project area of influence.

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Table C Banyuwangi Sub-Project IP Screening Checklist

	Key Concerns	Yes	No	Not Known	Remarks
A.	**Customary Communities Identification**				
1.	Are there socio-cultural groups present in or use the subproject area who may be considered as Customary Communities?		√		None
2.	Are there national or local laws or policies as well as anthropological researches/studies that consider these groups present in or using the subproject areas as Customary Communities?		√		Based on screening by Remote Indigenous Communities (*Komunitas Adat Terpencil*/KAT) by MoSA (Ministry of Social Affairs), Traditional Law Communities by MoEF (Ministry of Environment and Forestry), and Customary Territory Restoration Agency by Indigenous Peoples Alliance of the Archipelago (*Aliansi Masyarakat Adat Nusantara*/AMAN), there is no IP presence. Furthermore, according to anthropological research, no IP presence in the project area.
3.	Do such groups self-identify as being part of a distinct social and cultural group?		√		None
4.	Do such groups maintain collective attachments to distinct habitats or ancestral territories and/or to the natural resources in these habitats and territories?		√		None
5.	Do such groups maintain cultural, economic, social, and political institutions distinct from the dominant society and culture?		√		None
6.	Do such groups speak a distinct language or dialect?		√		Most of the community speaks Javanese
7.	Have such groups been historically, socially and economically marginalized, disempowered, excluded, and/or discriminated against?		√		None
8.	Are such groups represented as Customary Communities in any formal decision-making bodies at the national or local levels?		√		None

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Key Concerns	Yes	No	Not Known	Remarks
B. Identification of Potential Impacts				
9. Will the subproject directly or indirectly benefit or target Customary Communities?		√		None
10. Will the subproject directly or indirectly affect Customary Communities' traditional socio-cultural and belief practices? (e.g. child-rearing, health, education arts and governance)		√		None
11. Will the subproject affect the livelihood systems of Customary Communities? (e.g., food production system, natural resource management, crafts and trade, employment status)		√		None
12. Will the subproject be in an area (land or territory) occupied, owned, or used by Customary Communities, and/or claimed as ancestral domain?		√		None
13. Commercial development of the cultural resources and knowledge of Customary Communities?		√		None
14. Physical displacement from traditional or customary lands?		√		None
15. Commercial development of natural resources (such as minerals, hydrocarbons, forests, water, hunting or fishing grounds) within customary lands under use that would impact the livelihoods or the cultural, ceremonial, spiritual uses that define the identify and community of Customary Communities?		√		None
16. Establishing legal recognition of rights to lands and territories that area traditionally owned or customarily used, occupied or claimed by Customary Communities?		√		None
17. Acquisition of lands that are traditionally owned or customarily used, occupied or claimed by Customary Communities?		√		None

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