Environmental and Social Impact Assessment Report (ESIA) – Part 3

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8 ENVIRONMENTAL IMPACT ASSESSMENT

8.1 INTRODUCTION

The overall approach to the rating and evaluation of impacts follows the methodology presented in **Chapter 3**. This Section provides greater detail in the evaluation of the significance of environmental impacts identified during Scoping. Where resource/receptor specific magnitude or sensitivity/ vulnerability definitions apply, these are discussed in the relevant subsections.

The impact assessment has taken into account the scoping results regarding the assessment of environmental and social aspects for the ESIA in fulfilment of the international lender standards discussed in **Chapter 2** as per the findings presented in **Chapter 5**. The impacts and management of general non-routine Project activities during construction and operations are discussed in **Chapter 10** of this Report.

8.2 ENVIRONMENTAL RECEPTORS

ESIA Scoping identified the following activities and environmental receptors to be carried forward to be further assessed in the ESIA.

Table 8-1 Summary of the Routine Project Activities and Key Environmental Receptors

Phase	Issues
Planned activities during Pre-Construction and Construction	• Climate Change; • Air Quality; • Acoustics & Vibration; • Soil and Groundwater; • Surface Water Quality; • Terrestrial Biodiversity; • Waste Management; • Marine Water Quality; and • Marine Biodiversity.
Planned activities during Operations	• Climate Change; • Air Quality; • Greenhouse Gases Emission; • Acoustics & Vibration; • Soil and Groundwater; • Surface Water Quality; • Terrestrial Biodiversity; • Waste Management; • Landscape & Visual; • Electric and Magnetic Fields (EMF); • Marine Water Quality; • Sedimentation and coastal processes; and • Marine Biodiversity.

There are a number of intrusive activities that occur throughout the lifecycle of the Project which, if not managed effectively, may cause impacts to the sensitive receptors in the vicinity of the Project Area.

The temporal and spatial spread of activities will mean that actual impacts will be dependent on the specific activities. Accordingly, to enable clearer assessment of impacts and development of management and mitigation measures specific to each activity/receptor interaction and reduce repetition, the potential impacts are described on a receptor basis.

This Section also develops management, mitigation and monitoring measures needed to ensure that any identified impacts can be reduced to as low as reasonably practical. Such measures are presented and will form part of the overall environmental and social management plan for the Project.

8.3 *GENERAL CLIMATE CHANGE*

8.3.1 *Potential Source of Impact*

In recent decades, changes in climate change have caused impacts on natural and human systems on all continents and across the oceans. According to the IPCC, changes in many extreme weather and climate events have been observed since about 1950. Some of these changes have been linked to human influences, including a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions.

According to the Intergovernmental Panel on Climate Change (IPCC), global warming trends and increasing temperature extremes have been observed across most of the Asian region over the past century. Water scarcity is expected to be a major challenge for many countries in the regions as a result of increased water demand across industry, agriculture and domestically but also the lack of good water management. Coastal systems are under increasing stress from climate drivers. Extreme climate event such as more frequent and intense heat waves and heavy rain, will have an increasing impact on human health with the type and magnitude of impact varying across Asia.

8.3.1.1 *Observed Climate Change*

Across Southeast Asia, temperature has been increasing at a rate of 0.14^0C to 0.20^0C per decade since the 1960s, in conjunction with a rising number of days and warm nights, and a decline in cooler weather. For Indonesia, there is a strong evidence of pronounced and high spatially coherence of warming of surface air temperature during the past three decades. The frequency of cool days and cool nights had decreased whereas more frequency of warm days and nights were observed and a clear warming trend of 0.18^0 - 0.30^0C per decade can be seen.

In Southeast Asia annual total wet-day rainfall has increased by 22 mm per decade while rainfall from extreme rain days has increased by 10 mm per decade; climate variability and trends differ vastly across the region and season. Annual precipitation overall has decreased by two or three percent across all of Indonesia over the last century, however there exist a substantial spatial variability of the rainfall extreme throughout the country, with the drying trend in Java being more pronounced.

There has also been a shift in the seasonality of precipitation. Precipitation in Indonesia (and in many parts of the world) is strongly influenced by El Nino and Southern Oscillation (ENSO) events; for instance 93% of droughts Indonesia between 1830 and 1953 occurred during El Niño years.

8.3.1.2 Projected Climate Change

Under IPCC scenarios it is very likely for all land areas of Asia in the mid-and late 21st century to see an increase in temperature. Average changes in mean annual temperature are projected to exceed 2^0C above the late 20th century baseline over most land areas in the mid-21st century. Projected temperature increases over Indonesia are generally consistent in the range of 2-2.5^0C.

Modelled precipitation changes are note as uniform; it is projected that annual rainfall will increase across the majority of the Indonesian island, with the possible exception of southern Indonesia including Java which is projected to decline.

However there is considerable variance in rainfall for different climate models. Changes in the timing and seasonality of rainfall is also projected to change.

8.3.2 Assessment of Impacts

Impacts of observed changes in climate are already evident in Indonesia and will likely worsen due to further human-induced climate change. Continued emission of greenhouse gases will cause further warming and long-lasting changes including the raise of surface and ocean temperatures, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems such as increase sea levels, more frequent fires to increased health risk.

Indonesia will likely experience sea-level rise, changes in the intensity of rainfall patterns which will increase the risk of floods and droughts, increase of surface and ocean temperatures, degradation of biodiversity, increased health risks, and more frequent and intense weather events.

The following section highlights some of these projected climate change impacts that are relevant in the context of this ESIA Report.

8.3.2.1 *Changes in Water Availability*

Observed climate change impacts in Indonesia include changes in the intensity and patterns of precipitation, which are a result of the increase of surface temperatures. There are currently few studies on the impact of climate change on water stress and drought in Indonesia, especially at the national scale. Important uncertainties concern the role of the Asian monsoon affecting drought occurrences in Indonesia under climate change scenarios.

The IPCC Fourth Assessment Report (AR4) previously reported potential increases in precipitation over Indonesia under global climate change scenarios. Large uncertainties remain, particularly regarding the response of the El Niño Southern Oscillation to climate change. A majority of the available models show a tendency for increasing flood risk; few studies have made projections of changes in flood hazard under climate change in Indonesia at national or local scale.

However, given that severe floods have affected Indonesia several times in recent history (and the Project surroundings), a better quantification of the risk of flooding in Indonesia under climate change scenarios is needed. Events such as the Jakarta flood on 2nd February 2007 affected 80 districts in Jakarta. More than 70,000 houses were inundated with water levels ranging from 10cm to 5m and 69 people were killed and an estimated 420,440 people were displaced. The Indonesian government estimates that losses amount to Rp 4.1 trillion (US$ 450 million) (*WHO, 2007*). Since then, large areas of the country, including parts of West Sumatra, Central, East and West Java and Jakarta have been severely affected by heavy rains and subsequent landslides and flooding in recent years.

8.3.2.2 *Tropical Cyclones*

The country report for Indonesia produced for the Department of Energy and Climate Change, suggested that the frequency of landfilling tropical cyclones in Indonesia could decrease with climate change, for both West Pacific, affecting the eastern part of the country; and South Indian Ocean cyclones, affecting the western and southern regions.

However, the intensity of cyclones could increase with climate change, particularly for the most severe storms. The combination of these two (2) effects, and the uncertainties in each of their magnitudes, leads to considerable uncertainty in the estimation of future cyclone damages in Indonesia under climate change.

8.3.2.3 *Increase of Sea Surface Level*

Global mean sea level rise (SLR) will continue during the 21st century likely at a faster rate than observed from 1971 to 2010. SLR will not be uniform across regions; by the end of the 21st century, it is very likely that sea level will rise in more than about 95% of the ocean area. For the period 2081—2100 relative to 1986—2005, the rise will likely be in the ranges of 0.26 to 0.55 m and 0.45 to 0.82m for selected representative Concentration Pathways (RCP2.6 and RCP8.5 respectively) adopted by the IPCC for its fifth Assessment Report in 2014.

SLR could have major impacts on Indonesia's coastal regions as well as marine resources such as reefs and mangroves. A 10% intensification of the current 1 -in-100-year storm surge combined with a prescribed 1m SLR could affect 39% of Indonesia's coastal GDP and 14,400 km^2 of coastal land and increase the annual number of people in coastal populations being flooded.

8.3.2.4 Human Health

Climate change will have widespread and diverse health impacts. For example, more frequent and intense heat waves will increase mortality and morbidity in vulnerable groups. The transmission of infectious disease will be affected as a result of warmer air and water temperatures and altered rain patterns and water flows. Changes in the geographical distribution of vector-borne diseases are already being observed, as vector species that carry and transmit diseases migrate to more hospitable environments.

Climate change will have associated direct effects, such as higher temperatures, changes in precipitation and sea- level rise can cause more frequent and severe heat waves, floods, extreme weather events, and prolonged droughts and lead to increased injury, illness, and death; and Indirect effects, which are more difficult to attribute to climate change, may include more widespread vector-borne infections (e.g., malaria and dengue), an expansion of water-borne diseases, such as diarrhoea and increase in infectious diseases.

Table 8-2 outlines the key risks from climate change and the potential for risk reduction through mitigation and adaptation relevant to this Project and reference to how the impacts of climate change on the Project has been addressed in the design.

Table 8-2 Key Risks from Climate Change and the Potential for Risk Reduction

Key risk	Adaptation issues & prospects	Climatic drivers	Addressed in section
Increased riverine, coastal and urban flooding leading to widespread damage to infrastructure, livelihoods and settlement	• Exposure reduction via structural and non-structural measures, effective land-use planning, and selective relocation; • Reduction in the vulnerability of lifeline infrastructure and services (e.g., water, energy, waste management, food, biomass, mobility, local ecosystems, telecommunications); • Construction of monitoring and early warning systems; and • Measures to identify exposed areas, assist vulnerable areas and households, and diversify livelihoods.	• Extreme precipitation; • Sea level; and • Cyclone.	Flood & Sea Level Risk (refer to **Section 10 and Annex L**)
Increased risk of flood-related deaths, injuries, infectious disease and mental disorders	Disaster preparedness including early-warning systems and local coping strategies.	• Extreme precipitation; and • Cyclone.	Flood & Sea Level Risk (refer to **Section 10 and Annex L**)
Increased risk of water and vector-borne diseases	Early-warning systems, vector control programs, water management and sanitation programs.	• Extreme precipitation; • Drying trend; • Warming trend; and • Extreme temperatures	Social and Community Health (refer to **Section 9**)

8.4 AIR QUALITY

8.4.1 *Potential Source of Impact*

The Project activities and associated emissions to air that may have an impact on ambient air quality during the construction and operation of the CCGT Power Plant and associate facilities including the Floating Storage Regasification Unit (FSRU), the Onshore Gas Receiving Facility (ORF), onshore pipelines, and Transmission Line (hereafter collectively referred to as "the Project") are presented below in **Table 8-3.**

Table 8-3 Project Activities and Associated Emissions to Air

Project Phase	Project Activity	Source of Emission	Substances[1]
Construction	• Land clearance; • Land excavation; • Material transfer; • Material stockpiling; • Use of unpaved roads; • Installation of onshore pipeline; and • Construction of Project infrastructure including CCGT, FSRU, ORF and transmissions lines.	• Point source: Exhaust emissions from diesel engine driven mobile and non-mobile machinery, vehicles and vessels. • Fugitive: dust generated from the mechanical disturbance of granular materials exposed to the air.	• NO_2, SO_2, TSP, PM_{10} and $PM_{2.5}$
Operation	• Power generation at the CCGT power plant; • Power generation required for black start, station black out and/or emergency power; • Gas processing at the ORF; and • Power generation on the FSRU. • Process Water Cooling.	• Point source: Stack emissions from diesel engine-generators, gas turbines, high pressure emergency vent and cooling towers	• NO_2, CO, SO_2, TSP, PM_{10} and $PM_{2.5,}$ hydrocarbon and NaCl.

(1) Nitrogen Dioxide (NO_2); sulphur dioxide (SO_2); total suspended particulates (TSP); particulate matter with an aerodynamic diameter no greater than 10µg (PM_{10}); particulate matter with an aerodynamic diameter no greater than 2.5µg ($PM_{2.5}$); Carbon Monoxide (CO).

Annex D of this report presents a comprehensive overview of the air quality assessment summarised subsequently in this section.

8.4.2 *Air Quality Standards and Guidelines*

The legal framework of relevance to the air quality impact assessment is listed below:

- *World Bank IFC General EHS Guidelines for Air Emissions and Ambient Air Quality, 2007;*

- *World Bank IFC EHS Guidelines for Construction and Decommissioning, 2007;*

- *World Bank IFC EHS Guidelines for Thermal Power Plants, 2008;*
- *World Bank IFC EHS Guidelines for Liquefied Natural Gas (LNG) Facilities, 2017;*
- *World Bank IFC EHS Guidelines for Shipping, 2007;* and
- *Regulation of the Republic of Indonesia Number 41 (1999) regarding Air Pollution Control (PP41/1999).*

The IFC's General EHS guidelines for air emissions and ambient air quality state that:

- *Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognised source; and*
- *Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25 percent of the applicable air quality standards to allow additional, future sustainable development in the same airshed.*

In accordance with the IFC guidelines for Air Emissions and Ambient Air Quality, the air quality standards presented in the Indonesian Regulation of the Republic of Indonesia Number 41 (1999) regarding Air Pollution Control (PP41/1999) should be considered the appropriate standard and are therefore used for comparison of baseline data and predicted impacts in the air quality impact assessment. A summary of the Indonesian air quality standards are presented in **Table 8-4.**

Table 8-4 Indonesia (PP41/1999) Ambient Air Quality Standards

Parameter	Averaging Period	Air Quality Standard ($\mu g/m^3$)
Nitrogen Dioxide (NO_2)	1-hour	400
	24-hour	150
	Annual	100
Sulphur dioxide (SO_2)	1-hour	900
	24-hour	365
	Annual	60
Carbon Monoxide (CO)	1-hour	30,000
	24-hour	10,000
Total Suspended Particulate (TSP)	24-hour	230
	Annual	90
PM_{10}	24-hour	150
$PM_{2.5}$	24-hour	65
	Annual	15
Ozone (O_3)	1-hour	50

Parameter	Averaging Period	Air Quality Standard (µg/m³)
	Annual	235
Lead (Pb)	24-hour	2
	Annual	1
Hydrocarbons (HC)	3-hours	160
Total Fluorides (F)	24-hour	3
	90 days	0.5
Chlorine and Chlorine dioxide	24-hour	150

In terms of potential impacts to ecology and agriculture, local assessment criteria do not exist and the IFC do not set standards or guidelines for protection of vegetation. Instead, critical levels provided by the WHO and the EU have been used to inform the impact assessment and are presented below in **Table 8-5**.

Table 8-5 Air Quality Critical Levels used for the Assessment of Impacts on Sensitive Ecological and Agricultural Receptors

Pollutant	Averaging Period	Critical Levels (µg/m³)(1,2)
Nitrogen Oxides (NO_x)	Annual mean	30
Sulphur dioxide (SO_2)	Annual Mean	20

(1) *Source: WHO, 2000*
(2) *Source: EU, 2008*

8.4.3 *Emission Limits Applicable to the Project*

The relevant emission limits as per the IFC EHS Guidelines for Thermal Power Plants greater than 50 megawatt thermal input (MWth) are presented in **Table 8-6.**

Table 8-6 International Finance Corporation (IFC) Air Emissions Guidelines for Combustion Turbine (>50MWth)

Combustion Technology / Fuel	Particulate Matter (PM)	Sulphur Dioxide (SO_2)	Nitrogen Oxides (NO_x)	Dry Gas, Excess O_2 content (%)
	in mg/Nm³ or as indicated			
	NDA(1) / DA(2)	NDA(1) / DA(2)	NDA(1) / DA(2)	
Natural Gas (all turbine types of unit >50MWth(3))	n/a	n/a	51 (25ppm)	15%

(1) Non-degraded airshed
(2) Degraded airshed
(3) Megawatt thermal input

8.4.4 *Scoping of Likely Impacts to Air Quality*

A detailed preliminary screening assessment was undertaken to better understand the Project activities, processes and emissions which are likely to have a significant impact on air quality and therefore require further more detailed consideration. The detailed screening assessment is presented in **Annex D Section 3**. The findings from the screening assessment concluded that the main activities which require further more detailed assessment are as follows:

- Construction activities: These activities are specifically associated with earthworks, the construction of the Project infrastructure, and track-out (carrying and contamination) of materials onto public roads leading to increased ambient concentrations of TSP and PM_{10} (refer to **Annex D Section 5.2** for the detailed impact assessment and **Section 8.4.5** of this chapter for the assessment summary);

- Offsite construction traffic: The use of vehicle on the public road network during the construction phase resulting in elevated concentrations of NO_2 and PM_{10} (refer to **Annex D Section 5.3** for the detailed impact assessment and **Section 8.4.6** of this chapter for the assessment summary);

- Operation of the CCGT Power Plant: The continuous operation of two Combined Cycle Gas Turbines (CCGT) used for power generation during the normal operation of the Project resulting in elevated ambient concentrations of NO_2 and CO (refer to **Annex D Section 5.4** for the detailed impact assessment and **Section 8.4.7** of this chapter for the assessment summary);

- Operation of cooling towers: The continuous operation of two seawater cooling tower systems can lead to increased sodium chloride (NaCl) deposition on the surrounding agriculture (refer to **Annex D Section 5.5** for the detailed impact assessment and **Section 8.4.8** of this chapter for the assessment summary); and

- The intermittent and infrequent use of diesel generators required for black start and emergency shut down procedures during the operation phase resulting in elevated ambient concentrations of NO_2 and SO_2. This scenario, however, is considered an unplanned/emergency event and has therefore been reported in **Chapter 10** of this ESIA. The detailed assessment of impacts is presented in **Annex D Section 6**.

8.4.5 Assessment of Impacts – Construction Activities

8.4.5.1 Overview

The activities associated with the construction phase of the Project have the potential to generate TSP and particulate matter (PM_{10}). These activities include ground excavation, material transfer and material stockpiling; construction of the main infrastructure including the power plant and transmission line tower; and track-out of dusty materials and dirt onto the public road network. Fugitive dust has the potential to cause impacts on sensitive receptors in the vicinity of the above named activities if not managed accordingly. Dust emissions can vary substantially from day to day and will depend on the level of activity, the specific operations being undertaken and the meteorological conditions.

8.4.5.2 Assessment Approach and Criteria

The Institute of Air Quality Management (IAQM) (1) provide guidance for defining the dust impact risk from construction sites based on a) the scale and nature of the works which determines the potential dust emissions magnitude; and b) the sensitivity of the receiving area. The IAQM guidance has been used as the main reference document for determining the potential risk of impact from the anticipated construction works in order to determine the level of site specific mitigation that should be applied. The premise of the IAQM guidance is that with the implementation of effective site specific mitigation and management measures, the environmental effect will not be significant in most cases. The guidance also provides screening criteria of 350m and 50m from the construction site and access road respectively beyond which impacts are not considered likely.

The potential dust impact risk from the different project components and activities and the specific mitigation measures which are required have been considered. The construction of the FSRU and Jetty have been screened out on the basis that no dust will be generated in the marine environment and no sensitive receptors exist within 350m.

Where necessary professional judgement has been used to estimate the impact magnitude from the different project components and activities.

8.4.5.3 Determining the Magnitude of the Impact

The IAQM define the potential dust emissions magnitude based on the scale of the anticipated works and is classified as small, medium or large. The criteria for estimating the magnitude of dust impacts from earthworks, construction and track-out as per the IAQM guidance note is presented in **Chapter 5.2.2** of **Annex D** and has been used to inform this impact assessment.

8.4.5.4 Determining the Sensitivity of the Area

The IAQM define the sensitivity of the area based on receptor type and the number of receptors within a certain distance from the source. Residential properties, schools, hospitals are classified as high sensitivity to dust soiling and health effects. Locations where there are particularly important plant species where the dust sensitivity is uncertain or unknown (i.e. rice paddy) are classified as medium sensitivity. The criteria for estimating the sensitivity of the area to dust soiling effects on people and property; human health impacts

(1) Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction [Online] Available at: http://iaqm.co.uk/guidance/ [Accessed 05 February 2018]

from PM_{10}; and impacts to ecology from dust deposition as per the IAQM guidance is presented in **Section 5.2.2** of **Annex D.**

8.4.5.5 Determining the Risk of Impact

The impact magnitude is combined with the sensitivity of the area to determine the risk of the dust impact with no mitigation applied. The matrices in **Section 5.2.2** of **Annex D** provide the approach for defining the impact risk due to earthworks, construction and track-out. The findings from the risk assessment inform the level of mitigation, which is necessary to reduce impacts to an acceptable level.

8.4.5.6 Summary of Dust Risk

The detailed risk assessment of dust impacts as a result of earthworks, construction and track out at the CCGT Power Plant, onshore pipeline and substation is presented in **Chapter 5.2** of **Annex D.**

A summary of the risk pre mitigation for each Project component is presented below in **Table 8-7** through **Table 8-10**.

Table 8-7 Summary of Dust Risk from the Combined Cycle Gas Turbine Power Plant (pre-mitigation)

Potential Impact	Risk		
	Earthworks	Construction	Track out
Dust Soiling	High	Medium	High
Human Health	High	Medium	High
Ecological	Medium	Medium	Negligible

Table 8-8 Summary of Dust Risk from the Onshore Pipeline (pre-mitigation)

Potential Impact	Risk		
	Earthworks	Construction	Track out
Dust Soiling	Medium	Negligible	High
Human Health	Medium	Negligible	High
Ecological	Medium	Negligible	Negligible

Table 8-9 Summary of Dust Risk from the Cibatu Substation (pre-mitigation)

Potential Impact	Risk		
	Earthworks	Construction	Track out
Dust Soiling	Low	Negligible	High
Human Health	Low	Negligible	High
Ecological	Medium	Low	Medium

Table 8-10 Summary of Dust Risk from Transmission Line Towers (pre-mitigation)

Potential Impact	Risk		
	Earthworks	Construction	Track out
Dust Soiling	Negligible	Negligible	Negligible
Human Health	Low	Low	Negligible
Ecological	Low	Low	Low

8.4.5.7 *Mitigation Measures, Management and Monitoring Measures*

At all construction sites a series of specific Project component mitigation measures for earthworks, construction and trackout are required based on the outcome of the dust risk assessment and are presented in **Table 8-11**. Where the assessment predicts negligible adverse impacts no site specific mitigation measures are proposed.

Table 8-11 Mitigation Measures

Project Component	Activity	Mitigation
All construction sites	Construction	• Develop and Implement a Dust Management Plan (DMP). The DMP will contain the measures outlined in this document and a plan for implementation. • Regular site inspections will be performed to monitor compliance with the DMP. All inspection results will be recorded and corrective actions taken where mitigation and management measures are not being implemented effectively. • Daily onsite and offsite inspections will be undertaken to visually assess the dust emissions from earthwork and construction activities, and from vehicles exiting the construction sites. Results from the inspection will be recorded and appropriate measures will be taken to reduce emissions where necessary. • All dust and air quality complaints will be recorded, the cause identified and the appropriate measures taken to reduce emissions in a timely manner. • The frequency of site inspections will be increased when activities with a high potential to produce dust are being carried out and during prolonged dry and windy conditions. • Use of site watering to suppress wind and physical disturbance dust generation. • Only cutting, grinding, or sawing equipment fitted with suitable dust suppression techniques such as water sprays will be used. • All chutes, conveyors and skips will be covered at all times. • Drop heights from conveyors, loading shovels and hoppers will be minimised • Ensure an adequate water supply on site for effective dust suppression and mitigation
CCGT Power Plant	Earthworks	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers, or cover with topsoil, as soon as practicable. • Only remove the top soil in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape. • Real time PM_{10} monitoring will be undertaken at two fenceline locations. Monitoring will commence 3-months prior to the earthwork phase commencing.
	Construction	• The construction site will be planned so that machinery and dust causing activities are located away from air sensitive receptors as far as possible • Wind breaks will be erected around the construction site at least the height of any stockpile on site. • All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required. • Deliveries of ready-made cement and other fine powders will be delivered in enclosed tankers and stored in silos with suitable emission controls to prevent escape of material and overfilling during delivery.

Project Component	Activity	Mitigation
	Trackout	• Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable. • Implement a wheel washing system. • Regular inspection and washing of site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m from air sensitive receptors where possible.
Onshore Pipeline	Earthworks	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top soil in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape.
	Trackout	• Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable. • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.
Cibatu Substation	Earthworks	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top cover in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape.
	Construction	• All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required.
	Trackout	• Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable. • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.

Project Component	Activity	Mitigation
Transmission Line Towers	Construction	• All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required.
	Trackout	• Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Implement a wheel washing system.

8.4.5.8 Significance of Residual Impacts

The IAQM guidance suggest that when correctly applying and actively managing the mitigating controls the impacts to receptors located within 350 m downwind of any construction activity are not likely to be significant for the large majority of the time. However, due to the nature of construction activities, the scale and duration of the construction phase, and the possibility of extreme weather conditions, it is possible that communities may experience occasional, short term dust annoyance. The IAQM states that "*the likely scale of this would not normally be considered sufficient to change the conclusion that with mitigation the effects will be 'not significant'.* On this basis it can be concluded that construction phase activities are likely to result in a **Minor impact** at worst post mitigation.

8.4.6 Assessment of Impacts – Offsite Construction Traffic

8.4.6.1 Overview

Exhaust emissions from increased offsite traffic required during the construction phase could potentially lead to impacts on air quality at sensitive receptors in the study area. The potential impact to sensitive receptors has been assessed using the UK Highways Agency Design Manual for Roads and Bridges (DMRB).

8.4.6.2 Assessment Approach and Criteria

The DMRB methodology has been used to determine the process contribution (PC) of NO_x/NO_2 and PM_{10} at 5m, 20m, 50m, 100m and 200m from the road side to determine the potential magnitude of the impact at air sensitive receptors located along access roads used by construction traffic during the construction phase. The detailed methodology is presented in **Annex D Section 5.3.2.**

Given that the exact number of vehicle movements on any given road during the construction period is currently unknown, a conservative value of 1,000 and 10,000 additional heavy good vehicle (HGV) movements per day has been used to understand the likely impacts on ambient air quality.

8.4.6.3 Traffic Related Impacts

The results presented in **Annex D Chapter 5.3.3** indicate that the concentration of NO_2 and PM_{10} is well below the relevant air quality standard at all distances from the road when considering the most conservative value of 10,000 HGV movements per day. The magnitude of the impact is considered negligible. The resulting likely impact on air quality from vehicle exhausts associated with increased traffic on the public road network during the construction phase is presented in **Table 8-12.**

On the basis that the sensitivity within the general study area is **Medium**, the impact to air quality from vehicle exhausts associated with increased traffic on the public road network during the construction phase is said to have a **Negligible impact** on air quality.

Table 8-12 Assessment of Impacts on Air Quality Due to Offsite Construction Traffic

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

8.4.6.4 Mitigation Measures, Management and Monitoring Measures

Good practice procedures such as those outlines in the IFC EHS Guidelines for Air Emissions and Ambient Air Quality will be implemented to ensure that the impact on ambient air quality from vehicle exhausts is kept as low as is reasonably achievable:

- Old vehicles will be replaced with new, more fuel efficient alternatives;
- Where feasible high use vehicles will be converted to cleaner fuels (it is assumed 0.5% sulphur content in the locally purchased diesel fuel); and
- All vehicles, equipment and machinery will undergo a pre-use inspection prior to use and periodic maintenance inspections.

8.4.6.5 Assessment of Residual Impact

The residual impact on air quality from vehicle exhausts associated with increased traffic on the public road network during the construction phase is **Negligible.**

8.4.7 Assessment of Impacts – Operation of CCGT Power Plant

8.4.7.1 Overview

The assessment of potential impacts related to air quality in this section is based on the detailed baseline assessment presented in **Annex D Chapter 4.3** (summary presented in **Chapter 7**) and the information available from the Sponsor at the time of writing. The potential impacts to air quality were quantified using detailed dispersion modelling and the detailed impact assessment is presented in **Annex D Chapter 5.4**.

8.4.7.2 *Assessment Approach and Criteria*

The magnitude of the impact on air quality was ascertained by means of comparison to the air quality standards presented in **Table 8-4** and is based upon whether or not the impacts result in air quality standards being exceeded or contribute a substantial proportion of airborne pollutants in the local airshed. The magnitude is based on both the 'Project Contribution (PC)'; this is the impact arising solely from Project related emissions, and the Predicted Environmental Concentration (PEC); this is the PC added to the existing baseline.

The significance of impacts is defined in terms of the magnitude of impacts (i.e. the PEC), the sensitivity of the receptors, and whether the baseline concentrations are above or below the air quality standards. Using this approach, the significance criteria for air quality have been defined.

The magnitude and significance of impacts for non-degraded and degraded airsheds have been derived and presented in **Table 8-13** and **Table 8-14** respectively. The general approach used in this assessment assumes that sensitivity within the general study area is 'Medium'. Under no circumstances is the sensitivity for human health described as 'Low'.

Table 8-13 Magnitude Criteria for Assessment of Air Pollutants

Magnitude of impact	Non-degraded airshed (i.e. baseline < AQS)	Degraded airshed (i.e. baseline > AQS)
Negligible	PC <25% of AQS	PC <10% of AQS
Small	PC between 25% and 50% of AQS and PEC <100% of AQS	PC between 10% and 30% of AQS
Medium	PC between 50% and 100% of AQS, and PEC <100% AQS; or PC between 25% and 50% of AQS, and PEC >100% of AQS	PC between 30% and 50% of AQS
Large	PC > 100% of AQS; or PC > 50% of AQS, and PEC >100% of AQS	PC > 50% of AQS

PC: Process Contribution
PEC: Predicted Environmental Concentration
AQS: Air Quality Standard/Guideline

Table 8-14 Determination of Significance

Impact Magnitude	Receptor Sensitivity		
	Low	**Medium**	**High**
Negligible	Negligible	Negligible	Negligible
Small	Negligible	Minor	Moderate
Medium	Minor	Moderate	Major
Large	Moderate	Major	Major

8.4.7.3 Selection of Modelling Scenarios

A base case modelling scenario was initially considered to include a stack height of 60m and a NO_x emission rate based on the IFC NO_x emission limit value and the turbine manufacturer guaranteed NO_x emission level of 51mg/Nm^3. The resulting NO_2 1-hour maximum PC was found to exceed 25% of the NO_2 1-hour Indonesian air quality standard and considered not compliant with the criteria outlined in previously (refer to **Section 8.4.7.5**). In order to facilitate the decision making process, the air quality impact assessment presented in **Annex D** details the methodology and findings from a number of additional modelling scenarios based on varying stack heights and a reduced NO_x concentration. This approach has been undertaken to determine the Project design which is necessary to achieve compliance with the air quality criteria. A summary of the modelling scenarios is presented in **Table 8-15.**

Table 8-15 Modelling Scenarios

Modelling Scenario (1)(2)(3)	Stack Height (m)	Substances Modelled	Emission Concentration (mg/Nm³)
Scenario 1a (Base Case)	60	NO_x	51
		CO	50
Scenario 1b	60	NO_x	40
Scenario 2a	65	NO_x	51
Scenario 2b	65	NO_x	40
Scenario 3a	70	NO_x	51
Scenario 3b	70	NO_x	40
Scenario 4a	75	NO_x	51
Scenario 4b	75	NO_x	40
Scenario 5a	82 (4)	NO_x	51
Scenario 5b	82 (4)	NO_x	40

(1) Scenario 1a (base case) considers a stack height of 60m, a guaranteed NO_x emission concentration of 51 mg/Nm^3 and CO emission concentration of 50mg/Nm^3. The NO_x emission concentration is also reflective of the IFC emission limit for natural gas fired combustion turbines > 50MWth (refer to **Table 8-6**).

(2) Scenario 2a, 3a, 4a and 5a consider increasing stack height while maintaining the GE 9HA.02 gas turbine NO_x emission rate at a guaranteed concentration of 51 mg/Nm^3.

(3) Scenario 1b, 2b, 3b, 4b and 5b consider increasing stack height with both GE 9HA.02 turbines operating at the expected base load NO_x emission level of 40mg/Nm^3. While the contractual guarantees from General Electric (GE) are for a maximum of 51 mg/Nm^3 NO_x, the two 9HA.02 gas turbines are not expected to operate at this limit during normal operation. Furthermore, the turbines will be fitted with GEs Dry Low NO_x (DLN2.6e) combustion system which will result in lower NO_x emissions. The applicability of this NO_x emission level is supported by the European Commission Best Available Techniques (BAT) Reference Document for Large Combustion Plants which presents evidence of new CCGT power plants (>50MWth) achieving a NO_x emission level between 15 and 40 mg/Nm^3 as a daily average and between 10 and 30 mg/Nm^3 as an annual average when applying BAT (i.e. dry low-NOx burners). (European Commission Best Available Techniques (BAT) Reference Document for Large Combustion Plants (2017) [Online] Available at: http://eippcb.jrc.ec.europa.eu/reference/BREF/LCP/JRC107769_LCP_bref2017.pdf)

(4) Good International Industry Practice (GIIP) stack height requirement

8.4.7.4 *Dispersion Modelling*

The dispersion model used to inform the air quality impact assessment was the USEPA AERMOD dispersion model version 16216r. AERMOD is a state of the art detailed dispersion model that can be used to represent complex multiple emission sources and predict air quality at receptor locations taking into account meteorology. The model is widely recognised for use in this type of application, including by the IFC, US EPA, UK Environment Agency and state based EPA's throughout Australia.

Detailed dispersion modelling was used to predict concentrations of emitted substances at ground level locations outside the Project area boundary and at a number of specific air sensitive receptors. Five (5) years of hourly sequential meteorological data was used so that inter annual variability was incorporated into the model.

Modelling results for the 1st highest (100th percentile) and 9th highest (99.9th) 1-hour ground level concentration were considered. The use of the 99.9th percentile is adopted across multiple jurisdictions around the world including Victoria in Australia, Alberta in Canada and the New Zealand Ministry for the Environment. The purpose of the 99.9th percentile is to remove modelling uncertainty as a result of extreme, rare and transient meteorological conditions. A modelling result taken as a peak value (100th percentile) in comparison to ambient air quality criteria can be greatly sensitive to modelling uncertainty (refer to **Annex D Section 5.4.5)**. For averaging periods longer than an hour, the modelling uncertainty is reduced as the averaging process over multiple hours reduces the peak 1-hour values, and longer averaging periods are therefore not subject to the same modelling uncertainty. Consequently, for criteria with averaging periods of 1-hour, the 9th highest (99.9th percentile) value has been reported. Use of the 9th highest 1-hour average value means that from the model predictions, results for 8751 hours of the year are equal to or lower than the value presented. For averaging periods greater than 1-hour the maximum predicted (100th percentile) concentration has been reported.

The modelling scenarios and detailed methodology, including receptor grid spacing, meteorological data information, NO_x to NO_2 conversion and the treatment of buildings, land use and terrain is presented in detail in **Annex D Section 5.4.2**. The emission inventory for the CCGT Power Plant is summarised below in **Table 8-16.** The study area and representative receptors are presented in **Figure 8-1**.

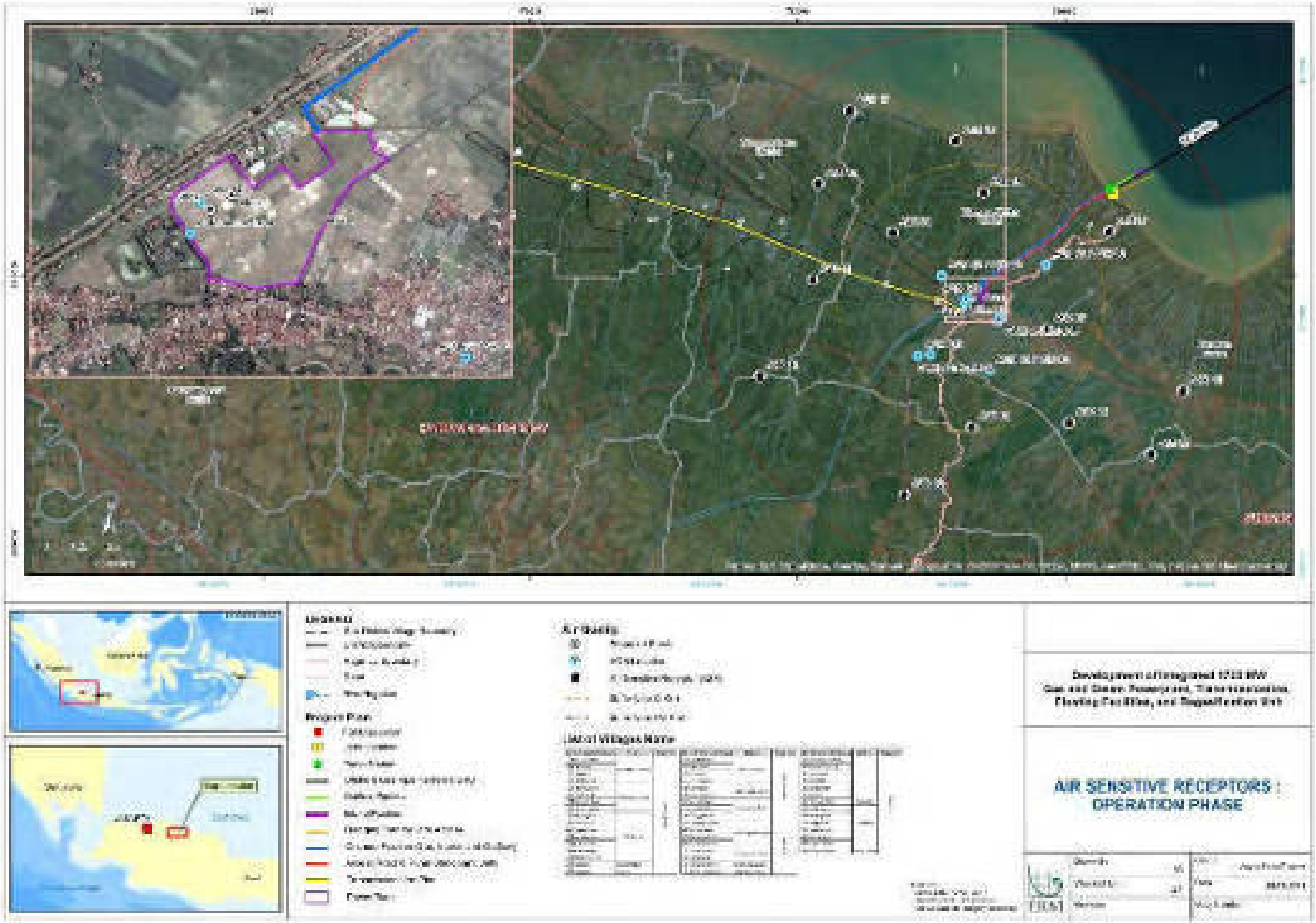
Table 8-16 Emission Inventory for CCGT Power Plant

	Unit	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
		a	b	a	b	a	b	a	b	a	b
Actual Stack Conditions											
Stack Location	Lat/Long	Stack 1: 6°14'37.84"S 107°35'19.58"E Stack 2: 6°14'40.04"S 107°35'16.25"E									
Stack height	m	60	60	65	65	70	70	75	75	82	82
Stack diameter	m	9.44									
Exit Temperature	k	340									
Emission Velocity	m/s	15.2									
Actual oxygen (O_2) content (dry)	%	10.7									
Actual moisture (H_2O) content (wet)	%	13.2									
Actual volume flow rate	Am^3/s	1067									
Reference Conditions (1)											
Temperature	K	273.15									
Oxygen content (dry gas)	%	15									
Moisture content (dry gas)	%	0									
Normalised Volume Flow Rate (2)											
Normalised volume flow rate	Nm^3/s	1283									
Emission Concentrations											
Oxides of Nitrogen (NO_x) (1)	mg/Nm^3	51	40	51	40	51	40	51	40	51	40
Carbon Monoxide (CO)	mg/Nm^3	50	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Emission Rates											
Oxides of Nitrogen (NO_x)	g/s	65.4	51.3	65.4	51.3	65.4	51.3	65.4	51.3	65.4	51.3
Carbon Monoxide (CO)	g/s	64.2	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*

(1) International Finance Corporation (IFC) (2008) Environmental, Health and Safety Guidelines for Thermal Power Plants [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines [Accessed 05 February 2018].

(2) Calculated using the Environment Agency (2013) Pollution Inventory Reporting – Combustion Activities Guidance Note [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296994/LIT_7825_e97f48.pdf [Accessed 05 February 2018]

Figure 8-1 Operation Phase Study Area and Representative Human Receptors



8.4.7.5 Assessment of Impacts - Scenario 1a: CCGT Power Plant Related Impacts to Air Quality

The detailed modelling results are presented in **Annex D Section 5.4.3**. The likely impacts on air quality associated with the continuous operation of the CCGT Power Plant and a NO_x emission concentration of 51mg/Nm3 are summarised as follows for each substance of interest and relevant averaging period:

- Nitrogen Dioxide (NO_2) 1-Hour Maximum (99.9th Percentile): The modelling results indicate that the maximum offsite PC based on the 99.9th percentile 1-hour value is 112µg/m^3 and exceeds 25% of the relevant air quality standard (400µg/m^3). The PEC (179µg/m^3) is below the air quality standard. On this basis the impact to air quality is considered Minor. A contour map showing the PC and PEC is presented in **Figure 8-2** and **Figure 8-3**.

- Nitrogen Dioxide (NO_2) 24-Hour Maximum (100th Percentile): The modelling results indicate that the maximum offsite PC (35.1µg/m^3) and the maximum offsite PEC (62.8µg/m^3) is less than 25% and 100% of the relevant air quality standard (150µg/m^3) respectively throughout the study area. On this basis the impacts to air quality are Negligible. A contour map showing the PC and PEC is presented in **Figure 8-4** and **Figure 8-5**;
- Nitrogen Dioxide (NO_2) Annual Average: The modelling results indicate that the maximum offsite PC (8.22µg/m^3) and the maximum offsite PEC (20.5µg/m^3) is less than 25% and 100% of the relevant air quality standard (100µg/m^3) respectively throughout the study area. On this basis the impacts to air quality are Negligible. A contour map showing the PC and PEC is presented in **Figure 8-6** and **Figure 8-7**;
- Carbon Monoxide (CO) 1-Hour Maximum (99.9th Percentile): The modelling results indicate that the maximum offsite PC (122µg/m^3) is less than 25% of the relevant air quality standard (30,000µg/m^3) throughout the study area. On this basis the impacts to air quality are Negligible. A contour map showing the PC is presented in **Figure 8-8**;
- Carbon Monoxide (CO) 24-Hour Maximum (100th Percentile): The modelling results indicate that the maximum offsite PC (38.2µg/m^3) is less than 25% of the relevant air quality standard (10,000µg/m^3) throughout the study area. On this basis the impacts to air quality are Negligible. A contour map showing the PC is presented in **Figure 8-9**; and
- Oxides of Nitrogen (NO_x) Annual Average: The modelling results indicate that the maximum offsite PC (9.14µg/m^3) exceeds 25% of the relevant standard (30µg/m^3). On this basis the impact to air quality is considered Minor. It is noted, however, that in the coastal areas where protected mangrove have been identified, and in areas where paddy fields are present around the site boundary, the impacts to air quality are Negligible (i.e. PC less than 25% of air quality standard) (**Figure 8-10**).

Figure 8-2 Scenario 1a: Nitrogen Dioxide (NO_2) One (1)-Hour Maximum Process Contribution (PC) – 99.9 Percentile (Human Health)

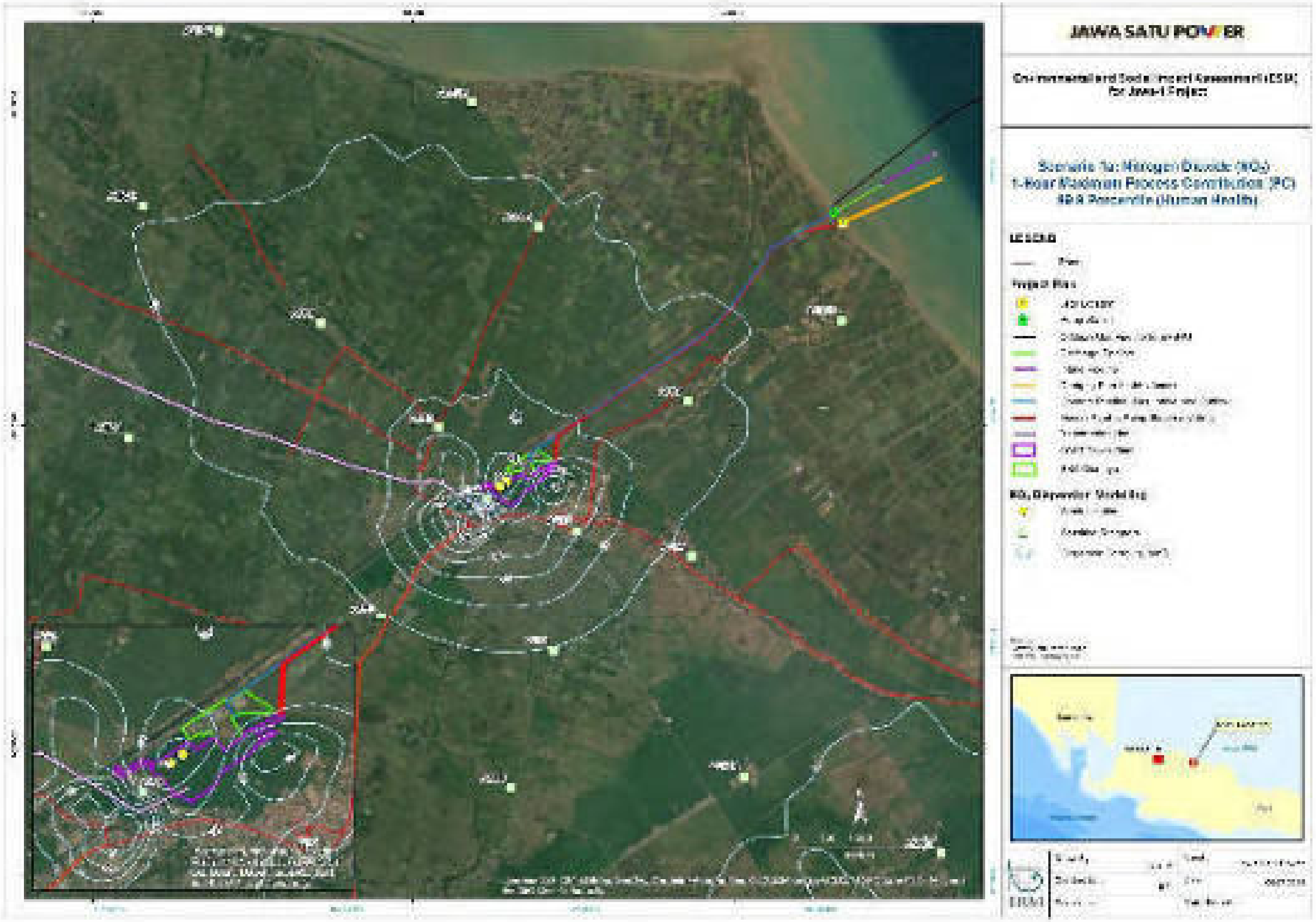


Figure 8-3 Scenario 1a: Nitrogen Dioxide (NO_2) One (1)-Hour Maximum Environmental Concentration (PEC) – 99.9 Percentile (Human Health)

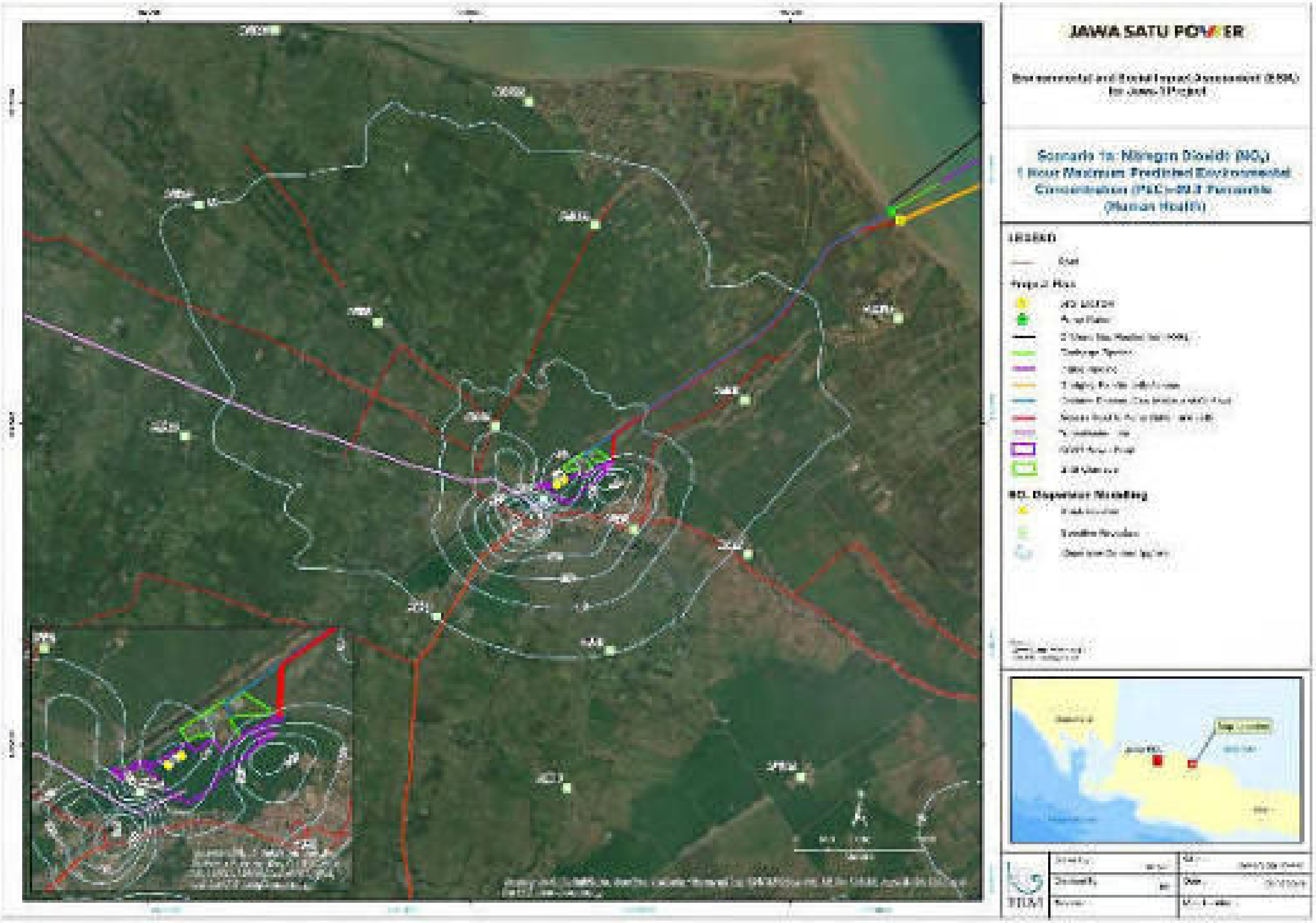


Figure 8-4 Scenario 1a: Nitrogen Dioxide (NO_2) 24-Hour Maximum Process Contribution (PC) – 100th Percentile (Human Health)

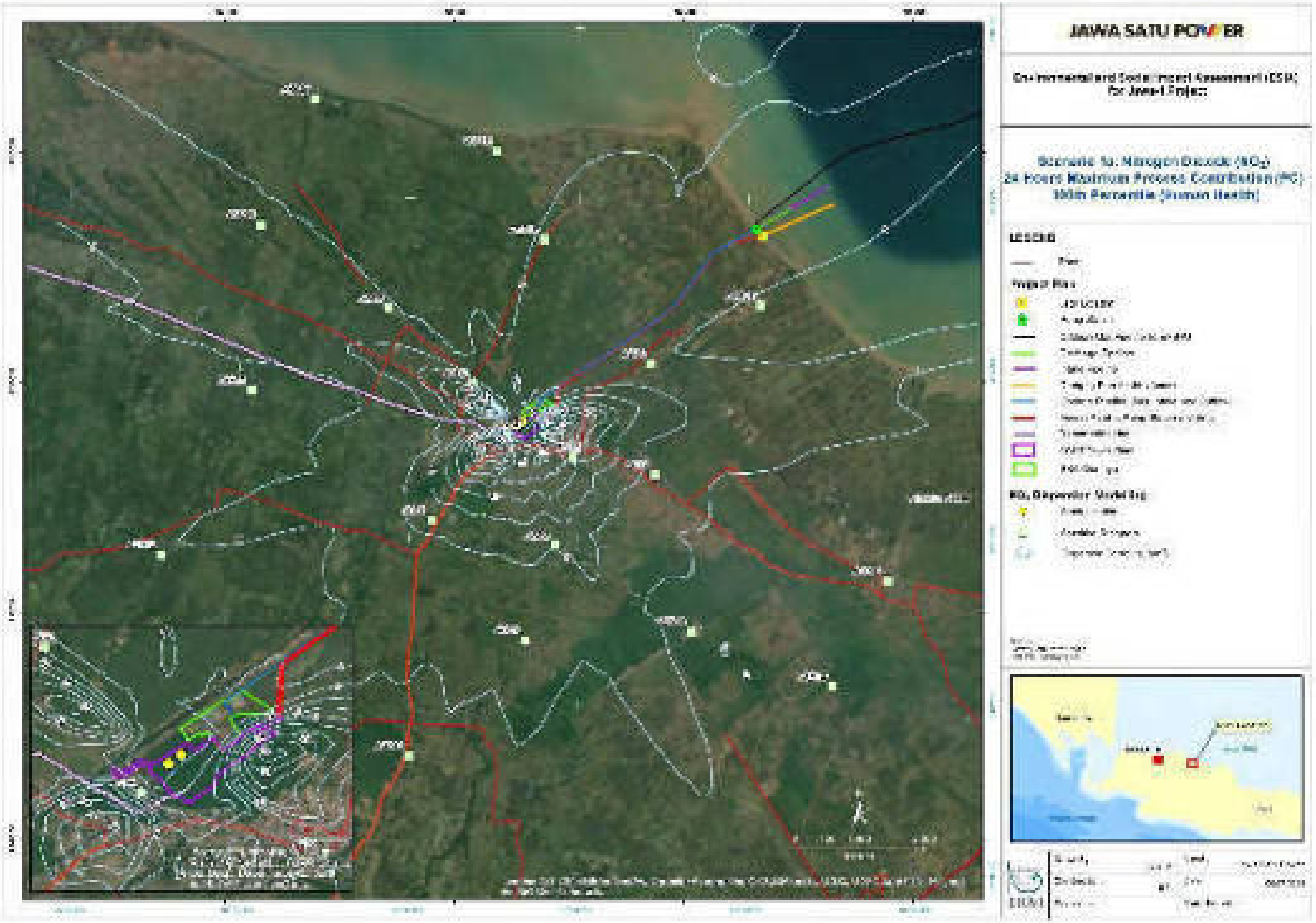


Figure 8-5 Scenario 1a: Nitrogen Dioxide (NO_2) 24-Hour Maximum Predicted Environmental Concentration (PEC) – 100th Percentile (Human Health)

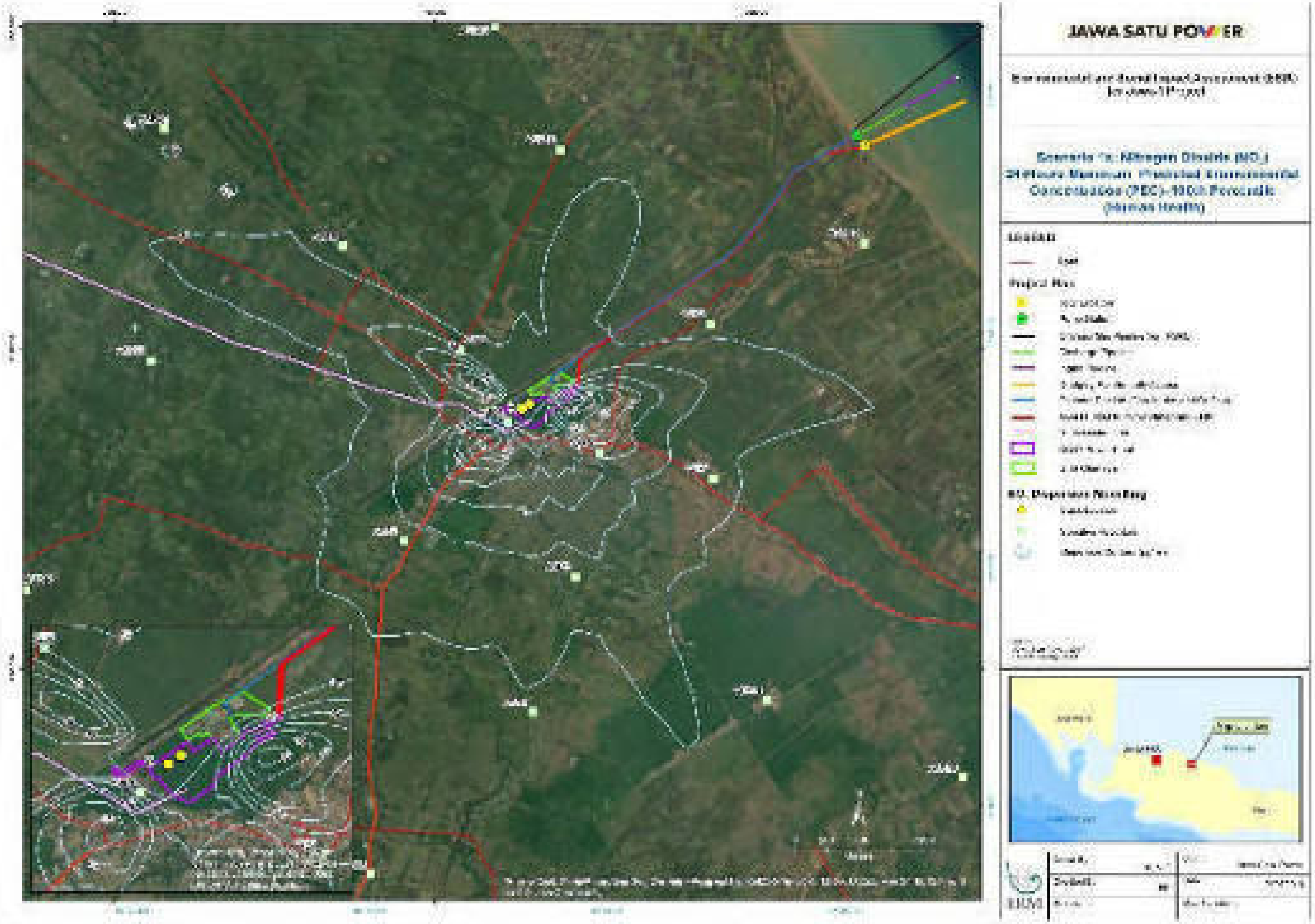


Figure 8-6 Scenario 1a: Nitrogen Dioxide (NO_2) Annual Average Process Contribution (PC) – (Human Health)

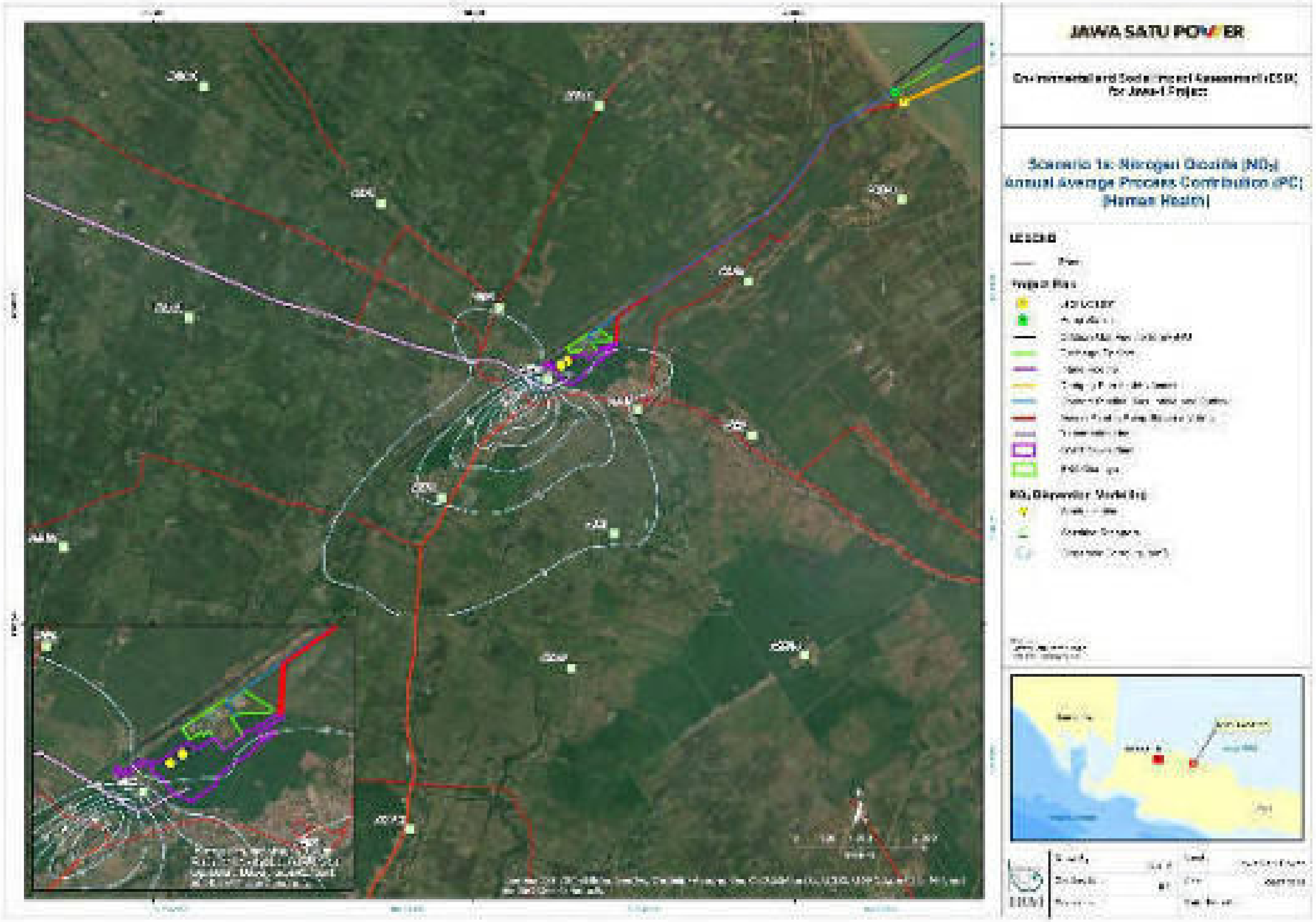


Figure 8-7 Scenario 1a: Nitrogen Dioxide (NO_2) Annual Average Predicted Environmental Concentration (PEC) – (Human Health)

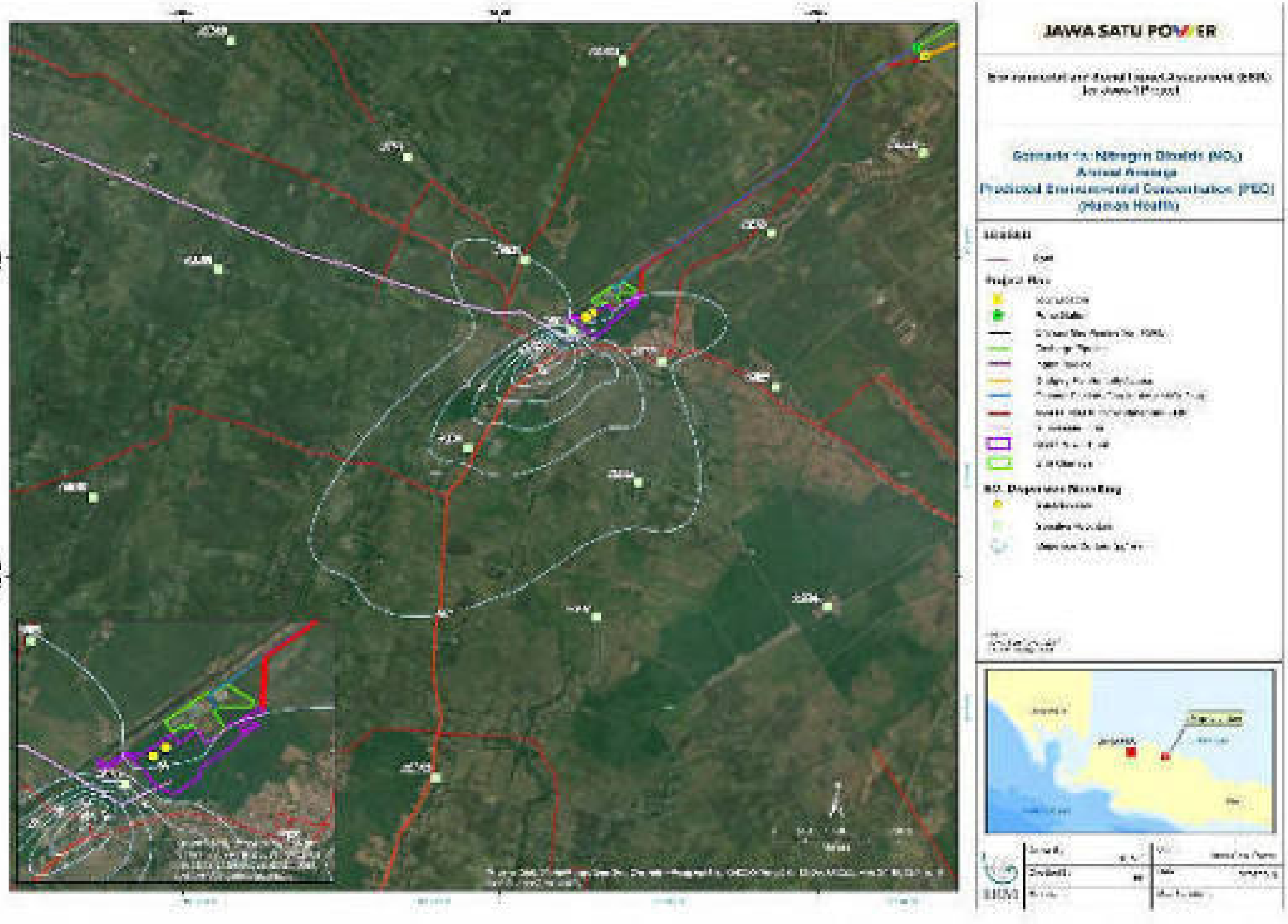


Figure 8-8 Scenario 1a: Carbon Monoxide (CO) 1-Hour Maximum Process Contribution (PC) – 99.9 Percentile (Human Health)

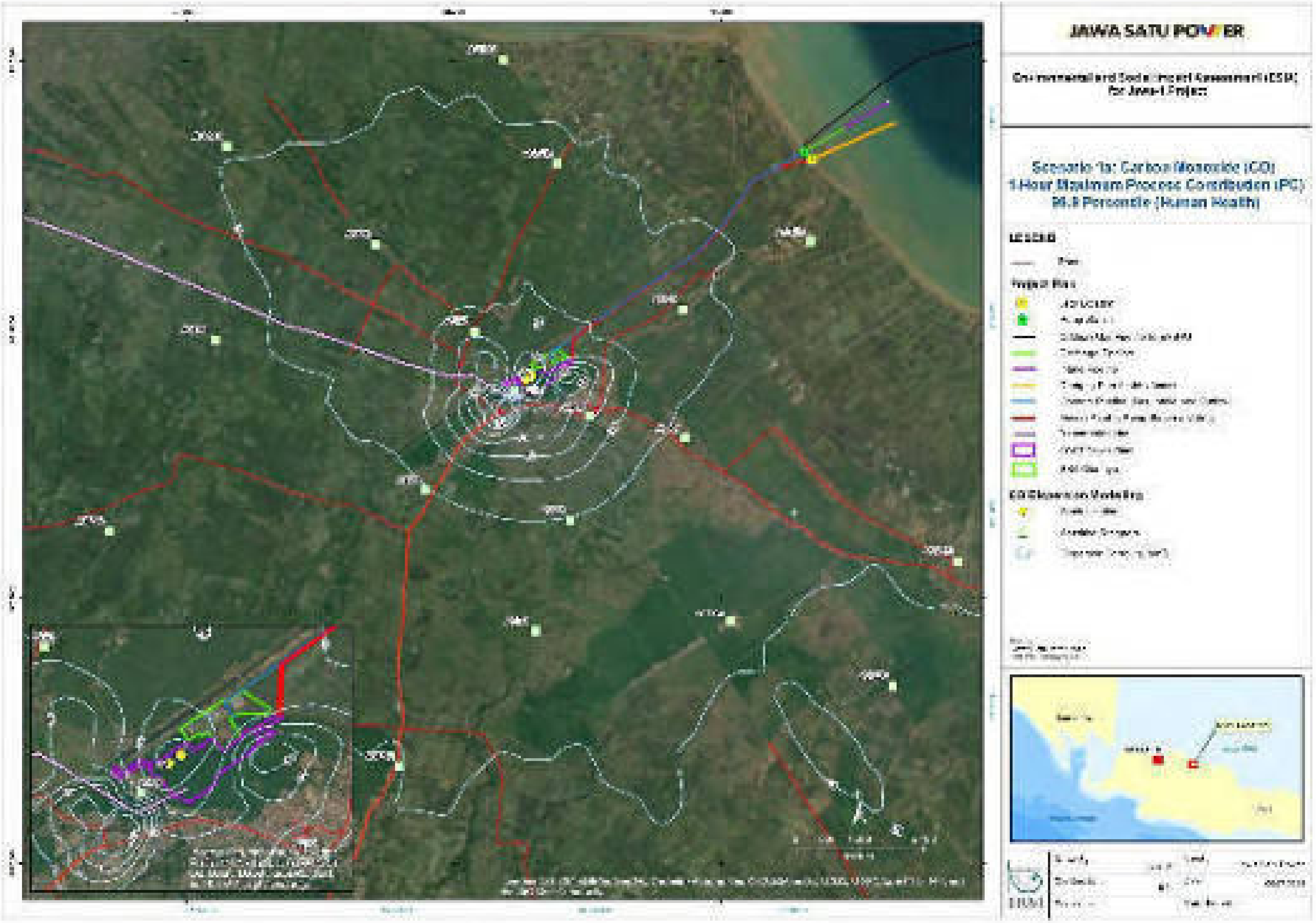


Figure 8-9 Scenario 1a: Carbon Monoxide (CO) 24-Hour Maximum Process Contribution (PC) – 100th Percentile (Human Health)

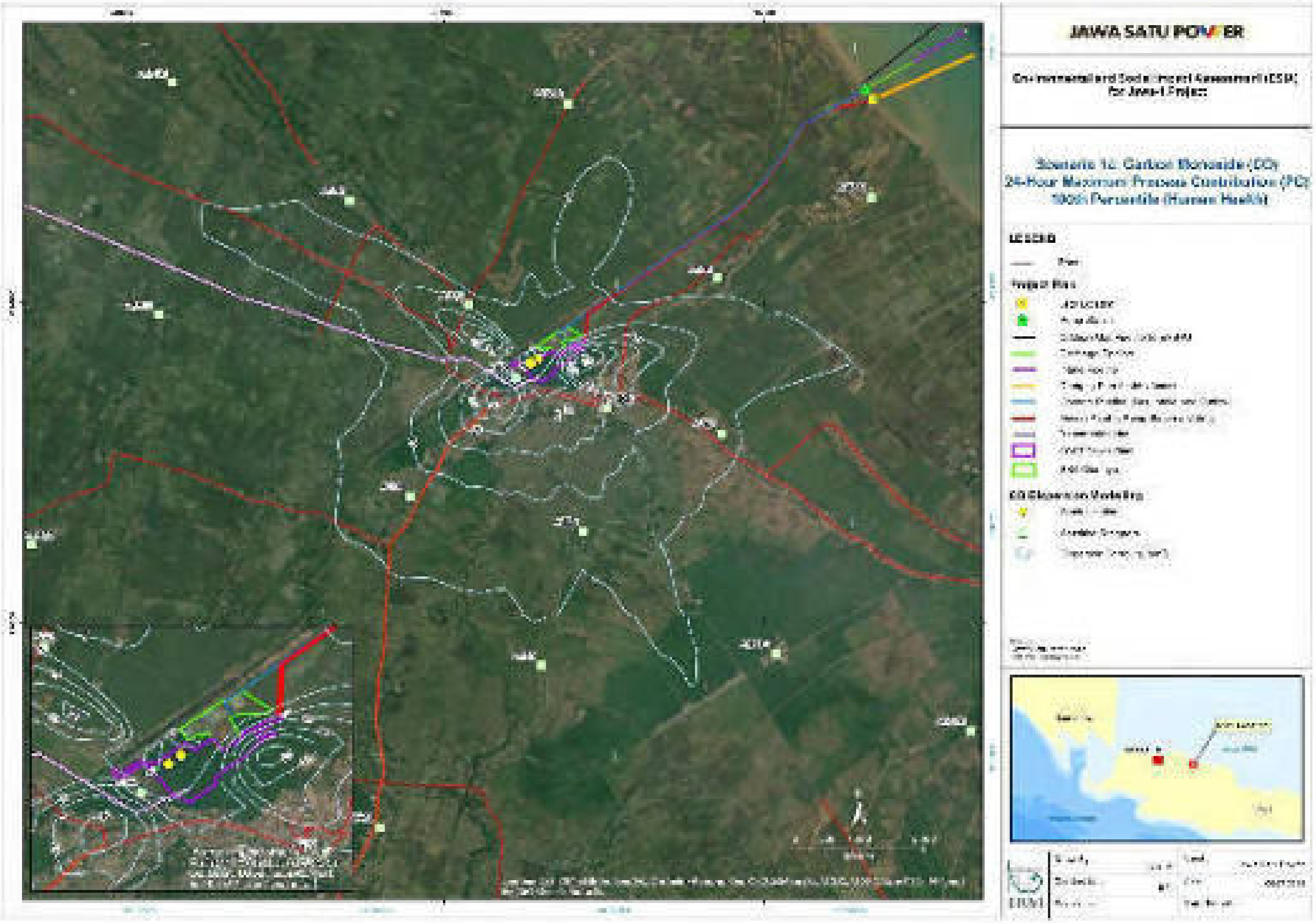
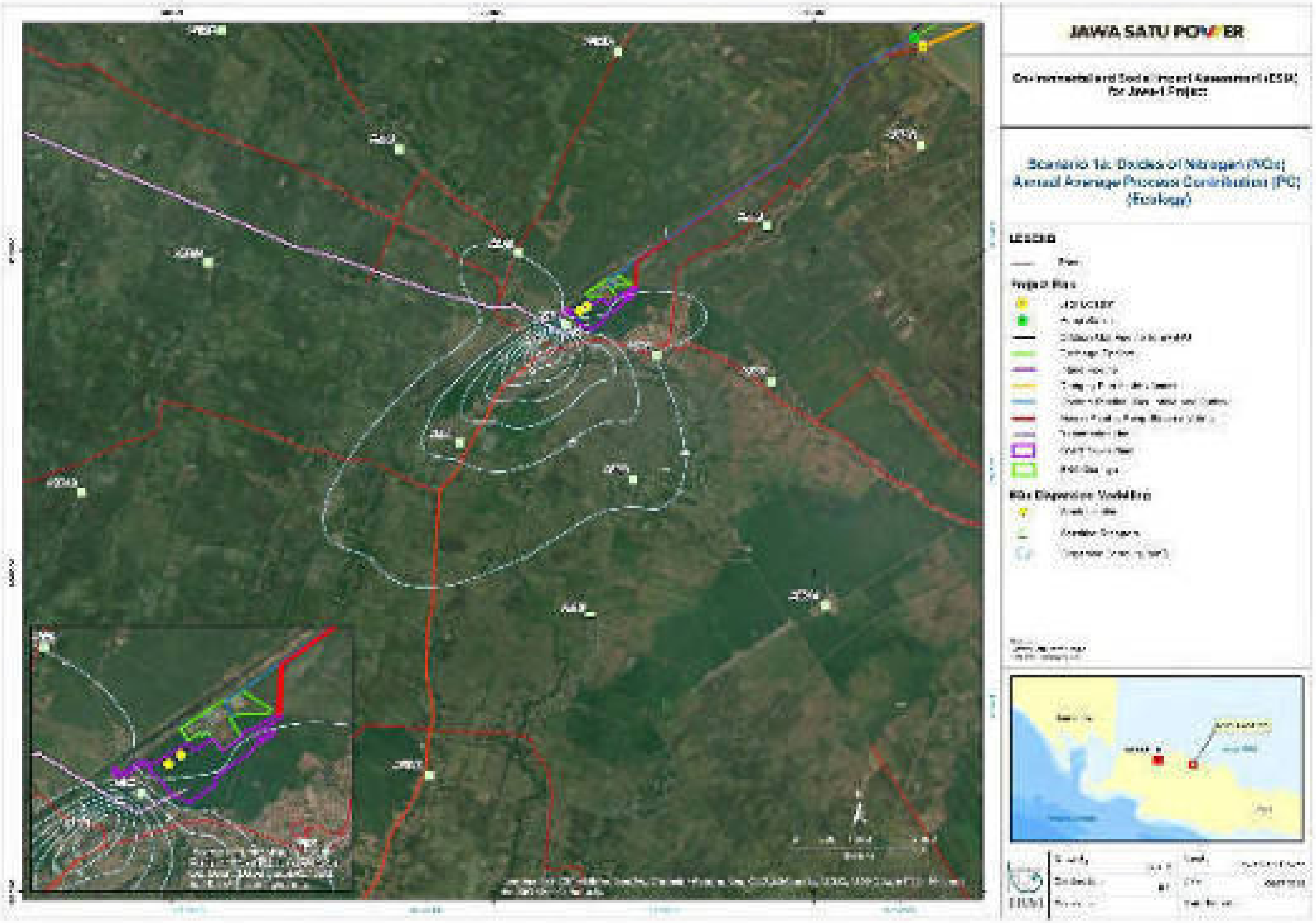


Figure 8-10 Scenario 1a: Oxides of Nitrogen (NO_x) Annual Average Process Contribution (PC) – (Ecology)



The likely impacts on air quality associated with Scenario 1a are presented in **Table 8-17** and **Table 8-18** for human health and ecology respectively.

The approach used in this assessment assumes that the sensitivity within the general study area is **Medium** for both human health and ecological receptors.

The emissions to air from the CCGT is predicted to have a **Minor impact** on ambient air quality at human air sensitive receptors due to the maximum 1-hour NO_2 ground level concentration exceeding 25% of the Indonesian 1-hour air quality standard. A **Negligible impact** on ambient air quality at ecological sensitive receptors is predicted.

Table 8-17 Scenario 1a: Assessment of Impacts on Air Quality Due to the Operation of the CCGT Power Plant (Human Health)

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

Table 8-18 Scenario 1a: Assessment of Impacts on Air Quality Due to the Operation of the CCGT Power Plant (Ecology)

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

8.4.7.6 *Summary of Stack Height and NO_x Concentration Analysis*

The minor impact on air quality presented in **Table 8-17** is reported as a result of the maximum 1-hour NO_2 ground level concentration exceeding 25% of the Indonesian 1-hour air quality standard. This finding results in a non-compliance relative to the air quality criteria presented in **Section 8.4.2.** On this basis, the air quality technical annex presented in **Annex D** provides a detailed analysis of the impacts relative to the modelling scenarios presented in **Table 8-15**. A summary of those findings is presented in **Table 8-19**.

Table 8-19 Maximum Offsite Ground Level Concentrations: Nitrogen Dioxide (NO_2) 1-Hour Maximum – 99.9 Percentile (Human Health)

Scenario	Stack Height	NO_x Concentration (mg/Nm³	Maximum PC(1)	PC/AQS (%)	PEC(2)(3)	PEC/AQS (%)	Impact Significance
			µg/m³				
Scenario 1a	60	51	112	28%	179	45%	Minor
Scenario 1b	60	40	87.9	22%	155	39%	Negligible
Scenario 2a	65	51	88.4	22%	155	39%	Negligible
Scenario 2b	65	40	69.3	17%	136	34%	Negligible
Scenario 3a	70	51	65.9	16%	133	33%	Negligible
Scenario 3b	70	40	51.7	13%	119	30%	Negligible
Scenario 4a	75	51	58.8	15%	126	31%	Negligible
Scenario 4b	75	40	46.2	12%	113	28%	Negligible
Scenario 5a	82	51	50.7	13%	118	29%	Negligible
Scenario 5b	82	40	39.8	10%	107	27%	Negligible

(1) Process Contribution
(2) Predicted Environmental Concentration
(3) The maximum monitored NO_2 1-hour average concentration of 66.9µg/m³ is considered as the 1-hour average baseline across the entire modelling domain a worst-case approach.

Chapter 4 presents the findings of the above scenarios (60m and 65m stack height) and 40mg/Nm³ and 51 mg/Nm³at the 100%ile.

The Project preference is to consider that analysis based on the 99%ile; as such a stack height of 60m at 51mg/Nm³ or 65m at 40mg/Nm³ will be selected to allow for compliance with the criteria. This is considering the current on degraded airshed, the results falling well below the WHO and national requirements and the fact that the 25% is met except for NO_2 at 1hr based on the 100%ile analysis (as discussed in *Chapter 4*). The immediate power plant area is also unlikely to be identified for future similar developments that may impact the airshed.

8.4.7.7 Mitigation Measures, Management and Monitoring Measures

The mitigation options informed by the results presented in **Table 8-19** and relative to the base case design and are as follows:

- Stack height increase from 60m to 65m; or
- NO_x emission concentration guaranteed reduction from 51mg/Nm³ to 40mg/Nm³.

In addition to the abovementioned mitigation measures the following good practice monitoring measures are required in accordance with the IFC guidelines:

- Implementation of continuous stack emission monitoring throughout the operational lifetime of the Project to confirm that the NO_x emission concentration from the turbines do not exceed the Projects guaranteed levels;

- Annual stack emission testing of NO_x emissions will be undertaken to counter check the performance of the emission monitoring system;

- Installation of two continuous ambient NO_2 air quality and meteorological monitoring systems. One monitoring system will be positioned in the area where the maximum short-term ground level concentrations have been predicted based on detailed dispersion modelling. The second monitoring system will be located in an area representative of the true background so a differentiation can be made between background and potential impacts to air quality from the Project. The effectiveness of the monitoring program will be reviewed regularly.

8.4.7.8 *Assessment of Residual Impacts*

The residual impact from the operation of the CCGT power plant is expected to be **Negligible** when incorporating the mitigating options discussed in **Section 8.4.7.7.**

8.4.8 *Assessment of Impacts – Operation of Cooling Towers*

8.4.8.1 *Overview*

The Project will be equipped with two (2) wet cooling tower systems necessary for the normal operation of the power station. The system will utilise sea water and will dissipate large heat loads to the atmosphere. Due to the direct contact between the cooling water and the air passing through it, small amounts of water are lost as liquid drift. The liquid drift evaporates to a solid salt crystal when the water in the drift evaporates. The deposition of salt (Sodium Chloride (NaCl)) on the surrounding agriculture can have an adverse impact on crop production.

The assessment of wet and dry NaCl deposition and its effect on agriculture has been considered in detail in **Annex D Section 5.5** and is summarised in the following section.

8.4.8.2 *Assessment Approach and Criteria*

Impacts from salt deposition may cause reductions in agricultural yield through leaf damage (leaf necrosis) however the IFC and WHO do not provide standards or guidelines on which to base an assessment.

Research undertaken for the purpose of this assessment concludes that deposition rates reaching or exceeding 10kg/ha/mo in any month throughout the growing season can lead to leaf damage in many species of plant. Threshold values will vary, however, depending on rainfall frequency, humidity, and the specific sensitivity of the species.

8.4.8.3 Dispersion Modelling

The USEPA AERMOD dispersion model version 16216r was used to predict the maximum total (wet and dry) deposition rates of NaCl averaged over a one month period in the study area. Five (5) years of hourly sequential meteorological data was used so that inter annual variability was incorporated into the model and the highest one month average of any of the five meteorological years was used to define the impact significance as a worst case.

The amount of total particulate matter (TPM) released to the atmosphere was calculated using the following formula:

- TPM [g/h] = Total Dissolved Solids (TDS) [ppmw] x Drift Loss [%] / 100% x Circulating Water Rate [m^3/hr]

Each fan was treated as a point source and modelled using the information presented in **Table 8-20**.

Table 8-20 Cooling Tower and Modelling Information

Item	Data	Unit
Number of cooling towers	2	-
Cells/fans per cooling tower	16	-
Total cells/fans	32	-
Cooling tower structure height	18.7	m
Cell/fan diameter	9.75	m
Exit velocity	8.73	m/s
Exit temperature	37.8	C
Circulating rate	54478	m^3/hr
	907603 (1)	lpm
Total dissolved solids (TDS)	44,100	mg/l
Design drift	0.0005	%
	4.54	lpm
	200127	mg/min
	3.34	g/s
	0.208	g/s/PM_{10}/cell
Operating hours	8760	hours
Sodium Chloride (NaCl) Particle Density	2.165	g/cm^3
(1) 1 cubic meter / hour = 16.7lpm		

8.4.8.4 Cooling Tower Related Impacts to Vegetation

The expected deposition associated with the operation of the cooling towers is presented in **Figure 8-11**. The modelling results indicate that salt deposition rates from the Project will not exceed 10kg/ha/mo at any offsite locations. Based on the expected existing conditions at the site, and on the basis that the assessment threshold will not be exceeded, adverse impacts to agriculture due to the Project are considered **Negligible**.

Figure 8-11 Predicted Sodium Chloride (Salt) Deposition Rates from Cooling Towers - Total (Wet and Dry) Deposition Rate (kg/ha/mo)

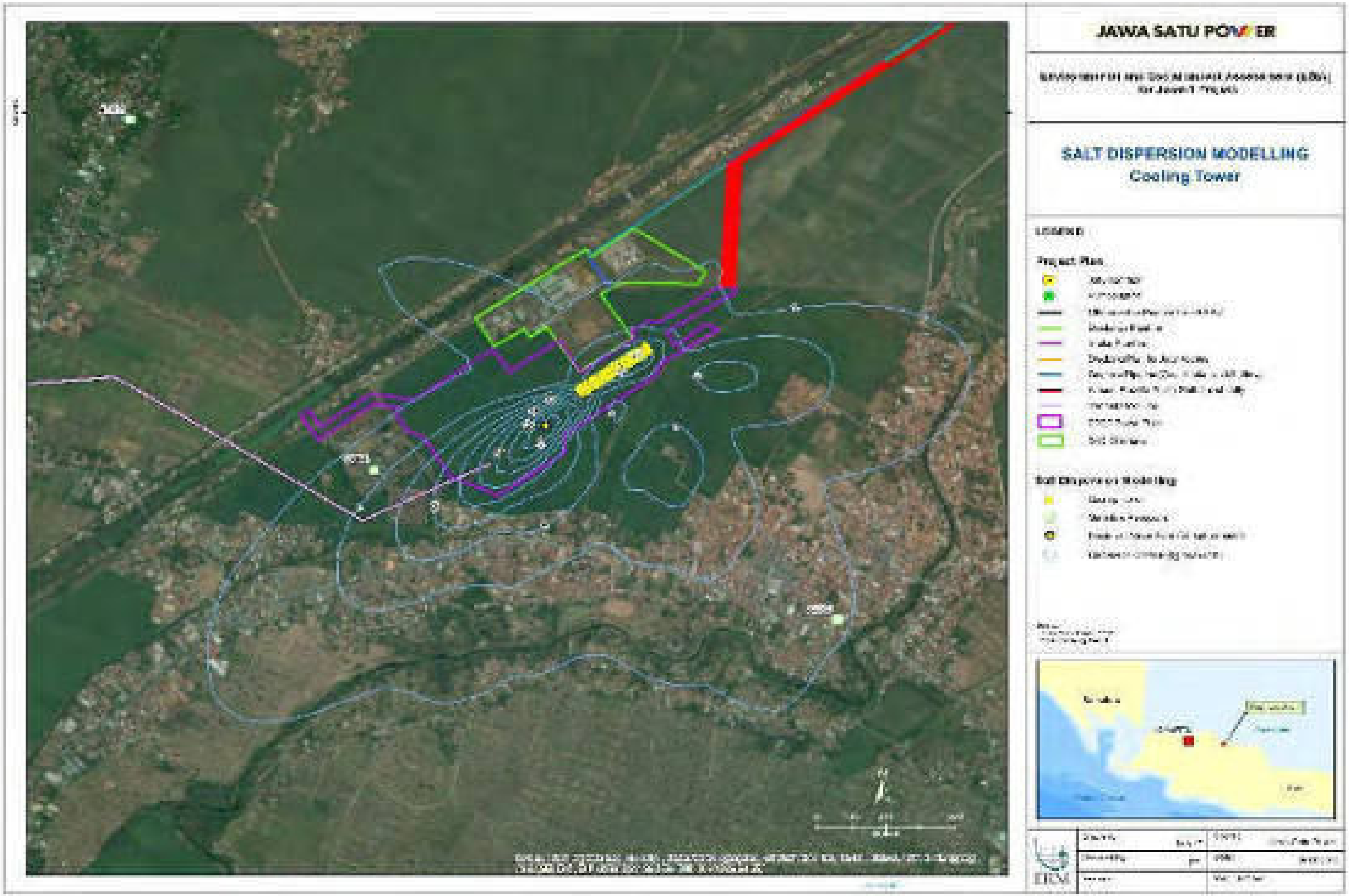


Table 8-21 Assessment of Impacts on Agriculture Due to the Operation of the Cooling Towers

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

8.4.8.5 *Mitigation Measures, Management and Monitoring Measures*

Based on the finding presented in **Section 8.4.8.4** no additional mitigation is considered necessary in terms of reducing the impacts on surrounding agriculture.

Impacts from salt on urban development as well as machinery and equipment within the Project area may occur due to salt corrosion, mainly within the dry season. It is therefore recommended that all exposed surfaces be coated or painted to reduce corrosion from salt deposition. Regular maintenance of exposed surfaces is also required.

8.4.8.6 *Assessment of Residual Impact*

The residual impacts due to the continuous operation of the cooling towers are expected to be **Negligible**.

8.5 *GREENHOUSE GAS EMISSIONS*

This assessment provides an estimate of the Greenhouse Gas (GHG) emissions that are likely to be emitted by the Project, as related to the issue of climate change. GHGs are assessed to provide an indication of what the Project's GHG emissions will be, and to evaluate ways to minimise / mitigate them early on in the development process.

Indonesia ratified the Paris Agreement in October 2016 agreeing to 29% reduction below business as usual (BAU) of its Nationally Determined Contribution (NDC); largely aimed through reductions in the forestry sector. Its current 2025 National Energy Policy (NEP) target for gas is 22% and 24% in 2050.

Indonesia's Second National Communication in 2010 under the United Nations Framework Convention on Climate Change (UNFCCC) reported GHG emissions were estimated at 1,800MtCO_2-e in 2005. Largely due to land use change, peat and forest fires and the combustion of fossil fuels (19%). In addition to the moratorium on primary forest clearing and prohibiting the conversion of peat Indonesian is targeting a 23% of its energy mix to be sourced from renewables by 2025.

8.5.1 *Potential Sources of Impacts*

The Project's construction phase will result in GHG emissions as a result of vehicle and generator use and the provision of energy for onsite activities. More significantly, it will be the Project's GHG emissions during operations that will need to be carefully considered due to the FSRU and CCGT activities.

8.5.2 *Assessment Approach and Criteria*

The estimate of the Project GHG footprint was done based on the Greenhouse Gas Protocol Corporate Accounting Standard (2).

GHGs included in the GHG assessment methodology are the gases under the UNFCCC/Kyoto Protocol. Of these, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are considered the main GHG pollutants for the Project based on the planned activities.

The GHG Protocol defines three (3) emissions 'scopes' for GHG accounting and reporting purposes: Scope 1, Scope 2 and Scope 3. Scope 1 includes direct GHG emissions coming from the Project. Scope 2 includes indirect GHG emissions associated with consumption of energy produced off-site (i.e. electricity from the grid). Scope 3 includes all other indirect GHG sources.

Both the construction and operation phases have been quantified in terms of their GHG emissions.

Assuming a 20 year asset life from the start of operations, the Project as a whole is anticipated to comprise 77.7 Mt CO_2-e of (Scope 1 and 2) emissions during its total life cycle. Of these, 99.8% of emissions are anticipated to be related to (combustion and fugitive) emissions during the operational phase. On this basis, only the operational emission inventory is discussed in more detail below.

A summary of the Scope 1, Scope 2 and Scope 3 Emissions included in the operational phase of the Project is provided in **Figure 8-12**.

(2) The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Revised, World Resources Institute.

Figure 8-12 Scope 1, 2 and 3 Emissions related to the Project Operational Phase

Scope 1 *emissions include combustion sources (i.e. gas turbine). For this GHG inventory, Combustion related Scope 1 emissions have been included for the 1,760 MW Combined Cycle Gas Turbine (CCGT) Power Plant and diesel generators located at a Liquefied Natural Gas (LNG) Floating Storage and Regasification Unit (FSRU). Scope 1 emissions associated with natural gas (i.e. methane) releases have been quantified associated with emergency / maintenance venting at an Onshore Receiving Facility (ORF) as well as gas transmission fugitive losses. Operation of the CCGT is anticipated to constitute almost 90% of the operational GHG emission inventory on an annual basis. The gas consumption by the CCGT is estimated to be around 64,000,000 mmBTU/year (~67,523 TJ/year) based on a 60% capacity factor. This is based on the engineers high heat and calculated using the weighted average net heat rate x net generation (~9,950 GWh p.a.) and no boil off losses assumed from the FSRU. It also assumes non-cyclic operations (100%) for the 2 units.*

Greenhouse gas emissions from this source reference the emission factor contained in IPCC Guidelines for National Greenhouse Gas Inventories (2006).

Scope 2 *emissions include all emissions associated with electricity imports, heat imports, as well as with cold imports and compressed air imports. Power is anticipated to be imported only when the CCGT is completely shut down. It has been estimated that the FSRU will be shut down for an average of 10 days a year. Additionally, it is also assumed there will be four times a year when the CCGT is shutdown/tripped. It is estimated that during a normal shutdown the average CCGT load is 4 MW and during the FSRU dry dock outages, 3 MW. These Scope 1 emissions are anticipated to comprise less than 0.1% of the Scope 1 and 2 emissions during the operational phase.*

Scope 3 *emissions include all other indirect emissions, such as (but not limited to) contracted and other associated activities. As an example, this includes emissions associated with any machine or vehicle operated by a supplier. IFC Performance Standards require that facilities to quantify Scope 1 and Scope 2, but not Scope 3. However, there are material Scope 3 GHG emission sources associated with the Project, and these are discussed briefly below.*

The production and transportation (shipping) of LNG to the FSRU is assumed to be under the operational control of a third party. These potentially significant emissions will be accounted for within the GHG emission inventories of the entities that complete these activities.

The calculations that informed the GHG emissions are provided in **Table 8-22**

Table 8-22 GHG Emissions Calculation

Parameter	Value	Unit
Annual gas consumption	67,523 [1]	TJ
GHG emission factor	56,100	kg CO_2-e/TJ (LHV)
GHG emissions	3,788,040.3	t CO_2-e/annum
Generation capacity of CCGT	1,760	MW
Capacity factor	60	%
Emission intensity (annualised)	409	g CO_2-e/kWh

Note 1: This figure, and derived annualised emission intensity, represent annual operational estimates, which include allowances for fuel consumption associated with plant startup and

shutdown, as well as ranging operating loads and variability in plant condition. Refer to Table 8-24 for operational emissions intensity of CCGT plant under full load operation.

8.5.3 Assessment of Impacts – Increased GHG Emissions

The ADB Environmental Safeguards require the application of pollution prevention and control technologies and practices consistent with international good practice. Pollution prevention and abatement is said to be required if the project is emitting GHGs. As such the client is required to promote the reduction of GHG emissions from the project. The Project is considered as a significant producer of GHGs given it is emitting over 100,000 tonnes CO_2-e per year. As such the Project is required to quantify its GHG emissions.

IFC PS 3 requires that the consideration of alternatives and the implementation of technically and financially feasible and cost-effective options is undertaken to reduce project-related GHG emissions during the design and operation of the project.

A consideration of project alternatives is provided in **Chapter 4** of this report.

These alternatives are discussed below, as they relate specifically to GHG management.

Alternatives have been considered in terms of alternative geographies for an equivalent CCGT; clearly these alternative scenarios will have no material impact upon the GHG generation. This is with the exception of additional transmission losses that may be incurred as a result of locating the power generation source remote from the demand (which would potentially increase the GHG intensity of the activity).

As noted in Chapter 4, feasibility for the Project indicates that 1,760 MW of additional electricity power generating capacity is required by 2019 to meet the demand of Indonesia's growing middle class population and the manufacturing sector, as well as to support national economic growth.

Regarding alternative power sources, Table 4.10 within Chapter 4 provides qualitative comparisons of fuel source options available including coal, hydropower, nuclear and renewable energy such as solar and wind energy. With respect to the other fossil fuels noted, for an equivalent amount of heat, burning natural gas produces about 30% less CO_2 than burning petroleum and about 45% less than burning coal.

Commentary on the lower GHG intensive options is reproduced below:

- Hydropower; The energy source would likely require large hydropower sources at multiple sites in West Java in order to achieve the required power generation, which can contribute to negative environmental and social impacts (e.g., changes in river ecosystem, disruptions in wildlife, and social displacement).

- Nuclear; Nuclear cannot be permitted and constructed within the required time limit.
- Renewable Energy i.e. Wind or Solar; Renewable energy cannot provide the sufficient supply needed for the Project's requirement in West Java.

Finally, as stated in *Chapter 4*, and discussed quantitatively below, the model of CCGT plant proposed uses the highly efficient combustion technology and is anticipated to have the lowest GHG intensity of CCGT plant that is Currently available.

Further, the IFC requires projects that are expected to produce more than 25,000 tonnes of CO_2-e annually to also quantify direct emissions from its facilities as well as indirect emissions associated with the off-site production of energy used by the project.

Note, there is currently no Indonesian requirement for the Project to reduce its GHG emissions.

The global nature of the impacts of climate change such as temperature increases, sea level rise, ecological impacts, changes in crop productivity, disease distribution etc. are well documented. Despite the potential severity of consequences at the national and global level, it is not meaningful to link emissions from single source to particular impacts at this scale.

It is more instructive, rather, to look at the impact of the Project on Indonesia's National GHG Inventory, as well as global anthropogenic emissions, and the implications of this rather than the physical impacts of climate change.

In 2014, global emissions of greenhouse gases from anthropogenic activities excluding land use change and deforestation came to 36.14 Giga Tonnes (Gt) CO_2-e (*CDIAC, 2017*). For the same year, Indonesia ranked the 14th highest in terms of national GHG emissions, with an estimated 126.6 Mt CO_2-e (*CDIAC, 2017).*

The annual operational (Scope 1 and 2) emissions estimated from the project are anticipated to be of the order of 3.9 Mt CO_2-e. The Project is therefore anticipated to contribute to 3% of Indonesia's national GHG emissions annually, and 0.01% of global anthropogenic emissions over the same period.

However, the Project is responding to additional power demands for the region. Therefore, it needs to be queried as to whether there are alternative, lower GHG intensive power generation options available. Given the scale of the Project (1,760MW), and the requirement for baseload power generation, it is appropriate to compare the Project with other thermal (fossil fuel) power generation alternatives.

A comparison of conventional (thermal) baseload electricity generation operations is provided in **Table 8-23**.

Table 8-23 Electricity Generation Greenhouse Gas Intensities (tCO_2-e/MWh)

Operation	Natural Gas		Black Coal		
	OCGT	**CCGT**	**Sub-critical**	**Super critical**	**Ultra super critical**
Assumed average efficiency (%)	39	53	33	41	43
Extraction and processing	0.14	0.1	0.03	0.02	0.02
Transport	0.02	0.01	0.03	0.03	0.03
Processing and Power Generation	0.59	0.43	0.97	0.78	0.74
Total	**0.75**	**0.55**	**1.03**	**0.83**	**0.79**
Min estimate	0.64	0.49	0.75	0.61	0.58
Max estimate	0.84	0.64	1.56	1.26	1.2

Source: Worley Parsons, 2011

Compared with other conventional fossil fuel baseload power generation, a CCGT Power Plant is the least GHG-intensive option. Table 4 within the *IFC Thermal Power Plant Guidelines 2008* provides typical CO_2 emissions performance of new thermal power plants. IFC, 2008 further supports that CCGT is the least GHG-intensive of all fossil fuel baseload power generation options.

For new CCGT Power Plant facilities, the following CO_2 emissions performance is noted (Table 4 of *IFC, 2008*):

- 0.40 tCO_2/MWh (gross, LHV) – CCGT Power Plant, 51% efficiency.

The Project's annualised GHG intensity can be estimated referencing a 1,760MW facility operating at a 60% capacity factor and producing 3.79 Mt CO_2-e from the gas combustion. This calculation leads to an estimate of 0.41 tCO_2/MWh, which is commensurate with both Worley Parsons (2011) and IFC (2008) estimates. This annualised value is representative of the overall emissions intensity of the plant when operated across a range of anticipated scenarios.

A review of the performance specification for the proposed plant indicates that the plant is capable of achieving a net heat rate of 5,999 kJ/kWh (Lower Heating Value) when operated at full load. When considered in conjunction with the IPPC emission factor for natural gas combustion, this equates to an operational emission intensity of 337 kg CO_2-e/MWh. **Table 8-24** presents a summary of this estimate.

Table 8-24 GHG Emission Intensity of Plant at Full Operating Load

Parameter	Value	Unit / Basis
Performance specification net heat rate	5,996	kJ/kWh (LHV, SO)[1]
Thermal efficiency	60%	- (LHV, SO)
GHG emission factor	56.1	kg CO_2-e/GJ (LHV)
Emission Intensity	**337**	kg CO_2-e/MWh

Note 1: Guaranteed Net Heat Rate based on electricity 'sent out' (SO) when operating at full load. This value inclusive of auxiliary plant losses.

This emission intensity places the proposed plant towards the lowest achievable GHG intensity for fossil fuel electricity generation currently available.

It is also instructive to compare the estimated GHG intensity of the project (0.41 tCO_2-e/MWh for generation alone; lifetime average) with the electricity grid emission factor corresponding to Java of 0.9 tCO_2-e /MWh (*Institute for Global Environmental Strategies, 2017*). This thus indicates that electricity generated via the Project's CCGT has a GHG intensity of approximately 50% compared to the existing power generation mix for the region.

To conclude whether this impact is deemed significant or not, a risk classification approach is used. The approach is derived from classic risk assessment nomenclature which involves the expression of risk as the consequence of the event multiplied by the probability of that event. The environmental assessment equivalent is the magnitude of the impact multiplied by the sensitivity/vulnerability/importance of the resource or receptor.

The impact magnitude of the Project, in terms of its contribution to GHG emission inventories, is thus considered to be **Medium** at a National (Indonesian) level, and **Small** in a global context. The weight of evidence is that anthropogenic climate change will impact multiple resources, human activities and ecological systems on a global scale (i.e. multiple, geographically diverse receptors). The importance of the system subject to impacts is thus **High**.

Application of a conventional risk classification matrix to the Project thus indicates that at a national level, the significance is **Major**, while at a global level the significance is considered **Moderate**.

Table 8-25 Assessment of Increased GHG Emissions

Evaluation of Significance		Sensitivity/Vulnerability/ Importance of Resource/Receptor		
		Low	**Medium**	**High**
	Negligible	Negligible	Negligible	Negligible

Magnitude of Impact	**Small**	Negligible	Minor	**Moderate (Global Level)**
	Medium	Minor	Moderate	**Major (National Level)**
	Large	Moderate	Major	Major

8.5.4 *Mitigation Measures, Management and Monitoring*

The key mitigation measures proposed to minimise GHG emissions associated with the Project include:

- Annual monitoring, quantifying and reporting of GHG emissions (direct and indirect) will be undertaken to establish CO_2-e emissions and support the Project in improving awareness of emissions and understanding how improvements can be implemented;

- Cold venting of gas directly to atmosphere will be avoided where possible. If significant quantities are emitted, the Project should consider flaring, as this converts the CH_4 to CO_2 and thereby reduce the net GHG emissions in terms of CO_2-e emissions;

- Optimisation of construction schedule and placement of laydown areas/temporary camp sites to reduce overall traffic movements/distance travelled, thus reducing GHG emissions from transport; Other opportunities exist to further reduce GHG emissions will be evaluated for feasibility as the Project progresses further along the Front End Engineering and Design (FEED) and Detailed Design (DD) stages; and

- Actual land clearing/disturbance will be minimised to the greatest extent possible. Net GHG emissions could also be reduced by revegetation in many areas that will be cleared only for temporary activities such as laydown areas and temporary camps for construction.

Throughout the design process, assessment of GHG mitigation options will continue. The opportunity exists to continue to optimise energy consumption throughout the Project, where key project decisions relating to equipment selection have not been made. Technical studies relating to equipment selection (e.g. Best Available Technology studies) will take into account GHG emissions and energy efficiency as factors for consideration.

Consistent with IFC Performance Standards, for projects > 25,000 t CO_2-e/year (current project anticipated to comprise 3.9 Mt CO_2-e/year), quantification of direct GHG emissions is required to be conducted by the Sponsor annually.

8.5.5 *Assessment of Residual Impact*

The combustion of natural gas within the CCGT Power Plant comprises approximately 90% of the annual operational GHG emission, and this contribution will not change significantly under the proposed mitigation measures for the Project.

On this basis, the impact significance is not anticipated to change post-mitigation, as summarised in **Table 8-26** of residual impact below.

Table 8-26 Summary of Residual Impact

Activities	Significance before Mitigation	Residual Impact Significance
Increase GHG Emissions and Climate Change (Indonesia Level)	**Major (National Level)**	**Major (National Level)**
Increase GHG Emissions and Climate Change (Global Level)	**Moderate (Global Level)**	**Moderate (Global Level)**

8.6 *ACOUSTICS AND VIBRATION*

Nuisance, or an unacceptable level of noise (and vibration) amenity, may arise due to construction and operational activities associated with new or existing developments.

This potential for issues to arise is most associated with air-borne and ground-borne emissions from significant project noise and vibration generating sources that are in close proximity to potentially sensitive human and wildlife receptors i.e. nearby dwellings, schools, churches, commercial/industrial facilities, or sea life near off-shore assets.

An acoustics assessment has been completed and is provided in **Annex E** of this report. It included consideration of the following features:

- Construction (including road traffic) air-borne noise and ground-borne vibration impacts to human receptors from significant emission generating works and activities, for the various on-shore components and phases associated with the development, that are proposed to occur within and near the project site.

- Construction underwater noise impacts to wildlife receptors from significant emission generating works and activities, for the various off-shore components and phases associated with the development, that are proposed to occur within and near the project site[3].

- Operational air-borne noise and ground-borne vibration impacts to human receptors from significant emission generating activities, for the various on-shore components and phases associated with the development (i.e. significant fixed infrastructure assets such as the CCGT power plant and

[3] This acoustical feature is being assessed in more detail by other specialists but given its association with the potential project noise, has been evaluated in this assessment with conceptual recommendations being provided.

the transmission line) that are proposed to occur within and near the project site.

A qualitative assessment has been conducted for Project noise and vibration components that have limited or no potential to generate any impacts at nearby potentially sensitive receptors, whilst a quantitative assessment has been conducted for other components and phases where a potential for impacts to occur has been identified.

A preliminary evaluation of potential impacts identified that construction and operational air-borne noise are considered the highest environmental risk. These potential impacts are therefore the focus of **Annex E** acoustics assessment, as summarised in this section.

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

8.6.1 Potential Source of Impact

Key Project components or activities that may have a significant noise impact include the following:

- Construction at the CCGT Power Station (including piling);
- Construction of the 500 kV transmission line;
- Road traffic during construction;
- Operation of the CCGT Power Station;
- Operation of the 500 kV transmission line; and
- Operation of the Cibatu Baru II/ Sukatani substation.

8.6.2 Assessment Approach and Criteria

The assessment was conducted to achieve a scope of works that addressed all potential noise and vibration issues by evaluating, predicting and assessing construction and operational noise and vibration from the Project (offshore, nearshore and onshore components) at the closest and/or potentially most affected sensitive receptors near the project site.

8.6.2.1 Noise Standards and Guidelines

The noise assessment has been conducted with due regard to and in accordance with the following IFC guidelines, as well as other relevant local and international documents, policy and standards.

- World Bank Group: International Finance Corporation (IFC) - *Environmental, Health, and Safety Guidelines for Thermal Power Plants* (IFC Thermal Power Plants Guideline, 2017), draft for second public consultation, dated May/June 2017;

- World Bank Group: International Finance Corporation (IFC) - Environmental, Health and Safety (EHS) Guidelines - *General EHS Guidelines: Environmental Noise Management, Section 1.7 Noise* (IFC 1.7 Noise), dated 30 April 2007; and

- World Bank Group: International Finance Corporation (IFC) - *Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution* (IFC Electrical Power Guideline, 2007), dated 30 April 2007.

8.6.2.2 Evaluation of Impacts

Noise impact assessment standards and guidelines (such as IFC 1.7 Noise) generally give threshold levels that, above which, emissions have the potential to create nuisance or disturbance, or they define changes in noise levels, from which significant noise impacts to the receptors' amenity may be expected.

In addition, typical noise impact assessment methodologies require an approach that combines impact magnitude with receptor sensitivity to determine impact significance, for the specific source under assessment (e.g. industrial noise), thus:

RECEPTOR SENSITIVITY x IMPACT MAGNITUDE

= IMPACT SIGNIFICANCE

In applying guidance such as that described above it is necessary to scale impact magnitude into ranges required in an impact assessment. Hence an impact significance matrix has been developed that considers the following aspects:

- IFC Performance Standards on Environmental and Social Sustainability.

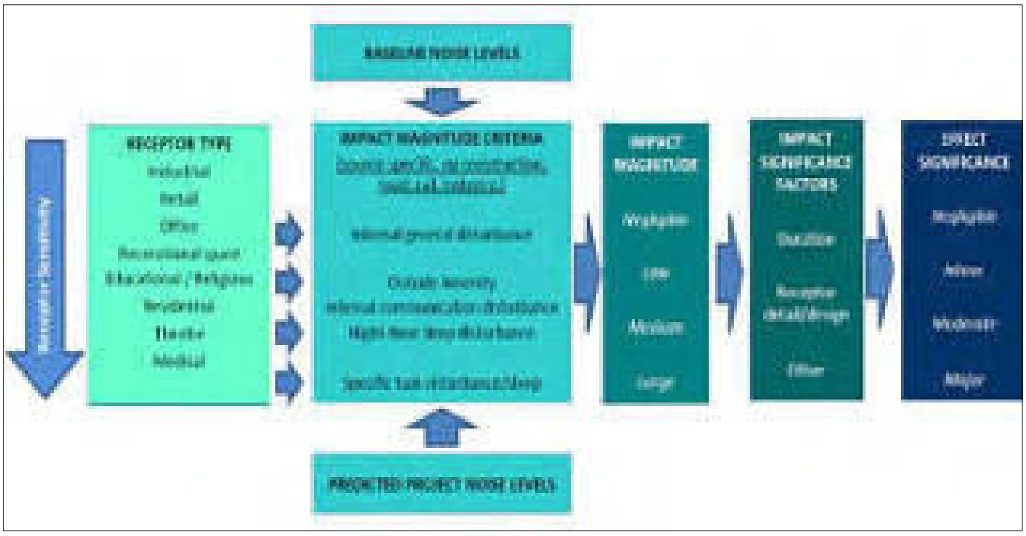
- Typical remote settings for projects where low background noise levels are commonly experienced.

- The variation of impacts associated with the duration or frequency of occurrence of potential construction and operational aspects.

A duration or frequency of "**long-term / constant**" is used to determine impacts for operational emissions, this is adopted for construction emissions. It is noted that some works and activities associated with the construction of the project are expected to qualify as either "**short-term /occasional**" or "**temporary / rare**" duration or frequency the given the overall construction schedule and programming the medium-term/often descriptor is considered most appropriate in the context of the broader project.

This approach is visually summarised as presented in **Figure 8.13**.

Figure 8.13 Noise Impact Significance Assessment Process



8.6.2.3 *Vibration Standards*

In the absence of local requirements, the following international standards were adopted for the terms of reference from which vibration criteria (human exposure/annoyance and structural damage) were established are:

- British Standards Institution (BSI, United Kingdom) – BS 6472 - *Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)* (BS 6472), dated 1992.
- British Standards Institution (BSI, United Kingdom) – BS 5228 - *Code of Practice for Noise and Vibration Control on Construction and Open Sites*, Part 2: Vibration (BS 5228:2), dated 2009.
- Department of Environment and Conservation NSW (DECC, Australia) – *Assessing Vibration: a Technical Guideline* (DECC Guideline, 2006), dated February 2006.

- German Institute for Standardisation (GIS, Germany) – DIN 4150 Part 3: *Structural Vibration: Effects of Vibration on Structures* (DIN 4150:3), dated February 1999.

Unlike noise where impact significance ratings may be derived from incremental thresholds the combined impact magnitude with receptor sensitivity and/or exposure: vibration guidelines are typically adopted in a manner that recognises any levels that are predicted to exceed the criteria are likely to generate a significant impact that should be mitigated.

Values predicted to exceed the structural damage criteria would be considered a significant adverse impact and further detailed assessment, investigation or monitoring would likely be required. Further information on these values is provided in **Annex E**.

8.6.2.4 *Potentially Sensitive Receptors*

The potentially sensitive receptors where potential power plant noise impacts have been assessed are identified in **Figure 8-14** and tabulated in **Table 8-27**.

Table 8-27 Potentially Sensitive Noise Receptor Locations

Noise ID	Description.	GPS Co-ordinates (X and Y, Zone 48)	
N-1	Residential (Dwelling) Receptor/s situated south-west of the CCGT power plant.	786166	9308897
N-2	Residential (Dwelling) Receptor/s situated south of the CCGT power plant.	786376	9308737
N-3	Residential (Dwelling) Receptor/s situated east of the CCGT power plant.	787390	9309099
N-4	Residential (Dwelling) Receptor/s situated north of the CCGT power plant.	786369	9309369
N-5	Residential (Dwelling) Receptor/s situated north-east of the CCGT power plant.	787326	9309880
R1	Residential (Dwelling) Receptor/s situated south of the CCGT power plant, within NCA 1	786447	9308724
R2	Pertagas Workforce Accommodation Receptor situated west of the CCGT power plant, within NCA 2.	785997	9309012
R3	Residential (Dwelling) Receptor/s situated north-west of the CCGT power plant, within NCA 3.	786192	9309274
R4	Residential (Dwelling) Receptor/s situated north of the CCGT power plant, within NCA 4.	786542	9309507
R5	Residential (Dwelling) Receptor/s situated east of the CCGT power plant, within NCA 5.	787397	9309090
R6	Residential (Dwelling) Receptor/s situated south-east of the CCGT power plant, within NCA 6.	787113	9308727

These locations were adopted from the Samsung, 2016 Noise Study Review or identified for this assessment via a rapid review of aerial photography and based on their proximity to key emission sources.

These locations do not represent all receptors located in the vicinity or area of influence of the project but have been selected for the purposes of this assessment. They are considered to be representative of locations that will experience the highest CCGT power plant noise (or vibration levels) and most significant impacts associated with the construction and ongoing operation of the project.

Furthermore, where additional receptors are identified he predicted noise levels at the nearest assessed receptor (N-1 to N-5 and R1 to R6) provides an indication of potential project emissions and impacts that could be experienced at these other locations not specifically identified in this assessment.

As detailed in **Section 6** and **Section 7** of the **Annex E,** the potential area of influence of other project components was utilised to identify additional receptor locations for the assessment of those components i.e. the transmission line and substation. These locations, where noise monitoring was also conducted are identified in **Figure 8-14.**

Figure 8-14 Power Station Site Locality and Nearest Receptors

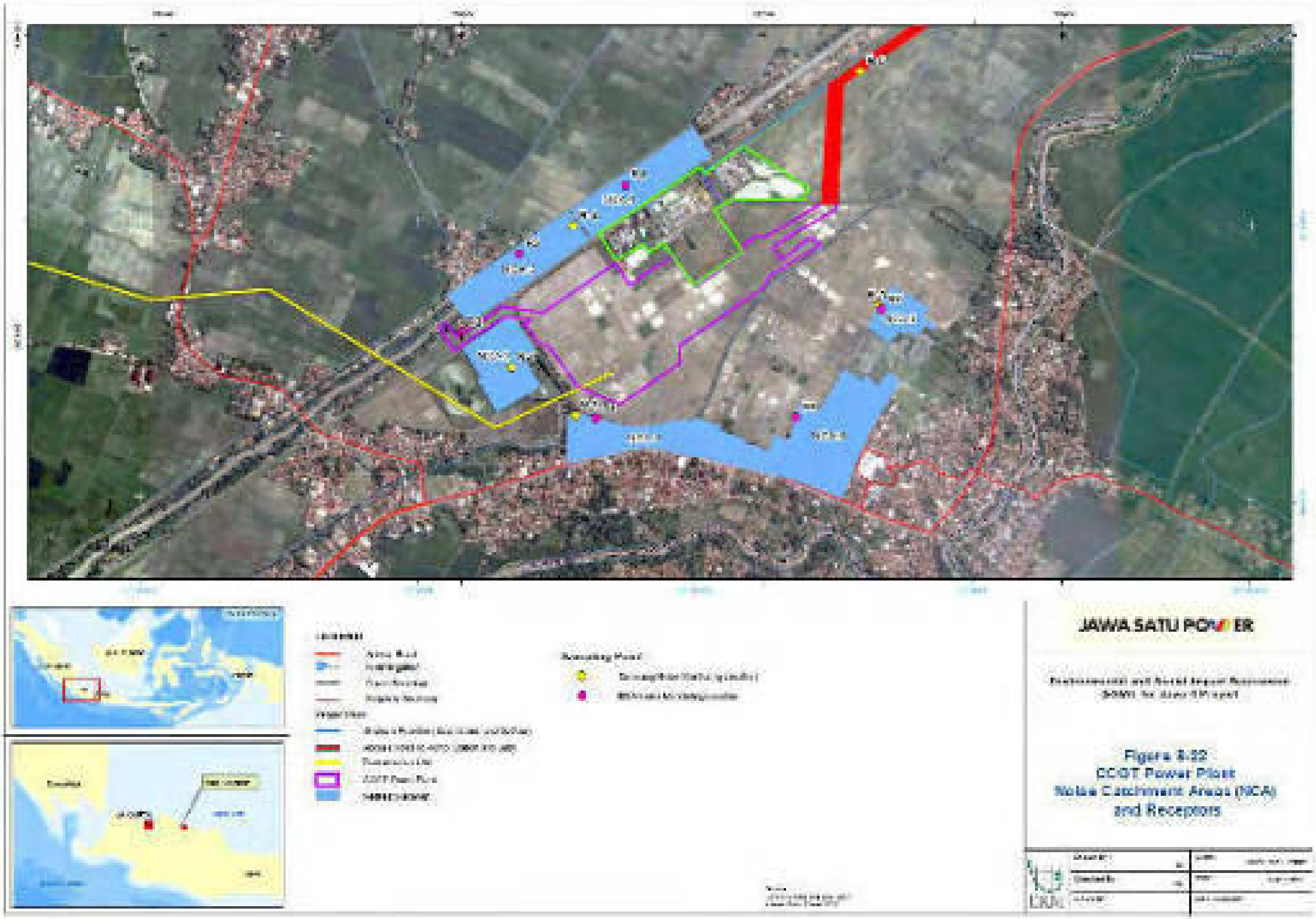
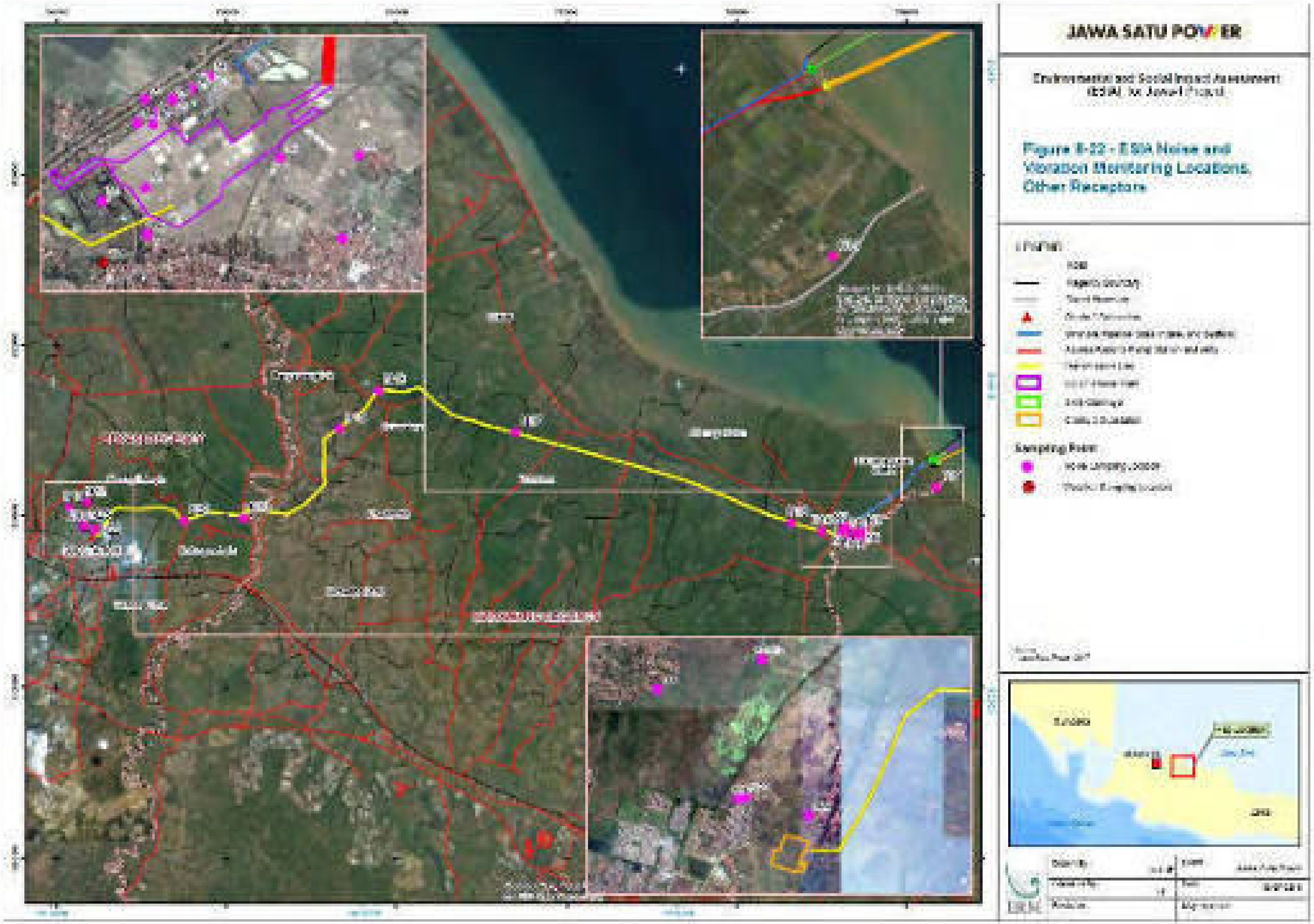


Figure 8-15 Other Project Components and Potentially Sensitive Receptors



8.6.2.5 Noise Criteria

The local and international noise guideline criteria for the assessment of potential noise impacts are consolidated in **Table 8-28**.

In the absence of defined periods for the 48/MENLH/11/1996 local guidance the IFC daytime (7AM to 10PM) and night time (10PM to 7AM) definitions have been adopted. In the absence of defined $L_{eq,T}$ noise parameters for the 48/MENLH/11/1996 local guidance the IFC $L_{eq,1hr}$ parameter has been adopted.

The most stringent "fixed" criteria values for each receptor type are highlighted in bold typeset in the table below. Of course, the IFC 1.7 Noise permissible increase requirements are based on exiting noise conditions, hence they may be more or less stringent than the fixed values as evaluated on a case by case basis.

For the power plant, eleven specific noise receptor locations have been established (see below), criteria derived and impacts assessed based on the locations adopted to inform the power plant design, and additional locations derived for this report. For other project components the potential area of influence of each key component e.g. transmission line or substation was established and then specific receptor locations again derived to assess impacts. Regardless, a consistent approach was adopted as per the consolidated criteria presented in **Table 8-28**.

Further information regarding the power plant criteria is reproduced here as it represents the project infrastructure with the most significant risk of generating noise impacts and has been design such the noise reducing measures have already been incorporated into the projects design, such as barriers and building specifications to achieve compliance.

Table 8-28 Project-Specific Noise Criteria

Receptor Type	48/MENLH/11/1996 Noise Limits Leq, 1hr in dBA		IFC 1.7 Noise Limits, dBA (Fixed Values) - Leq, 1hr in dBA		IFC 1.7 Noise Limits, dBA (Permissible Increase) - Leq, 1hr in dBA	
	Daytime (7am to 10pm)	Night time (10pm to 7am)	Daytime (7am to 10pm)	Night time (10pm to 7am)	Daytime (7am to 10pm)	Night time (10pm to 7am)
Residential	55	55	55	**45**	Impacts should not exceed the levels presented (IFC fixed values), or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.	
Institutional	55	55	55	**45**		
Educational	55	55	55	**45**		
Industrial	**70**	**70**	**70**	**70**		
Commercial	**65**	**65**	70	70		

1. As existing noise conditions vary from one receptor location to another, all potential areas of influence described in *Chapter 3* and presented in *Chapter 6* and *7* of the Annex E acoustics assessment have been defined based on the most stringent fixed criteria values presented in this table, as applicable to when emission will occur e.g. daytime only, or both daytime and night.

Jetty Piling: in the absence of measured existing noise levels at N14 (the closest and potentially most affected residential receptors situated near the Jetty) it has been assumed that existing levels do not exceed the 55 / 45 dBA fixed noise level criteria and as such the IFC 1.7 Noise Limits (fixed values) - $L_{eq, 1 hour}$ in dBA apply. This is consistent with the approach adopted and described below for the CCGT Design Noise Levels to derive criteria as follows: L_{eq} + 3 dBA = $L_{eq, 1 hour}$ project-specific criteria, for each receptor; where the existing ambient values already exceed the fixed value 55/45 dBA criteria.

CCGT Power Plant: the project-specific noise criteria for the eleven receptors (previously described in **Table 8-28** of this report) that have informed the projects CCGT power plant design to date are reproduced from the *Samsung C&T – Engineering and Construction Group (Samsung) – Indonesia Jawa-1 Noise Study Review – Ver. 07 - Cooling Tower Re-location to East-Side* report, dated 2016.7.9 and prepared by Samsung - Quality Technology Division, Technical Team (Samsung, 2016 Noise Study Review).

The Samsung, 2016 Noise Study Review focused on the most stringent night time criteria and as such daytime criteria values have been derived for this assessment based on the lowest measured noise level values ($L_{eq, daytime}$) presented in Table 4.2 and Table 4.3 of the Annex E acoustics assessment report.

The basis of these project-specific night time criteria values as stated in the Samsung, 2016 Noise Study Review is: existing $L_{eq, 8 hour night}$ + 3 dBA = $L_{eq, 1 hour}$ project-specific criteria, for each receptor. This applies where the existing ambient values already exceed the fixed value 55/45 dBA criteria.

The same method has been adopted to derive daytime criteria as follows: $L_{eq, daytime}$ + 3 dBA = $L_{eq, 1 hour}$ project-specific criteria, for each receptor, where $L_{eq, daytime}$ is the lowest measured value presented in *Table 4.2* and *Table 4.3* of the Annex E acoustics assessment report. This applies where the existing ambient values already exceed the fixed value 55/45 dBA criteria.

For locations N-1 to N-5 identified in the Samsung, 2016 Noise Study Review the criteria values were adopted as reported. For each of the additional six receptors (R1 to R6) identified for this assessment the criteria value from the closest Samsung, 2016 Noise Study Review location (of N-1 to N-5) has been used.

The consolidated set of criteria values are presented in Table 5.4 and Annex B of the Annex E acoustics assessment, as reproduced below in **Table 8-28**.

Table 8-29 Project-Specific CCGT Noise Criteria

Noise ID	Description	Noise Criteria, dBA – Leq, 1 hour	
		Daytime (7AM to 10PM)	Night time (10PM to 7AM)
N-1	Residential (Dwelling) Receptor/s situated south-west of the CCGT power plant.	55.0	51.9
N-2	Residential (Dwelling) Receptor/s situated south of the CCGT power plant.	62.4	55.1
N-3	Residential (Dwelling) Receptor/s situated east of the CCGT power plant.	59.9	48.6
N-4	Residential (Dwelling) Receptor/s situated north of the CCGT power plant.	60.8	55.0
N-5	Residential (Dwelling) Receptor/s situated north-east of the CCGT power plant.	55.0	54.5
R1	Residential (Dwelling) Receptor/s situated south of the CCGT power plant, within NCA 1	62.4	55.1
R2	Workforce Accommodation Receptor situated west of the CCGT power plant, within NCA 2.	55.0	51.9
R3	Residential (Dwelling) Receptor/s situated north-west of the CCGT power plant, within NCA 3.	60.8	55.0
R4	Residential (Dwelling) Receptor/s situated north of the CCGT power plant, within NCA 4.	60.8	55.0
R5	Residential (Dwelling) Receptor/s situated east of the CCGT power plant, within NCA 5.	59.9	48.6
R6	Residential (Dwelling) Receptor/s situated south-east of the CCGT power plant, within NCA 6.	59.9	48.6

1. Source: Samsung, 2016 Noise Study Review. Derived with due regard to the existing night time Leq noise levels presented in Table 4.4 of this report and with due regard to the requirements of IFC 1.7 Noise.

8.6.3 *Assessment of Impacts*

The overall assessment features are summarised in **Annex E**. This section outlines an evaluation of all potential construction and operational noise and vibration sources and impacts for the various project components and activities.

This evaluation is a key feature of the assessment methodology established for a project of this scale and design and enables a focused assessment of the most significant issues with the potential to impact surrounding receptors or the broader community.

A qualitative assessment of select project components, phases and emissions is provided here where limited or no potential to generate impacts at nearby potentially sensitive receptors is anticipated, or where further assessment is not warranted at this stage as their impacts are readily mitigated or managed via standard industry practices.

Unless otherwise stated below, the plant, equipment and machinery, or activities undertaken, for the projects construction and operation may generate vibration that is perceptible in very close proximity to the source. However, potential annoyance/disturbance issues or cosmetic/structural damage is unlikely to occur at off-site receptors. This is due to the manner in which vibration dissipates rapidly with distance. Accordingly, the projects vibration generated during construction, including road traffic is expected to comply with the project-specific vibration criteria described in Chapter 5 of the **Annex E** acoustics assessment report.

This chapter also presents the justification of the quantitative noise assessment approach for CCGT construction noise (including road traffic and piling), CCGT operational noise, operational substation noise and the 500 kV transmission line. Further information and technical methods regarding these quantitative assessments is provided in **Section 3** of the **Annex E** acoustics assessment.

8.6.3.1 *Construction Noise and Vibration Impacts*

An evaluation of likely construction (general works and activities, and road traffic) air-borne noise and ground-borne vibration impacts to human receptors has been conducted. An evaluation of likely construction underwater noise impacts to wildlife receptors was also completed.

8.6.3.2 *General Construction (Onshore)*

Based on the location, type and scale of construction works and activities that will be required for the onshore 1,760 MW CCGT power plant (including piling), noise impacts could occur if suitable mitigation and/or management measures are not implemented. Similarly, noise impacts could occur due to construction road traffic associated with the CCGT power plant, and other project components requiring the transportation of staff, equipment, fill and other resources to the project via road.

Based on this evaluation of the potential magnitude and extent of impacts associated with these two key nearshore works and activities a quantitative assessment of their estimated emissions is provided in **Section 6** of **Annex E** acoustics assessment report. Recommendations for mitigation, management measures and/or monitoring contingencies are reproduced here from the acoustics assessment report, they are designed to reduce levels and minimise onshore noise impacts at nearby receptors.

The residual impact ratings, derived assuming the successful implementation of the recommended measures, provisions, safeguards and contingencies are outlined below. In these cases the **Annex E** acoustics assessment has identified a range of potential CCGT Power Plant residual impacts due to the location of a) the most affected receptors , b) other affected nearby receptors and c) type of works.

Table 8-30 1,760 MW CCGT power plant – Construction Noise – Human Receptors

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

Table 8-31 Construction Access Roads – Construction Noise - Human Receptors

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

Based on the location, type and scale of construction works and activities that will be required for a) the Onshore Receiving Facility, b) 500 kV Transmission Line, c) onshore gas delivery pipeline and d) Cibatu Baru II/Sukatani Substation, noise impacts are unlikely to occur. Noise emissions may be audible at times but they are not expected to be the dominant project (or ambient) noise source/s during their construction.

Furthermore, the total duration that these works will occur is limited when compared to that of other project components, for example the CCGT power plant. This is of particular importance with regard to the 52.16 km, 500 kV transmission line and onshore gas delivery pipeline where works will occur in a linear manner along the alignment of each component, meaning that emissions will occur at one location for a short period of time and then move away, along the alignment.

The residual impact ratings for each of these project components are outlined below.

Table 8-32 Onshore Receiving Facility (ORF) – Construction Noise– Human Receptors

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

Table 8-33 500 kV Transmission Line - Construction Noise – Human Receptors

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

Table 8-34 Gas Delivery Pipelines – Construction Noise – Human Receptors

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

Table 8-35 Cibatu Baru II/Sukatani Substation - Construction Noise – Human Receptors

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

Based on the location, type and scale of construction works and activities that will be required for the a) onshore 1,760 MW CCGT power plant, b) Onshore Receiving Facility, c) 500 kV Transmission Line, d) onshore gas delivery pipeline and e) Cibatu Baru II/Sukatani Substation, vibration impacts (to human or building receptors) are unlikely to occur. Similarly, vibration impacts associated with construction road traffic are unlikely to occur.

Even though impact piling is proposed, the closest potentially sensitive structure is 90 metres from any proposed piling works, such that vibration levels are expected to be at or below 2 mm/s and compliant with the assessment criteria presented in *Section 5.2.2* of this report. Bulk earthworks are proposed within close proximity (< 10 metres) to nearby receptors however the plant, equipment and machinery that would typically be in use, or activities to be undertaken for bulk earthworks, are not considered a significant vibration generating source like that associated with impact piling.

Vibration may be perceptible at times but is not expected to be a significant and/or constant source or feature of the projects construction with the potential to annoy or impact nearby receptors/buildings. Furthermore, structural or cosmetic damage to nearby and potential sensitive structures is unlikely to occur as the plant, equipment and machinery, and or activities to be undertaken onshore, are do not represent significant vibration generating sources.

The vibration impact ratings for all on-shore project components are summarised below.

Table 8-36 CCGT Power Plant Construction Vibration – Human Receptors

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

Table 8-37 ***Onshore Receiving Facility, 500 kV Transmission Line, onshore gas delivery pipeline and Cibatu Baru II/Sukatani Substation – Construction Vibration – Human Receptors***

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

8.6.3.3 *General Construction (Nearshore)*

Based on the location, type and scale of construction works and activities that will be required for the nearshore a) Seawater Water Intake, b) Cooling Water Outfall Discharge Pipeline and c) Jetty (including piling), it is unlikely that significant noise and vibration impacts would occur.

Despite the unlikely occurrence of impacts associated with the Jetty construction, a quantitative assessment of potential piling emissions has been conducted to demonstrate this project components limited risk of generating impacts, as piling is commonly recognised as a potential noise issue.

The residual noise and vibration impact ratings for all near-shore project components are provided below.

Table 8-38 ***Seawater Water Intake and Cooling Water Outfall Discharge Pipeline – Construction Noise and Vibration – Human Receptors***

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

Table 8-39 Jetty - Construction Noise and Vibration – Human Receptors

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

8.6.3.4 *General Construction (Offshore)*

The evaluation of likely offshore construction (e.g. piling) noise impacts to human receptors identified limited or no potential for issues to occur. The evaluation of likely construction (e.g. piling) underwater noise impacts to wildlife receptors did however identify a potential for issues to occur.

Based on the type of construction works and activities that will be required for the offshore a) Floating Storage and Regasification Unit (FSRU) and b) Gas Delivery Pipelines, it is likely that significant underwater noise impacts could occur that may warrant consideration of mitigation and management measures. This is limited however to significant underwater noise generating sources, such as piling, that would require specific measures to be implemented to minimise impacts to wildlife receptors.

As noted earlier in this report, this acoustical feature is being assessed in more detail by other specialists. Given its association with the potential project noise, **Section 8** of the **Annex E** acoustics assessment presents recommended safeguard mitigation and management measures specific to this task that are commonly incorporated into good construction management practices.

These recommended safeguards and provisions were derived with due regard to the JNCC Annex A: Guideline, 2009 and JNCC Guideline, 2017), dated August 2017.

8.6.3.5 *Operational Noise and Vibration Impacts*

An evaluation of likely operational air-borne noise and ground-borne vibration impacts to human receptors has been conducted. An evaluation of likely operational underwater noise impacts to wildlife receptors was also completed.

The residual impact ratings, derived for each project component and acoustical factor, assuming the successful implementation of the recommended measures, provisions, safeguards and contingencies are outlined below. Further information is provided in this section, following the impact rating tables.

Table 8-40 Floating Storage and Regasification Unit (FSRU) – Operational Noise and Vibration – Human Receptors

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

Table 8-41 Gas Delivery Pipelines – Operational Noise and Vibration – Human Receptors

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

Table 8-42 Onshore Receiving Facility (ORF) – Operational Noise and Vibration – Human Receptors

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

Table 8-43 Seawater Water Intake and Cooling Water Outfall Discharge Pipeline – Operational Noise and Vibration – Human Receptors

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

Table 8-44 1,760 MW CCGT power plant – Operational Noise and Vibration – Human Receptors

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

Table 8-45 Access Road – Operational Noise and Vibration - Human Receptors

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

Table 8-46 500 kV Transmission Line - Operational Noise – Human Receptors

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

Table 8-47 500 kV Transmission Line - Operational Vibration – Human Receptors

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

Table 8-48 Cibatu Baru II/Sukatani Substation - Operational Noise – Human Receptors

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

Table 8-49 Cibatu Baru II/Sukatani Substation - Operational Vibration – Human Receptors

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

8.6.3.6 General Operation (Onshore and Nearshore)

Based on the location, type and scale of operational activities proposed for the onshore a) 1,760 MW CCGT power plant, it is likely that significant noise impacts could occur that may warrant consideration of mitigation and management measures. These impacts will be mitigated through the implementation of appropriate noise controls that, through monitoring, demonstrate compliance with the standards.

To a lesser extent impacts warranting potential mitigation could occur for b) the 500 kV Transmission Line, and c) the Cibatu Baru II/Sukatani Substation.

Unlike the statements made above for construction works and activities recommendations to reduce levels and minimise onshore impacts are best established via a quantitative (modelling) assessment. This modelling has been completed in detail for the CCGT power plant and then noise levels estimated at distance offsets for the 500 kV transmission line alignment and substation. These features are discussed in **Section 3** with results presented in **Section 7** of the **Annex E**.

A detailed assessment of operational vibration has not been conducted however based on a) the type of operational equipment that is required for the project and b) the distance offset to the closest and/or potentially most affected receptors, perceptible levels of vibration may be experienced. Specific recommendations for vibration mitigation and management measures are provided in **Section 8.6.4**.

For the proposed operational activities associated with the nearshore a) Seawater Water Intake, b) Cooling Water Outfall Discharge Pipeline, and c) Onshore Receiving Facility it is unlikely that significant noise and vibration impacts could occur that may warrant consideration of mitigation and management measures.

This is primarily due to significant influence of the key CCGT power plant operational activity noted above, or typical design measures that are implemented during detailed design of the project to ensure impacts are minimal, if any at all.

8.6.3.7 Operational Road Traffic (Onshore)

An evaluation of likely operational road traffic air-borne noise and ground-borne vibration impacts to human receptors identified that significant operational road traffic (noise and vibration) impacts from the project i.e. from vehicles on the access road are not anticipated.

Although project noise levels will be sometimes audible at receptors, the operational access road (constructed between the equipment jetty and the power plant) will have a limited number of vehicles generating minimal noise emissions when compared to the overall site contribution from other site components. On this basis, significant operational road traffic (noise and vibration) impacts from the project are not anticipated and no further assessment is warranted or provided in this report.

8.6.3.8 General Operation (Offshore)

The evaluation of likely operational underwater noise impacts to wildlife receptors identified that significant issues are not anticipated to occur. This outcome is broadly based on the type of operational activities, plant, equipment and machinery that are proposed for the Project, and a general evaluation that they do not commonly cause underwater noise impacts.

This acoustical feature is however being assessed in more detail by other specialists and any recommendations by them for underwater noise mitigation and/or management measures (to reduce noise levels and minimise impacts) should be implemented.

8.6.4 Mitigation Measures, Management and Monitoring

Section 8 of the **Annex E** presents recommendations, safeguards, provisions and contingencies for the construction and operational noise and vibration associated with the project. These measures (as reproduced here) are based on the levels and potential impacts evaluated in Section 2 and assessed in detail in Section 6 and Section **7** of the **Annex E**. They are designed to minimise impacts at the most affected receptors and on the broader community. The focus of potential construction (including road traffic and piling) noise measures is air-borne noise impacts to human receptors. The focus of potential operational (CCGT power plant, substation and 500 kV transmission line) noise measures is contingencies for air-borne noise impacts to human receptors once the project is operational.

The construction safeguards and provisions presented below target significant emission generating works and activities, for the various onshore components associated with the project, that are proposed to occur within and near the project site.

In addition, safeguards and provisions are provided below for potential operational air-borne noise impacts to human receptors. These operational safeguards and provisions target operational noise verification and compliance monitoring for significant emission generating activities, for the various onshore components associated with the project (i.e. the CCGT power plant, substation and 500 kV transmission line) that are proposed to occur within and near the project site.

8.6.4.1 Construction Phase

To assist ensure noise emissions associated with construction works and activities are reduced as far as possible and impacts minimised, the following mitigation and management measures are recommended.

General CCGT Construction (Site Preparation, Building Construction, Bulk Earthworks, or similar)

- CCGT construction work and activities should be carried out during the IFC daytime hours (i.e. 7AM to 10PM). Where possible the CCGT construction works and activities should conclude at 6PM daily, to further minimise impacts and provide respite outsiders standard business hours.

- Any work that is performed outside these hours (i.e. during the night time period, 10PM to 7AM) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (i.e. 45 dBA), at all potentially affected sensitive receptors. Where this is not possible it may be necessary to undertake the night works with agreement from nearby and potentially affected neighbours. The EPC has confirmed, noise level mitigations will be implemented based on monitoring to be conducted for background noise levels in August 2018.

- Where works near R2, or any unforeseen activities in close proximity to other receptors, are to occur and these works are anticipated to generate high noise levels of >70 dBA, potential respite periods (e.g. three hours of work, followed by one hour of respite) should be implemented. Respite should be implemented if it is the preference of the affected receptors and if it is feasible and reasonable, and practicable, to implement during the works.

In some circumstances respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure.

- Construction road traffic associated with CCGT works should be limited to the IFC daytime hours (i.e. 7AM to 10PM). Any traffic that is required outside these hours (i.e. during the night time period, 10PM to 7AM) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (45 dBA), at all potentially affected sensitive receptors.

CCGT Piling (Impact Piling, or Similar)

- CCGT piling and activities should be carried out during the IFC daytime hours (i.e. 7AM to 6PM). Where possible the CCGT construction works and activities should conclude at 6PM daily, to further minimise impacts and provide respite outsiders standard business hours. If piling works are required to be conducted after 6pm it will be limited to augering and welding only.

- Any work that is performed outside these hours (i.e. during the night time period, 10PM to 7AM) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (i.e. 45 dBA), at all potentially affected sensitive receptors. Where this is not possible it may be necessary to undertake the night works with agreement from nearby and potentially affected neighbours.

- CCGT piling should be conducted as per the method summarised in *Section 3.1* and reproduced in **Annex E** of this report.

  - All noise reducing mitigation that is presented **Annex E** of this report should occur i.e. pre-drilling to ten metres depth, at all piling locations; use of pile caps and cushions, the latter consisting of five layers of high strength multiflex board; and installation of the EGI fence adjacent to the village area.

  - An EGI fence will be erected at the southwest boundary to mitigation noise imapcts on the nearby school. The height (likely 2m) and specification should be determined after EPC test piling and noise monitoring.

  - The work sequence that is presented **Annex E** should be strictly adhered to and no more than 12 piling rig units should work concurrently unless an alternative work sequence and piling rig layout design/plan is identified that will reduce noise levels, or minimise impacts to those presented in this report.

- Where any unforeseen piling works will occur in close proximity to a receptor and these works are anticipated to generate high noise levels >70 dBA, potential respite periods (e.g. three hours of work, followed by one hour of respite) should be implemented. Respite should be implemented if it is the preference of the affected receptors and if it is feasible and reasonable, and practicable, to implement during the works. In some circumstances respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure.

- Construction road traffic associated with CCGT works should be limited to the IFC daytime hours (i.e. 7AM to 10PM). Any traffic that is required outside these hours (i.e. during the night time period, 10PM to 7AM) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (45 dBA), at all potentially affected sensitive receptors.

All CCGT Works (incl. Piling)

- During the construction design, appropriate plant, equipment and/or machinery should be selected for each task and efficient work practices adopted to minimise the total construction period and the number of noise sources on the site. The quietest item of plant available should be selected where options that suit the design permit.

- During the works, unnecessary noise due to idling diesel engines and fast engine speeds should be avoided when lower speeds are sufficient.

- During the works, drivers should be instructed to travel directly to site and avoid any extended periods of engine idling at or near residential areas.

- During any night works, any activity that has the potential to generate impulsive noise should be completely avoided. These types of events are particularly annoying, especially at night and have the limited potential to generate sleep disturbance or awakening impacts.

- During the works, ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the site.

- During the works, ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse.

- Implementation of a community grievance mechanism and community consultation will be undertaken in advance of known noise emitting activities and during.

CCGT Construction Noise Monitoring (All Works incl. Piling)

Regular monitoring of construction (including piling) noise levels should be conducted and an evaluation of compliance provided for. All site noise levels should be measured in the absence of any influential sources not associated with the project. If the measured project noise levels are below the predicted values and comply with the criteria presented in this report, no further mitigation or management measures may be required. If the measured project levels are above the predicted noise levels and/or criteria presented in this report, further mitigation and/or management measures should be considered and implemented, where feasible, reasonable and practical to do so.

Jetty Piling (Impact Piling, or Similar)

Noise modelling of Jetty piling works has identified that unmitigated emissions comply with the most stringent night time project-specific criteria (45 dBA) at the closest and/or potentially most affected receptor (N14) situated within the potential area of influence of these activities, as documented in Section 6.1 of the **Annex E** acoustics assessment report. On this basis, the noise reducing mitigation and management measures that are applicable to CCGT piling works, do not apply to Jetty piling, which can be undertaken a) at any time of day i.e. during the daytime or the night time and b) without implementing the noise reducing measures reproduced in Annex C of the **Annex E** acoustics assessment report. JSP (or the piling contractor etc) should however remain aware of the potential for nuisance, or an unacceptable level of amenity, to occur due to piling noise and continue to plan for and then manage the project design accordingly.

8.6.5 *Assessment of Residual Impact*

The pre-mitigation and residual impact significance rankings are summarised in **Table 8-50** and discussed in the following subsections.

Table 8-50 Pre-Mitigation and Residual Impact Noise and Vibration Impact Significance Summary

Aspect	Activity	Receptor	Emission	Potential Impact	Impact Evaluation Significance (Pre-Mitigation)	Residual Impact
Construction						
CCGT Power Plant	High noise generating construction activities e.g. bulk earthworks	Most affected receptors, nearby community	Noise	Temporary and short-term noise disturbance impacts and amenity issues	**Major**	**Moderate**
		Other affected receptors, broader community	Noise		**Moderate**	**Moderate**
	General construction activities e.g. site preparation and building construction	Most affected receptors, nearby community	Noise	Temporary and medium-term noise disturbance impacts and amenity issues	**Moderate**	**Minor**
		Other affected receptors, broader community	Noise		**Moderate**	**Minor**
Road traffic on access roads	General construction traffic	Most affected receptors, nearby community only.	Noise	Temporary and medium-term noise disturbance impacts and amenity issues.	**Major**	**Moderate**
Onshore Receiving Facility (ORF)	General construction activities	Most affected receptors, nearby community only	Noise	Temporary and short-term noise disturbance impacts and amenity issues	**Minor**	**Minor**
Transmission Line	General construction activities	Most affected receptors, nearby community only.	Noise	Temporary and short-term noise disturbance impacts and amenity issues	**Minor**	**Minor**
Gas delivery pipeline	General construction activities	Most affected receptors, nearby community only.	Noise	Temporary and short-term noise disturbance impacts and amenity issues	**Negligible**	**Negligible**
Cibatu Baru II/Sukatani substation	General construction activities	Most affected receptors, nearby community only.	Noise	Temporary and short-term noise disturbance impacts and amenity issues	**Minor**	**Minor**

Aspect	Activity	Receptor	Emission	Potential Impact	Impact Evaluation Significance (Pre-Mitigation)	Residual Impact
Construction (Cont'd)						
CCGT Power Plant	General construction activities	Most affected receptors, nearby community only.	Vibration	Temporary and short-term disturbance impacts and amenity issues	**Minor**	**Minor**
Onshore Receiving Facility (ORF), Transmission Line, Gas delivery pipeline, Cibatu Baru II/Sukatani substation	General construction activities	Most affected receptors, nearby community only.	Vibration	Temporary and short-term disturbance impacts and amenity issues	**Negligible**	**Negligible**
Seawater Water Intake and Cooling Water Outfall Discharge Pipeline	General construction activities	Most affected receptors, nearby community only.	Noise + Vibration	Temporary and short-term disturbance impacts and amenity issues	**Minor**	**Minor**
Jetty	General construction activities	Most affected receptors, nearby community only.	Noise + Vibration	Temporary and short-term disturbance impacts and amenity issues	**Minor**	**Minor**
Operation						
Floating Storage and Regasification Unit (FSRU) – Operations	General operation	Most affected receptors, nearby community only.	Noise + Vibration	Disturbance impacts and amenity issues.	**Negligible**	**Negligible**
Gas Delivery Pipelines	General operation	Most affected receptors, nearby community only.	Noise + Vibration	Disturbance impacts and amenity issues.	**Negligible**	**Negligible**
Onshore Receiving Facility (ORF)	General operation	Most affected receptors, nearby community only.	Noise + Vibration	Disturbance impacts and amenity issues.	**Negligible**	**Negligible**
Seawater Water Intake and Cooling Water Outfall	General operation	Most affected receptors, nearby community only.	Noise + Vibration	Disturbance impacts and amenity issues.	**Negligible**	**Negligible**

Aspect	Activity	Receptor	Emission	Potential Impact	Impact Evaluation Significance (Pre-Mitigation)	Residual Impact
Operation (Cont'd)						
CCGT Power Plant	General operation	Most affected receptors, nearby community only.	Noise + Vibration	Disturbance impacts and amenity issues.	**Minor**	**Minor**
Access Roads Operations - Road traffic, light and heavy vehicles	General operational traffic	Most affected receptors, nearby community only.	Noise + Vibration	Disturbance impacts and amenity issues.	**Negligible**	**Negligible**
500 kV Transmission Line Operations	General operation	Most affected receptors, nearby community only.	Noise (Corona)	Disturbance impacts and amenity issues.	**Minor**	**Minor**
500 kV Transmission Line Operations	General operation	Most affected receptors, nearby community only.	Vibration	Disturbance impacts and amenity issues.	**Negligible**	**Negligible**
Cibatu Baru II/Sukatani Substation Operations	General operation	Most affected receptors, nearby community only.	Noise	Disturbance impacts and amenity issues.	**Minor**	**Minor**
Cibatu Baru II/Sukatani Substation Operations	General operation	Most affected receptors, nearby community only.	Vibration	Disturbance impacts and amenity issues.	**Negligible**	**Negligible**

8.6.5.1 *Construction*

In each case the combination of a) potential construction noise/vibration reducing mitigation measures, and b) management measures have been considered when evaluating the residual impact rating. In general terms, the noise reducing measures will assist to reduce the magnitude and extent of potential impacts, and these features will be measurable (e.g. via monitoring, or complaints handling) during the work. The management measures are expected to assist minimise the potential impact by e.g. limiting when activities occur or the frequency at which they might be experienced but are not expected to reduce the Projects emission magnitude. This is common for construction works and activities where a reduction in noise emission is not feasible, reasonable, practical or safe but minimising impacts via management measures is achievable to implement. In some circumstances, the pre-mitigation and residual impact rating are the same/unchanged, for example, a moderate rating is identified pre-mitigation and also as a residual impact for general construction road traffic on access roads. This circumstance arises when a noise/vibration impact is anticipated at the higher end of the rating bracket e.g. moderate etc. The recommended mitigation and management measures will be effective and will reduce the impacts experienced but not to the extent that the residual rating is reduced to the bracket below e.g. minor.

8.6.5.2 *Operation*

In all operational circumstances, the pre-mitigation and residual impact rating for operational noise and vibration are the same/unchanged. For example, a minor rating is identified pre-mitigation and also as a residual impact for operational noise associated with the CCGT power plant. This is because either a) the unmitigated design of the Project component is determined to comply with the relevant criteria and limits, or b) the project design has already incorporated noise reducing mitigation measures (e.g. buildings, enclosures, noise barriers, walls, equipment specification) which have been modelled and determined to achieve assist compliance with the relevant criteria and limits, as specified in the **Annex E** acoustics assessment report. In these operational circumstances, no further recommendations for noise/vibration reducing measures are warranted or provided but a set of provisions, safeguards and monitoring contingencies are documented to assist ensure these negligible or minor impacts are realised during operation.

8.7 SOIL AND GROUNDWATER

Understanding potential changes in soil quality and associated changes to the groundwater quality are essential in forming an overall understanding of Project impacts. In this regard, this Section presents an evaluation of the potential impacts on changes in soil and groundwater levels and quality and issues pertaining to quality of the *in-situ* soils. Secondary impacts relating to deterioration of surface water quality and soil erosion from surface water flows are discussed later in the section. This is primarily due to the fact that management of surface water is related to ensuring that topsoil does not become mobilised as suspended solids.

Potential soil and groundwater contamination due to improper construction waste storage and disposal would be the result of contaminated surface water run-off being discharged from waste storage and disposal areas is discussed in in this section. The production and discharge of this contaminated surface water is assessed extensively within **Section 8.8**. It is considered that this impact has therefore already been covered and will not be re-assessed within the context of impacts to soil and groundwater.

This is also the case with the impacts due to improper discharge of wastewater and runoff which if directed to either a surface water, groundwater or soil receptor would all be subject to similar impacts and thus mitigation, management and monitoring measures.

The assessment of potential impacts related to groundwater and soils in this section is based on the environmental and social baseline data (presented in **Chapter 7**) and the information available from the Sponsor at the time of writing.

It is noted that no quantitative modelling has been undertaken concerning any elements of the ground water impact assessment. Should there be significant changes in factors such as assumed input data or assessment criteria, then elements of this impact assessment and associated management, mitigation and monitoring measures may need to be amended to reflect these changes.

The environmental parameters sampled in the baseline survey, data from which have been used in the assessment, are commonly found contaminants and were selected based on extensive analysis suites provided by internationally recognised laboratories. Contaminants outside the analysis suite used under this ESIA were not assessed.

8.7.1 Potential Sources of Impacts

8.7.1.1 Construction Phase

Based upon Scoping, during the construction phase the following routine impacts are identified as potentially occurring:

- Soil disturbance, loss of soil structure, quantity and quality from site preparation and excavation activities and development of access roads;
- Soil and groundwater contamination liberated from naturally occurring "stored sources" (e.g. acid sulphate soils) arising from soil disturbance during excavation; and
- Soil and groundwater contamination due to the contaminated fill materials during all phases of Project construction.

8.7.1.2 Operations Phase

The operation phase is expected to continue for 25 years. The average number of permanent workers present during operation is expected to be up to 150 personnel. The assessment of operational phase impacts includes those arising from both routine operations and maintenance of the CCGT Power Plant, onshore pipelines, Transmission Line, the Substation, and the pump station

During the operation phase, potential soil and groundwater impacts may arise due to loss of soil due to increased erosion potential during operation phase.

It is noted that soil and groundwater contamination due to improper construction waste storage and disposal would be the result of contaminated surface water run-off being discharged from waste storage and disposal areas. The production and discharge of this contaminated surface water is assessed in **Section 8.8**. Additionally, impacts of soil and groundwater contamination due to potential accidental leaks, spills and leakages of hazardous chemicals and materials is discussed in **Chapter 10**.

It is considered that this impact has therefore already been covered and will not be re-assessed within the context of impacts to soil and groundwater. This is also the case with the impacts due to improper discharge of waste water and runoff which if direct to either a surface water, groundwater or soil receptor would all be subject to similar impacts and thus mitigation, management and monitoring measures.

8.7.2 Assessment Approach and Criteria

Annex A sets out the standards adopted for this assessment in terms of soil and ground water. These are stipulated by the *Government Regulation (PP) Number 82/2001* and *Regulation of Health Ministry No. 416/1990 in Appendix II*.

Table 8-51 Sensitivity Criteria for Impacts to Soil Quality

Sensitivity	Definition
Low	• Low soil fertility not used for agriculture, contaminated made-ground soils at brownfield sites, soils not supporting any particularly sensitive or important habitats.
Medium	• Typical agricultural land, soils supporting specific habitats (e.g. forests), soils on residential sites
High	• Intensively farmed, highly fertile soils, wetland soils, soils which host shallow aquifers relied upon for abstraction or essential for river base flow, soils of specific characteristics (e.g. pH, carbon content, mineralogy) that support specific significant or high-value flora or faunal habitats.

Source: *ERM, 2017b*

Table 8-52 Magnitude Criteria for Impacts to Soil Quality

Magnitude	Definition
Negligible	• Change well within the bounds of normal natural variation. No effect detectable or recovery within a very short timescale (<1 year). Could occur over any size of area.
Small	• Change likely to adversely affect the quality/value of the soil but recovery is expected in the short term (i.e. 1 – 4 years). Changes are over a small to moderate area. Impacts beyond levels of natural variation that do not exceed assessment criteria (i.e. low intensity), for any duration or geographic extent.
Medium	• Change over a moderate (i.e. 1 – 100 ha) to large area, likely to adversely affect the quality/value of the soil but recovery is predicted in the medium term (i.e. 5 – 10 years) and there is predicted to be no permanent impact to its integrity. Conversely, change over a small area (i.e. <1 ha) with direct adverse permanent or long-term effects.
Large	• Change is likely to cause a direct adverse permanent or long-term (i.e. >10 years) effect on the quality/value of the soil over a large area (i.e. >100 ha).

Source: *ERM, 2017b*

Table 8-53 Sensitivity Criteria for Groundwater Quality

Sensitivity	Definition
Negligible	• The groundwater resource does not support diverse habitat or populations within groundwater dependent ecosystem.
Low	• The groundwater resource supports aquatic habitat or population, but the habitat/population is common/ non-diverse/ insignificant.
Medium	• The groundwater resource supports diverse or susceptible populations of flora and/or fauna.
High	• The groundwater resource supports economically important or biologically unique species or provides essential habitat/ nutrients to sustain such species.

Source: *ERM, 2015*

Table 8-54 Magnitude Criteria for Impacts to Groundwater Quality

Magnitude	Definition
Negligible	• The Project is unlikely to have an impact on recharge/ discharge regimes at any time.
Small	• There is likely to be some alteration to existing recharge/ discharge regimes, although these changes are unlikely to result in any significant long term changes to groundwater levels, quality or flows. • There are known/ expected groundwater users/ supply or physical (property, agricultural fields, infrastructure, etc.) or sensitive ecological receptors within the aquifer or upstream or downstream but these are not considered susceptible to such changes in groundwater flow and/or quality.
Medium	• The Project is likely to involve significant changes to existing recharge / discharge regimes which result in long term changes to groundwater flows (vertical and/or horizontal) and/or quality. • There are known/ expected groundwater users/ supply or physical (property, agricultural fields, infrastructure, etc.) or sensitive ecological receptors within the aquifer or upstream or downstream which are susceptible to such changes in groundwater flow and/or quality.
Large	• The Project is likely to involve significant changes to groundwater flows (vertical and / or horizontal) and / or quality. • There are known/ expected groundwater users/ supply or physical (property, agricultural fields, infrastructure, etc.) or sensitive ecological receptors within the aquifer or upstream or downstream which are susceptible to changes in groundwater flow and/or quality that are likely to be significantly affected by such changes.

Source: *ERM, 2015*

8.7.3 Assessment of Impacts – Site Clearance Activities

8.7.3.1 Soil Disturbance due to Site Clearance Activities

Impacts during the construction phase are noted as being similar across all aspects of the Project (i.e. CCGT, onshore pipelines, Transmission Line and substation) and are thus assessed collectively.

The EPC contractors appointed by the Sponsor will carry out the construction of the onshore facilities. The entire construction phase is expected to continue for approximately 36 months. The approximate number of workers for the overall construction activities is approximately 3,500. The workers will be sourced both locally as well as externally.

Soil works, including vegetation clearance, potential grading and levelling, compaction, construction of various structures must be carried out at the CCGT Power Plant site, access roads, and for the laying of the right of way for the gas pipeline, transmission line and the substation.

Changes to soil structure may be caused by mechanical disturbance to the soil from these activities. Exposure of soil to rain and wind may in turn cause erosion and loss of top soil.

Earthworks will be carried out to raise the CCGT Power Plant platform to 4.0 m above mean sea level, a 1.5 m increase from the current height of the land. This requires approximately 315,000 m^3 of soil for backfilling purposes by the licensed land excavation company in Purwakarta or Subang region. Initial backfilling and consolidation activity will be conducted over three (3) months, with final height correction planned over a 5 month period from NTP +7 months.

Additionally, the ROW for pipeline installation will be cleared and will be graded to same level using a bulldozer or excavator. All roots and stumps shall be removed by grubbing, digging or such other means. All unwanted stumps, roots and other vegetation shall be disposed outside of the worksite boundaries. Prior to excavating in work area, all topsoil shall be stripped, stored and topsoil which is deemed to be unsuitable shall be disposed of to the dumping site approved by local Authorities. Soil Compactor will be utilised for compacting the opened ROW after land grading activity. Trenching will be conducted based on the approved engineering design procedures. The trenching activities will be conducted by the EPC Contractor.

The construction activities at the Transmission Line will require will land clearing and soil compaction activities. Following to this, tower foundations will be constructed involving land excavation, piling, setting, working floor making, stub shoes making, stub setting, crooked cut and supporting, formwork installation, cast preparation, earthing angle installation and grounding, cast foundation concrete, formwork disposal, filling and equipment demobilisation, and PLN boundary stacks installation.

An excavation of the land as deep as 3.5 m according to tower engineering design will be conducted for the tower that located within the paddy field. The excavated soil will be placed on the left and right side of holes, which will be utilised to close the holes after foundation making, is finished.

This phase of the Project is generally the most intensive in terms of loss of topsoil. Poor topsoil management can lead to a loss of topsoil through either the air (as dust) or as sediment entrained within surface water flows. Soil erosion can also result from poor management of stockpiled soils, excavated areas and general construction areas. Additionally, soil will be compacted at the CCGT Power Plant site and access roads, permanent operator housing and the lay down area to ensure soil stability.

Movement of heavy vehicles in the construction area will also result in soil compaction and damage to the soil structure. This compaction of the soil may potentially result in changed hydrological characteristics, such as reduced permeability and water infiltration to the soil, which could create additional surface run-off (and increase the flow velocity of this run-off), as well as reducing infiltration into subsurface aquifers. If compaction and erosion are not managed, associated potential impacts could include excessive sedimentation of local waterways, loss of topsoil and reduction in soil fertility, and detrimental changes to site hydrology.

Additionally, soil erosion is mostly a concern during periods of high rainfall. Loss of topsoil, if not controlled, can result in a waste of valuable topsoil resource which can be used in rehabilitation activities and or/agriculture. Presently there are no mitigation, management and monitoring measures directly associated with topsoil management.

This impact will occur throughout the construction phase, with the most intensive time being during the clearance of the proposed Transmission Line. However, the improper management during site clearance activities is expected to be limited to the project footprint only, and therefore the extent is considered local. Therefore, the magnitude scale of this impact is expected to be **Medium.**

The resource sensitivity (being the topsoil) is considered to be **Medium** as it a valuable asset which can be easily lost due to inappropriate management practices.

The significance of potential impacts to soil due to the improper management during site clearance activities at all Project area is assessed as **Moderate** as shown in **Table 8-55**.

Table 8-55 Assessment of Impacts on Soil due to Site Clearance Activities

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

A temporary storm drainage and collecting pit will be considered for disposal of stormwater as such it is not anticipated that groundwater levels will be affected by this activity.

Earthworks will be then carried out to raise the power plant platform to +4.0 m above mean sea level i.e. +1.5 m from the existing ground level. This requires approximately 300,000m^3 of soil for backfilling purposes by the licensed land excavation company in Purwakarta or Subang region. The backfilling and consolidation activity will be conducted by excavator, bulldozer, backhoe etc. and is predicted to last for 210 working days. The fill material will be deposited in layers and will not exceed a 230 mm loose depth. This will then be thoroughly compacted by rolling to a dry density not less than 90% of the maximum dry density as per the modified proctor test (ASTM D 1557) (*Samsung, 2018).*

Any displacement of ground water due to compaction will return to the compacted soil and re-saturate it as such the water table will not be affected by these activities. The soil backfill material is permeable hence the water table under its hydraulic pressure from the surrounding area would soon return it to its natural level.

In order to demonstrate that ground water levels will not be impacted or contaminated by this process an assessment of groundwater impacts is underway for the compacting process to be conducted at the power plant site. Should impacts be identified the EPC will implement mitigation measures to ensure the groundwater is not impacted and undertake regular monitoring throughout the compaction process.

8.7.3.2 Acid Sulphate Soil

Acid sulphate soils (ASS) are naturally occurring soils, sediments or organic substrates that are formed under waterlogged conditions. ASS may exist at the Project coastal locations, such as in mangroves, salt marsh vegetation or tidal areas, and at the bottom of coastal rivers and lakes where iron-rich sediments, sulphate sources (e.g. from seawater), sulphate-reducing bacteria, or supply of organic matter are present. When drained, excavated or exposed to air through a lowering of the water table, the sulphide reacts with oxygen to form sulphuric acid, which can release heavy metals within the soil as well as reduce oxygen levels.

During the construction phase of the coastal access road, jetty and pipelines, there is a concern that excavation of the coastal soils may expose ASS and result in negative impacts, such as toxic effects on vegetation, acidification of groundwater and surface water through leaching as well as mortality of fish and aquatic organisms.

A number of factors can be considered when assessing the potential for ASS. One is acidity or pH. A total of 13 soil bore locations were sampled from 2015 to 2017 to assess the geological conditions in areas where soil disturbance or excavation is proposed. Results are summarised in **Tables B.1** through **B.3** in **Annex B**.

Of these, sample S6 is at the landfall for the pipeline and costal jetty location of concern. The pH at S6 ranged from 7.73 at 0.5-1.5 m depth to 8.23 at between 2.0-3.0 m depth. This indicates slightly basic conditions, which is not conclusive as to whether the soil contains ASS as it is common in undisturbed soils and particularly marine influenced samples. Another factor is appearance, with the presence of waterlogged soils in the coastal area, characterised by dark grey to black subsurface sediments suggestive that ASS could potentially be present (e.g. sulfidic materials could be present but not yet oxidised).

Vegetation type can also help identify the potential for acid sulphate soils or can indicate that acidification may have already taken place. This includes vegetation that is salt-tolerant and occur in waterlogged areas, such as mangrove which thrive in anaerobic soils and saline waters and contribute organic matter that aids acid sulphate soil formation in coastal wetlands. The Project location for the coastal road, jetty and pipeline landfall is characterised by interspersed mangrove communities.

Water chemistry can also help in identifying potential for ASS presence. Surface water monitoring was conducted at river locations in the vicinity of the CCGT in 2016 and 2017 to assess the surface water conditions adjacent to the project location. Results are summarised in **Tables B.8, B.10, B.11** and **B.12** of **Annex B**. The chloride-to-sulphate ratio was calculated to assess the potential presence of ASS and is summarised in **Table 8-56**. A $Cl^{-}:SO_4^{2-}$ ratio of less than four, and certainly a ration less than two, is a strong indication of an extra source of sulphate from previous sulphide oxidation (*Mulvey, 1993*).

Table 8-56 Assessment of Chloride- Sulphate Ratio for Representative Surface Water Samples

Parameter	Units	RW2	RW3	RW6	RW7	RW8
pH	-	7	7.6	7.38	7.43	6.98
Chloride	mg/L	14.5	7	28.99	36.99	31.99
Sulphate (SO4)	mg/L	53.9	10	39.67	31.26	25.79
Ratio	**-**	**0.27**	**0.70**	**0.73**	**1.18**	**1.24**

Considering all the factors discussed above, the waterlogged coastal soils have the potential to contain ASS. Given the wetland nature of the soil, high fertility of surrounding area, chemical content, mangrove and bird areas, this is of high sensitivity. The proposed level of disturbance is greater than natural variation, is considered to be a small to moderate area and have a recover time of 1-4 years (small ranking). This results in an impact significance of **moderate** ranking, requiring mitigation. The potential impact of earthworks and soil clearance at this location is provided in **Table 8-57**.

Table 8-57 Assessment of Impacts from Acid Sulphate Soils to Site Clearance Activities

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

8.7.3.3 *Salt Emissions*

The expected deposition associated with the operation of the cooling towers is presented in **Figure 8-11**. The modelling results indicate that salt deposition rates from the Project will not exceed 10kg/ha/mo at any offsite locations. Based on the expected existing conditions at the site, and on the basis that the assessment threshold will not be exceeded, adverse impacts to soil and ground water due to the Project are considered **Negligible**. This impact is further discussed in *Section 8.4.7*.

8.7.3.4 *Mitigation Measures, Management and Monitoring*

During soil disturbing activities, the mitigation measures developed with regards to surface water quality (**Section 8.8.4**) will serve to prevent soil loss through limiting TSS loading in surface water bodies.

Other mitigation measures to be implemented are:

- Delineation of clearance boundaries to limit the areas to be cleared;
- Scheduling clearance activities to avoid extreme weather events such as heavy rainfall, extreme dry and high winds;
- Revegetation areas with temporary land use, conducting progressive rehabilitation;
- Demarcate routes for movement of heavy vehicles to minimise disturbance of exposed soils and compaction of sub-surface layers;
- Reuse topsoil within rehabilitation activities; and
- Control erosion through diversion drains, sediment fences, and sediment retention basins.

Where topsoil is to be stored for later use in rehabilitation activities, the following basic principles are to be applied:

- Stockpiles to be separated into topsoil and sub-soil and be located at least 10 m from any surface water source and groundwater well or 50 m from Cilamaya canal; and

- To the extent possible, stockpiles are to be located in areas surrounded by natural wind barriers to minimise the potential for wind erosion.

For earthworks and excavations in the waterlogged coastal soils where there is the potential for ASS, mitigation is based on the approach of:

- Identification and characterisation of ASS presence;

- Minimisation of disturbance and exposure to air;

- Control of dispersion through soil/water;

- Removal/treatment; and

- Monitoring.

The following measures are required:

- Prior to proceeding with any soil disturbance activities, conduct onsite ASS tests at coastal excavation locations;

- Where ASS is confirmed to be present, implement control measures for area exposed and potential spread of acid effects in soil/water, such as:

  - Schedule excavation such that the potential effects on any area disturbed at any one time are limited and managed;

  - Stockpiling of ASS is only permitted as a short-term activity where removal from site is not possible (e.g. weather) and must be placed on impermeable area with runoff protection, 50 m away from surface water;

  - Minimise the time that excavations are left open and the presence of temporary spoil piles to reduce the amount of time that ASS is exposed to the air;

  - No dumping of exposed ASS is permitted onto the surrounding land or into surface waters;

  - Use of marine, estuarine, brackish or fresh waters is not permitted as a means of diluting and/or neutralising ASS or associated contaminated waters; and

- Given the fine sediment and waterlogged nature of the potential area of ASS, covering excavated spoil with clean material is not recommended as the material may liquidise, flow and contaminate the surrounding area.

- Evaluate treatment and disposal options based on volume of ASS material, considering:
    - Removal, treatment and disposal offsite (preferred);
    - Neutralisation of ASS materials (e.g. lime application); or
    - Strategic reburial in anoxic environment;
- Monitoring samples of soil and surface water following completion of earthworks/excavation in ASS affected area.

The above mitigation measures should be detailed in an ASS Management Plan that details the steps, measures and strategies that will be used to manage potential impacts of the excavation works that have the potential to disturb ASS materials at the site to reduce the magnitude of the potential impact.

8.7.3.5 *Assessment of Residual Impact*

Based upon the implementation of the above management and mitigation measures, the residual impact level of each potential impact sources can be summarises as follows:

Table 8-58 Summary of Residual Impact

Activities	Significance before Mitigation	Residual Impact Significance
Loss of soil structure, quantity and quality due to site clearance activities	**Moderate**	**Minor**
Acid Sulphate Soil impacts to groundwater and aquatic biota from soil clearing at the access road and jetty coastal areas	**Moderate**	**Negligible**

8.7.4 *Assessment of Impacts - Loss of Soil due to increased Erosion during Operations*

The total area of the Project's footprint will be as follows:

- CCCT Power Plant: 21 ha or 210,000 m^2;
- Onshore Pipeline: 6.08 ha or 60,800 m^2;
- Transmission Line: approximately 13.47 ha or 134,700 m^2; and

- Substation: 1.1 ha or 11,000 m^2.

During the operation phase, the physical footprint of the proposed installations will increase the impermeable area of the Project, resulting in changed hydrological characteristics, such as reduced water infiltration to the soil, which could create additional surface run-off (and increase the flow velocity of this run-off), as well as reducing infiltration into subsurface aquifers.

The increased of impervious surfaces from the Project footprint are expected to cause rainfall runoff. This flow rate has the potential to cause soil erosion and sedimentation. However, if the drainage channel surrounding the Project is designed with enough capacity to accommodate this increased flow rate, potential impacts can be minimised.

Impacts to soil due to erosion from increased rainwater runoff would occur during rainfall events, and will be more frequent during the rainy season. Potential impacts to soil in the Project area due to increased rainfall run-off from the impervious surfaces are expected to be of **Medium** magnitude. The existing soil quality in the Project area is generally fair, but soil is susceptible to erosion. Hence, the overall sensitivity is rated as **Medium**.

The significance of potential impacts to soil due to erosion from increased run-off from impervious surfaces during the operation phase are assessed in the following table, and mitigation measures are presented in **Section 8.7.4.1**.

Table 8-59 Assessment of Impacts due to Increased Erosion Potential during Operations

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

The combination of a Medium Resource Sensitivity and Small Impact Magnitude will result in an overall **Minor** Impact.

8.7.4.1 *Mitigation Measures, Management and Monitoring*

It is recommended that the drainage channel and irrigation canal have enough capacity to accommodate the increased rainfall run-off from the Projects impervious surfaces.

8.7.4.2 Assessment of Residual Impact

Based upon the implementation of the above management and mitigation measures, residual impact significance would remain **Moderate**.

8.8 SURFACE WATER QUALITY

This Section presents an evaluation of the potential impacts on surface water associated with the construction of the proposed Project based on the impacts identified during Scoping (outlined in **Chapter 5**). The assessment of potential impacts related to surface water in this section is based on the baseline data presented within **Chapter 7** and the information available from the Sponsor at the time of writing.

The assessment focuses purely on water bodies as the receptor. It is recognised that any changes to surface water may potentially impact sensitive receptors that utilise these surface water resources. In this regard, the mitigation measures have also been provided where necessary to be implemented alongside in-place controls to reduce the potential residual impacts to acceptable levels.

It is noted that no quantitative modelling has been undertaken with regards to any elements of the surface water impact assessment. Should there be significant changes in factors such as assumed input data, engineering design of wastewater management and treatment components of the Project, or agreed assessment criteria, then elements of this impact assessment and associated management, mitigation and monitoring measures may be needed to reflect these changes.

8.8.1 Potential Sources of Impacts

8.8.1.1 Construction Phase

During the construction, different activities have the potential to generate wastewater, sedimentation, and increased water consumption, which could lead to impacts on the hydrology and quality of surrounding freshwater bodies. Based upon this, during the construction phase the following impacts are identified as potentially occurring:

- Wastewater discharges and run-off; and
- Construction waste storage and disposal.

8.8.1.2 Operations

The operation phase is expected to continue for 25 years. The average number of permanent workers present during operation is expected to be up to 150 personnel. The assessment of operational phase impacts includes those arising both from routine operations and maintenance of the onshore associated facilities i.e. CCGT Power Plant, Transmission Line and Substation.

During the operation phase, potential surface water impacts may arise as follows:

- Wastewater discharges and run-off; and
- Waste storage and disposal.

The impacts due to potential accidental leaks, spills and leakages of hazardous chemicals and materials are discussed in **Chapter 10**.

8.8.2 Assessment Approach and Criteria

The legal framework of relevance to Surface Water is listed below:

- *World Bank IFC General EHS Guidelines, 2007;*
- *World Bank IFC EHS Guidelines for Thermal Power Plants, 2007*; and
- *World Bank IFC EHS Guidelines for Electric Power Transmission and Distribution, 2007.*

The significance of the impacts has been assessed using the approach and methodology as described in **Chapter 3**. The criteria for sensitivity and magnitude of the impact to surface water quality are defined in **Table 8-60** and **Table 8-61**.

Table 8-60 Sensitivity Criteria for Surface Water Quality

Sensitivity	Definition
Low	• The water resource does not support diverse aquatic habitat or populations, or supports aquatic habitat or population that is low quality.
Medium	• The water resource supports diverse populations of flora and/or fauna.
High	• The water resource supports economically important or biologically unique aquatic species or provides essential habitat for such species.

Source: ERM, 2012a

Table 8-61 Magnitude Criteria for Impacts to Surface Water Quality

Magnitude	Definition
Negligible	• Potential short-term localised effects on water quality but likely to be highly transitory (e.g. lasting a matter of hours) and well within natural fluctuations.
Small	• Potential short-term localised effects on water quality but which are likely to return to equilibrium conditions within a short timeframe (e.g. hours or days at most).
Medium	• Potential localised effects on water quality which are likely to be fairly long lasting (e.g. weeks or months) and/or give rise to indirect ecological and/or socio-economic impacts.
Large	• Potentially severe effects on water quality which are likely to be long-lasting (e.g. months or more) or permanent and/or give rice to indirect ecological and/or socio-economic impacts.

Source: ERM, 2012a

8.8.3 Assessment of Impacts – Wastewater Discharges an Run-Off

8.8.3.1 Construction Phase

Wastewater discharge and runoff during the construction phase may lead to contamination of freshwater sources if not managed appropriately. During the construction phase, there are a number of anticipated wastewater sources.

Amount of sewage will arise from the construction workforce and offices. The uncontrolled discharge of wastewater is generally characterised as having a high concentration of solids (both suspended and dissolved), Oil & Grease, Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), nutrients (Ammonia) and E. coli counts.

In addition, periods of high rainfall could lead to overflow, or rapid through-flow, of the effluent to surface water prior to its full digestion in the septic tanks. Raw sewage can impact surface water quality by delivering pathogens that may be harmful to human and ecological receptors. Sanitary wastewater is generally characterised as having a high concentration of solids (suspended and dissolved), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), nutrients (nitrogen, ammonia) and Faecal Coliform counts. The organic substances (e.g. hydrocarbon, protein) are decomposed in water, and the decomposition of organic matter will reduce the oxygen content dissolved in water.

The general construction activities also have the potential to generate wastewater from the concrete batching plant, wastewater from washing equipment operation etc. These wastewaters could potentially contain chemicals (e.g. spent paints and solvents), alkali water, oil and grease and high concentration of suspended solids and traces of hydrocarbon. The discharge of wastewater produced during concreting can also lead to changes in the pH of the receiving water body, if not first treated.

The construction activities of the CCGT Power Plant, Transmission Line and substations will require as site clearance, earthworks, disposal of backfill materials, installation of hard standing areas, erosion of exposed bare soil, slopes and earth, and release of cement materials could cause run-off of unconsolidated sediments during rainfall. The generation of sediment laden run-off could be transferred to the nearby freshwater bodies, which could increase total suspended solids and turbidity in receiving waters.

Impacts from surface run-off are of more concern near surface water bodies such as rivers, streams and lakes, particularly where the adjacent land is made up of areas which are susceptible to erosion such as grasslands, agricultural land, and secondary forests.

The surface water quality conducted in 2016 includes a significant number of exceedances with the water quality standards. These include levels of Total Suspended Solid (TSS), Biological Demand (BOD), Sulphide, Copper and Oil & Grease. In addition to these parameters, Arsenic from the downstream location was recorded at 0.1793 mg/L, exceeded the maximum quality standard of 0.05 mg/L. These exceedances are likely to be associated with agricultural and urban land uses upstream of the canal (*ERM, 2017; IEE, 2016; Pöyry, 2016b)*.

In addition, sample of surface water taken in August and November 2016 and February and May 2017 showed that level of *Faecal Coliform* for all monitoring activities exceeded the applicable quality standards (*SGK Cilamaya, 2016*; *SGK Cilamaya, 2017*). The plankton and benthos monitoring was also conducted at two (2) locations i.e. upstream and downstream of Cilamaya River and indicated that the rivers water around the proposed Project site falls under medium - highly polluted categories (*Pöyry, 2016b*).

The severity of the potential impact would depend on the magnitude of the activity and the sensitivity of the surface water body affected. Impacts from surface run-off are dependent on surface water flow, which is higher during the rainy season and faster in areas with high surface gradient.

The Project is near some sensitive receptors with regards to surface water quality, such as agricultural lands, which rely on surface water for irrigation. Overall sensitivity is rated as **Medium**.

The impacts are expected to be fairly long lasting (e.g. weeks or months) and/or give rise to indirect environmental and/or social impacts.

The significance of impacts associated with surface water during the construction is discussed and presented in **Table 8-62**. The impact significance has been assessed as **Moderate.**

Table 8-62 ***Assessment of Impacts on Surface Water due to Wastewater Discharges and Run-Off during Construction***

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

The combination of a Medium Sensitivity and Small Impact Magnitude will result in an overall **Moderate** Impact.

8.8.3.2 Operations Phase

Sources and estimated quantities of wastewater generation from the Plant during the operation and maintenance phase are presented in **Table 8-63**.

Table 8-63 ***Wastewater Discharge Volumes***

Type	Discharges (ton/hour)
Cooling Water Blowdown	3,681.4
SWRO reject	75
Neutralisation Pond	21.0
Oil Separator	15.0
Miscellaneous Demineralisation Water	6.0
Laboratory	0.01
Sewage Treatment Plant	1.0

Source: *PT Jawa Satu Power, 2017*

Surface water quality analysis from the baseline surveys are as discussed above for construction. It is reminded that the Project is near some sensitive receptors with regards to surface water quality, such as agricultural lands, which rely on surface water for irrigation. Overall sensitivity is rated as **High.** Potential impacts associated with mismanagement of wastewater could be water pollution, localised land contamination and impacts to health.

Treated waste water and sanitary waste water will be discharged to the Java Sea. It is informed that the wastewater treatment plants are designed to be more stringent than standards and levels provided in General EHS Guidelines.

A number of controls to reduce the potential for impacts to water quality will be in place.

The wastewater treatment facility will be installed on-site to treat sewage wastewater, construction wastewater and contaminated run-off. Currently, the design of sewage wastewater is based on the *Quality of Waste Domestic Waste Water Individually, Appendix I, Minister of Environment No.68 of 2016* – which requires that the limit of Total Coliform Bacteria in the treated wastewater discharge is 3,000 MPN/100ml.

In addition, the oily waste water in the oily waste water surge pond is transferred to CPI oil/water separator constant flow rate and oil is removed to 10 mg/l in the separator. Collected oil/sludge in the CPI oil/water separator is drained to the Oil sludge tank and removed away by licensed local hauler when required.

Potential impacts to surface water quality in the Project area from wastewater discharges and run-off are expected to be localised effects on water quality which are likely to be fairly short-term to indirect impacts. Overall magnitude is rated as **Small.**

The significance of impacts associated with surface water quality during the operations is discussed and presented in **Table 8-64**.

Table 8-64 Assessment of Impacts from the Wastewater Discharges and Run-Off during Operations

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

The impact significance has been assessed as **Moderate**.

8.8.4 Mitigation Measures, Management, and Monitoring

Mitigation measures for construction and operations are presented in the following sections.

8.8.4.1 Construction Phase

- Sponsor shall also inform the EPCs to develop a Construction Environment Management Plan and Run-off and Sediment Control Plans prior to the commencement of construction activities to include the following:
  - Major earthworks activities during construction shall be scheduled during dry season as much as possible;

- Topsoil removed during clearing shall be stored in specified areas. Stockpiled earthworks, during and after clearing will be placed as bunds at strategic locations in order to reduce sediment loadings to the storm run-off;

- Stockpiles to be separated into topsoil and sub-soil and be located at least 10 m from any surface water source and groundwater well or 50 m from Cilamaya canal; and

- Open stockpiles of construction materials (e.g. aggregates, sand and fill material) in places which are identified to have a possibility of significant run-off will have measures in place to prevent the washing away of construction materials, soil, silt or debris into any drainage system;

- Earthworks to form the final surfaces will be followed up with surface protection and drainage works to prevent erosion caused by rainstorms. Soil erosion caused by wind and rainstorms shall also be reduced by minimising the land clearance area during construction activities, where possible, providing surface protection such as sheet cover; and

- Temporary traffic areas and access roads, if any, formed during construction will be protected by coarse stone ballast or equivalent.

All sub contractors when contracted to transport and dispose of Project wastes will demonstrate compliance with the Applicable Standards. Furthermore sites identified for disposal, when identified, will also adhere to the Applicable Standards and will be inspected prior to Project use.

These measures shall prevent soil erosion caused by rainstorms.

- All surface run-off from the construction areas potential sources of contamination will be minimised and reduced (e.g. by minimising the area of impermeable surfaces) and the peak discharge rate will be reduced (e.g. by using retention ponds and silt screen);

- Appropriate surface drainage surrounding the construction areas will be designed and provided where necessary. This includes diversion channels to intercept stormwater running-off the cleared areas and prior to large scale land clearance and removal of topsoil, where appropriate. These channels will be protected against erosion such as sandbag, rock armouring or lining as required;

- Stormwater management structures to collect the silt-laden surface runoff and allow the removal of silt by natural settlement, which in turn should reduce sediment loading prior to discharge into receiving environment;

- All drainage facilities and sediment control structures will be inspected on a regular basis and maintained to confirm proper and efficient operation at all times and particularly during rainstorms. Deposited silt and grit will be removed regularly. The stormwater drainage system will be periodically inspected for blockage sand cleaned at least once before the monsoon season each year;

- Measures will be taken to reduce the ingress of drainage into excavations. If trenches have to be excavated during the wet season or rainy conditions, they will be excavated and backfilled in short sections wherever practicable. Water will pumped out from trenches or foundation excavations will be discharged into storm drains via silt removal facilities;

- Personnel will be trained to visually inspect discharged water quality for oil and grease traces (that will be visible on the surface) periodically and take appropriate corrective actions;

- A dike wall shall also be constructed around high potential spillage area such as fuel tank. For spillage in other location is considered to be minor so that oil pan and containment devices are necessary to response. Additionally, containment devices are to be provided for storage areas of oil, fuel and chemicals to control contaminated surface runoff.

- Control and monitoring systems will be used to alert the crew to leaks or any other potential risks.

- Portable or permanent sanitation facilities serving all workers should be provided at all construction sites e.g. one (1) toilet for every 25 workers up to the first 100, and one for every 50 thereafter) will be provided for the construction workforce. Suitably sized septic tanks shall be provided to treat the sanitary discharge. Septic tank effluent will be serviced by pump trucks to avoid discharge to ground water.

- Wastewater collected from canteen kitchens, including that from basins, sinks and floor drains, should be discharged into sanitary sewers via grease traps. The sanitary sewer should then be treated prior to discharge or reuse as greywater.

- Surface run-off from bunded areas should pass through oil/water separators prior to discharge to the stormwater system.

- For the selection of chemicals for hydrotest water, the Project will select biocides / chemical additives that present a low risk of contamination, in terms of dose concentration, toxicity, biodegradability, bioavailability, and bioaccumulation potential.

8.8.4.2 *Operations Phase*

- All drainage facilities and sediment control structures will be inspected on a regular basis and maintained to confirm proper and efficient operation at all times and particularly during rainstorms. Deposited silt and grit will be removed regularly. The stormwater drainage system will be periodically inspected for blockage sand cleaned at least once before the monsoon season each year;

- Measures will be taken to reduce the ingress of drainage into excavations. If trenches have to be excavated during the wet season or rainy conditions, they will be excavated and backfilled in short sections wherever practicable. Water will pumped out from trenches or foundation excavations will be discharged into storm drains via silt removal facilities;

- Personnel will be trained to visually inspect discharged water quality for oil and grease traces (that will be visible on the surface) periodically and take appropriate corrective actions.

- Control and monitoring systems will be used to alert the crew to leaks or any other potential risks.

8.8.5 Assessment of Residual Impact

Based upon the implementation of the above management and mitigation measures, the residual impact level of potential impact on water quality from wastewater discharges and run-off during both construction and operations is **Minor**.

8.9 TERRESTRIAL BIODIVERSITY

8.9.1 *Potential Sources of Impacts*

Project activities that may have an impact on terrestrial biodiversity during the construction and operation phases are:

- Permanent loss of habitat and degradation of habitat from clearance and preparation for the construction of the CCGT Power Plant and along the Transmission Line for the supporting pads;
- Permanent loss of habitat and degradation of habitat due to the construction activities of CCGT Power Plant and associate facilities including the access road, onshore pipelines, and Transmission Line;
- Permanent loss of habitat and degradation of habitat due to the dredging, trenching and lay down of the pipeline and jetty construction;
- Temporary disturbance and displacement of fauna and flora due to the use and movement of heavy machinery and vehicles during construction and operational activities within the Project area;
- Temporary fragmentation of habitats in natural terrestrial habitats from erection of barriers (fences), transmission line, roads, pipelines and habitat loss;
- Direct mortality to fauna and flora from hunting and poaching from the workforce and local residents;
- Degradation of habitat from air emissions and runoff during operation; and
- Direct mortality of avifauna along the transmission line due to strike during operation.

8.9.2 *Assessment Approach and Criteria*

The legal framework of relevance to Terrestrial Biodiversity is listed below:

- *ASEAN Agreement on the Conservation of Nature and Natural Resources, 1985*;
- *IFC PS6 Biodiversity Conservation and Sustainable Management of Living Natural Resources, 2012*;
- *ADB Safeguard Policy Statement – Environment Safeguard*;
- *World Bank IFC General EHS Guidelines, 2007*;

- *World Bank IFC EHS Guidelines for Thermal Power Plants, 2008, and 2017* (in Draft); and

- *World Bank IFC EHS Guidelines for Electric Power Transmission and Distribution, 2007.*

The significance of the impacts has been assessed using the approach and methodology as described in **Chapter 3**. The criteria for sensitivity to and magnitude of the impact to Terrestrial Biodiversity (Habitat & Species) are defined in **Table 8-65** to **Table 8-68.**

Table 8-65 Sensitivity Criteria for Biodiversity - Habitat

Sensitivity	Definition
Low	• Habitats with no, or only a local designation/ recognition, habitats of significance for species listed as Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion.
Medium	• Habitats within nationally designated or recognised 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.
High	• Habitats within internationally designated or recognised 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.

Source: ERM, 2012a

Table 8-66 Magnitude Criteria for Impacts to Biodiversity - Habitat

Magnitude	Definition
Negligible	• No existing habitat is affected
Small	• Affects only a small area of habitat, such that there is no loss of viability/ function of the habitat.
Medium	• Affects part of the habitat, but does not threaten the long term viability/ function of the habitat.
Large	• Affects the entire habitat, or a significant proportion of it, and the long term viability/ function of the habitat is threatened.

Source: ERM, 2012a

Table 8-67 Sensitivity Criteria for Biodiversity - Species

Sensitivity	Definition
Low	• Species and sub-species of LC on the IUCN Red List, or not meeting criteria for medium or high value.
Medium	• Species on IUCN Red List as VU, NT, or DD, species protected under national legislation, nationally restricted range species, nationally important numbers

Sensitivity	Definition
	of migratory, or congregatory species, species not meeting criteria for high value, and species vital to the survival of a medium value species.
High	• Species on IUCN Red List as CR, or EN. Species having a globally restricted range (i.e. plants endemic to a site, or found globally at fewer than 10 sites, fauna having a distribution range (or globally 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.

Source: ERM, 2012a

Table 8-68 Magnitude Criteria for Impacts to Biodiversity – Species

Magnitude	Definition
Negligible	• No species is affected
Small	• Effect does not cause a substantial change in the population of the species, or other species dependent on it.
Medium	• Effect causes a substantial change in abundance and/ or reduction in 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.
Large	• Affects 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).

Source: ERM, 2012a

8.9.2.1 Scoping of Likely Impacts to Biodiversity Values

Table 8-69 broadly defines the types of threats to biodiversity values that have potential to occur as a result of this Project. These threats to biodiversity are derived from IFC PS6 and relate to the activities that are likely to occur during construction and post construction phases.

Table 8-69 Types of Threats to Biodiversity Values

Term	Description
Loss of habitat	Permanent loss of habitat or species due to permanent or temporary site activities.
Disturbance or displacement of individuals • Light • Noise • vibration impacts	Temporary disturbance to, or displacement/exclusion of a species from foraging habitat due to construction activities, and operational and maintenance activities. Permanent impacts from light, noise and vibration sources on surrounding habitats during operation causing disturbance and displacement and changes in behaviour

Term	Description
Barrier creation, fragmentation and edge effects	Permanent and temporary creation of barriers to the movements of animals, especially fish, but also mammals, reptiles and amphibians and invertebrates and plants with limited powers of dispersal. Fragmentation of habitat, or permanent /temporary severance of wildlife corridors between isolated habitats of importance for biodiversity. Impacts that occur when a habitat is exposed to a different adjacent habitat type or structure. These impacts can include increased risk of parasitism or disease, increased risk of predation, adverse microclimate conditions (including drying out and subsequent fire risk), and competition from invasive species
Degradation of habitat • Dust • Water pollution • Invasive species	Disturbance or damage to adjacent habitat and species caused by changes in microclimate, vulnerability to predation and invasion and overall changes in conditions that can lead to a change in the community and its values for flora and fauna. This can include increased exposure to noise, light and dust. Introduction or spreading of alien species during the construction works.
Mortality – vehicle strike, hunting and poaching	Mortality of individual fauna species as a result of vehicle or machinery strike or falling debris during clearing activities. Mortality to individual fauna species as a result of worker influx and hunting/poaching of extant fauna

8.9.2.2 *Biodiversity Impact Typology*

The scoping and screening of potential Project impacts identified a number of Project aspects and activities that have potential to biodiversity values. Whilst the potential impacts relate to a combination of Project aspects/activities and biodiversity threats, they can be summarised into a number of key potential impacts according to the biodiversity threat type. These impacts can relate to habitat areas, specific species or both.

These impact assessment types are further explored in relation to the biodiversity values identified within the Project Area and outlined in the physical and biological baseline (**Chapter 7**) and the specific Project activities/aspects.

This section discusses on the nature of impacts to biodiversity values at it relates to the characteristics of the Project Area as determined by assessing the impacts of the Project Description (**Chapter 4**). The information has been used to inform the evaluation of the significance of the impact in the impact assessment summary tables following each impact assessment type. Impact assessments have been undertaken for both the Construction Phase and Operation Phase.

ERM has utilised the mitigation hierarchy to outline avoidance, mitigation and compensation (offset) requirements as required by the ADB SPS and IFC PS6.

Table 8-70 scopes the impacts likely during the construction, operational and decommissioning phases of the Project. The impact assessment for these impact types are further assessed below.

Table 8-70 Scoping of Potential Impacts during Construction and Operational Phases

Type of Impact	**Direct/ Indirect**	**Operational Phase**
Permanent loss of habitat	Direct	No
Temporary disturbance or displacement of fauna	Direct	Continuing from construction phase
Temporary and permanent barrier creation, fragmentation and edge effects	Indirect	Continuing from construction phase
Temporary degradation of habitat	Indirect	Continuing from construction phase
Mortality – vehicle strike, hunting and poaching	Direct	Reassessed for operational phase

Notes:

Yes: considered to be likely impacts during the phase

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

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

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

8.9.3 Assessment of Impacts - Loss of Terrestrial Habitat from Construction

8.9.3.1 Description of Relevant Baseline Conditions

Habitat is important to support the lifecycles of fauna identified with the Project area. This includes habitat for breeding, foraging and roosting. Removal of the habitat reduces the habitat available to resident species and the ecological value of the area.

Habitat will be cleared for all Project components, including Natural Habitat and Modified Habitat. Clearing and habitat disturbance will be associated with the construction of the Transmission Line, CCGT Power Plant, jetty and onshore pipelines.

Critical Habitat for the Javan White Eye (*Zosterops flavus*) VU was identified within the DMU, however no Critical Habitat was identified within the Project Area. Therefore, no Critical Habitat will be impacted during the construction of the Project.

The area of habitat lost from clearing and construction in relation to these Project components is outlined in **Table 8-71** and **Table 8-72**. **Figure 8-16**, **Figure 8-17** and **Figure 8-18** shows the impacts of each facility and associated habitat impacts.

Table 8-71 Area of Land Class within Project Area and Area of Influence

S/N	Land Class	Natural/Modified	Area lost from Project development (ha)	Proportion of Habitat Loss (Project Area/AoI)
1	Fresh water	Natural	3.66	9.64%*
2	Secondary mangrove forest	Natural	0.33	0.96%
3	Dryland agriculture	Modified	0.21	0.15%
4	Settlement	Modified	0.78	0.02%
5	Bare land	Modified	2.81	3.97%
6	Plantation	Modified	0.84	0.22%
7	Paddy field	Modified	214.61	1.14%
8	Shrub	Modified	0.71	0.42%
9	Ponds	Modified	9.8	1.01%
	Totals		**233.75**	**0.98%**

* This area is the total area beneath the transmission line. The impact will be restricted to the transmission tower pads which will occur outside of this habitat type.

Table 8-72 Habitat Loss Associated with Terrestrial Project Components

Habitat Type	Natural Habitat (ha)	Modified Habitat (ha)
CCGT Power Plant	-	24.04
Transmission Line and substation	3.65	182.96
Other facilities	0.33	22.80
Totals	**3.98**	**229.80**

Approximately 32.1 ha of the Project area is classified as Protection Forest under the Indonesian Forestry law. The process to request approval under the Indonesian Forestry Law from the Ministry of Environment and Forestry is currently being undertaken by the project proponent. It is understood that this approval is subject to submission and approval of the Environmental Permit (AMDAL). Relevant translated documentation in relation to this request is contained at **Annex J.**

The area to be impacted is associated with the pipelines route and jetty area and is estimated to consist of approximately 15ha. It should be noted that this area consists primarily of shrimp ponds, rice paddies, settlements and small remnant mangrove forest areas and riparian vegetation.

The Modified Habitat lost consists primarily of ponds, rice paddy field and urban development. The CCGT Power Plant, roads, infrastructure and Transmission Line (52.16 km in length) will be constructed within this habitat. The transmission line will be constructed upon concrete pads with wires strung between towers. The area of Modified habitat beneath the transmission line is estimated to be 182.96 ha. However, the habitat impact associated with the transmission line will be minimal and restricted to impacts from the construction of the footings and access tracks. Based on the area of footings and associated access tracks, the estimated impact on Modified Habitat is therefore estimated at 11.8 ha. This is based on 118 towers and typical footing area of 1000m^2 per tower.

The area of terrestrial Natural Habitat lost within the Project area is estimated to be 4.02ha which includes 0.33ha of mangrove habitat at the shoreline (0.96% of the total mangrove habitat within the AoI). The transmission line will cross "freshwater" habitat which consists of mapped local streams and totals 3.65ha (9.64% of the total freshwater habitat within the AoI). It is not anticipated that the transmission line will have significant habitat impacts upon the freshwater habitat as the footings will be placed on Modified Habitat areas on land. The impacts to natural habitat are therefore limited to impacts to the mangrove habitat along the shoreline (0.33ha).

Areas of Critical Habitat identified for the Javan White Eye (*Zosterops flavus*) VU was identified approximately 5km east of the project area. No development will occur in this area. It should be noted that the mangrove habitat within the Project Area is not considered to be habitat for the Javan White-Eye as the mangrove species mix is not dominated by *Avicinnea sp.*, which is preferred habitat for the species.

All flora species identified during survey is listed as Least Concern, Data Deficient or Not Evaluated. Some species are listed as Endangered or Vulnerable but have been planted and introduced into the Project area and hence are not considered as threatened species in this assessment. Removal of these plant species is not considered to be a major impact during clearing activities.

Figure 8-16 Habitat Classifications for the Project Area

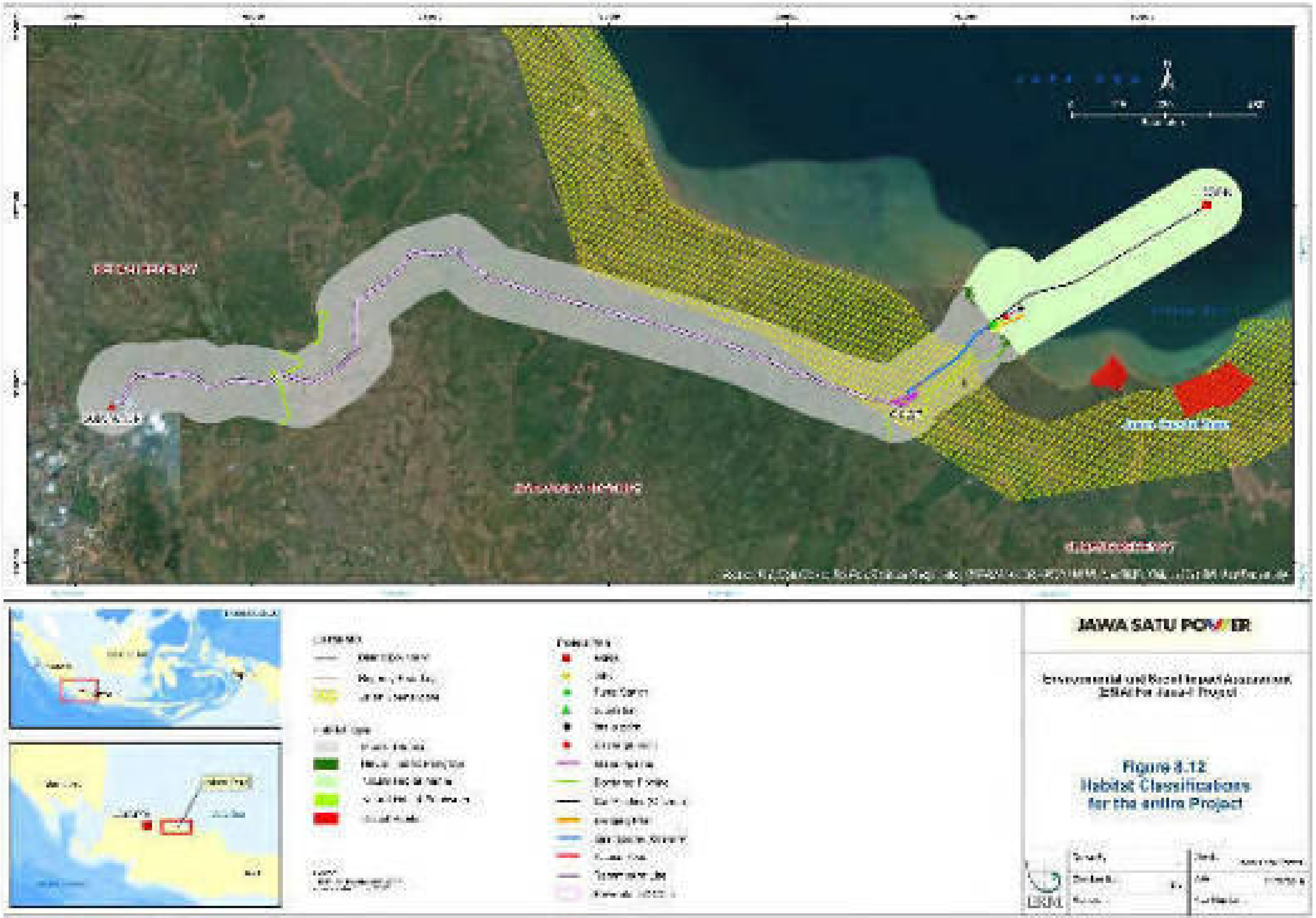


Figure 8-17 Habitat Classifications for CCGT Power Plant

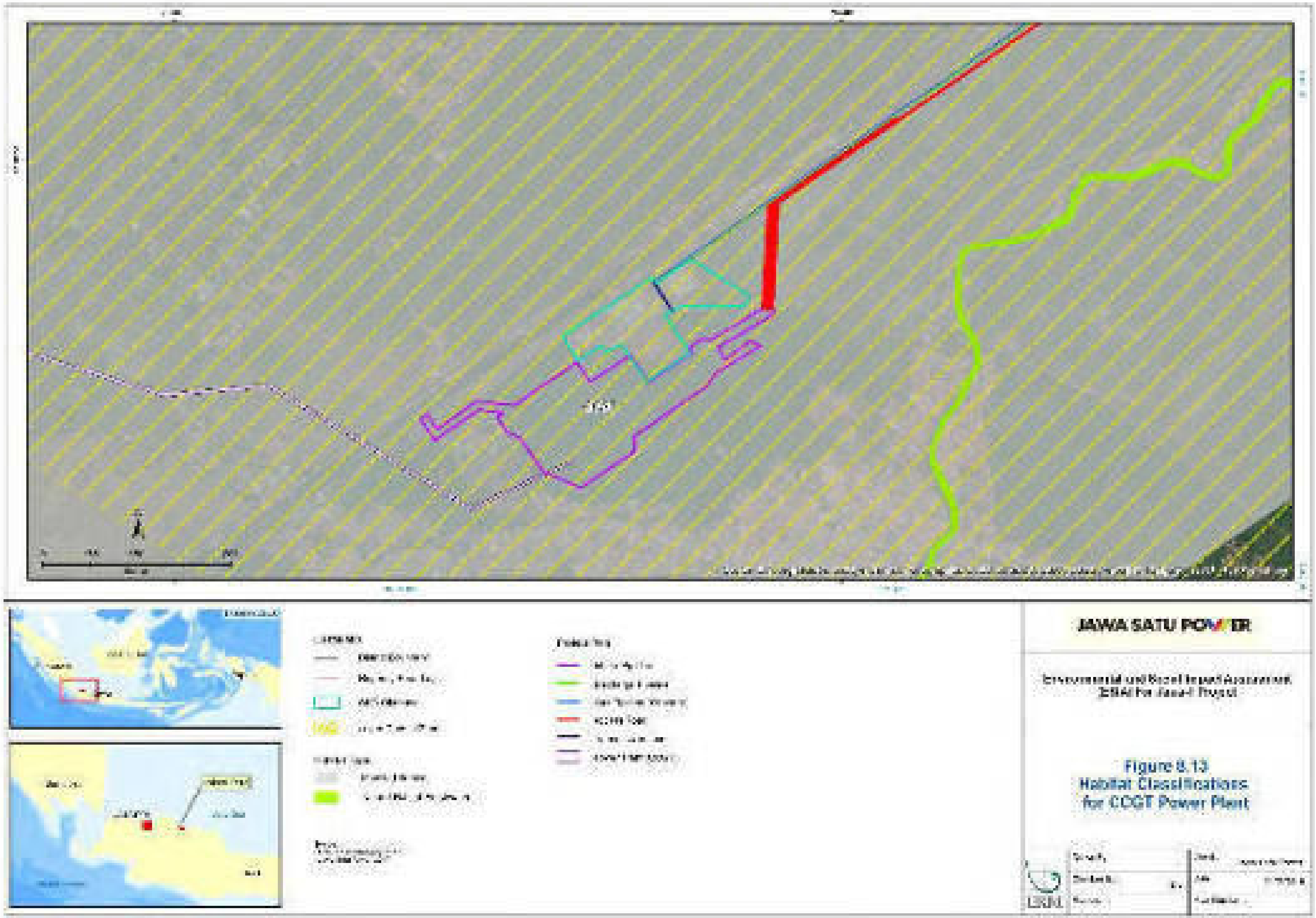
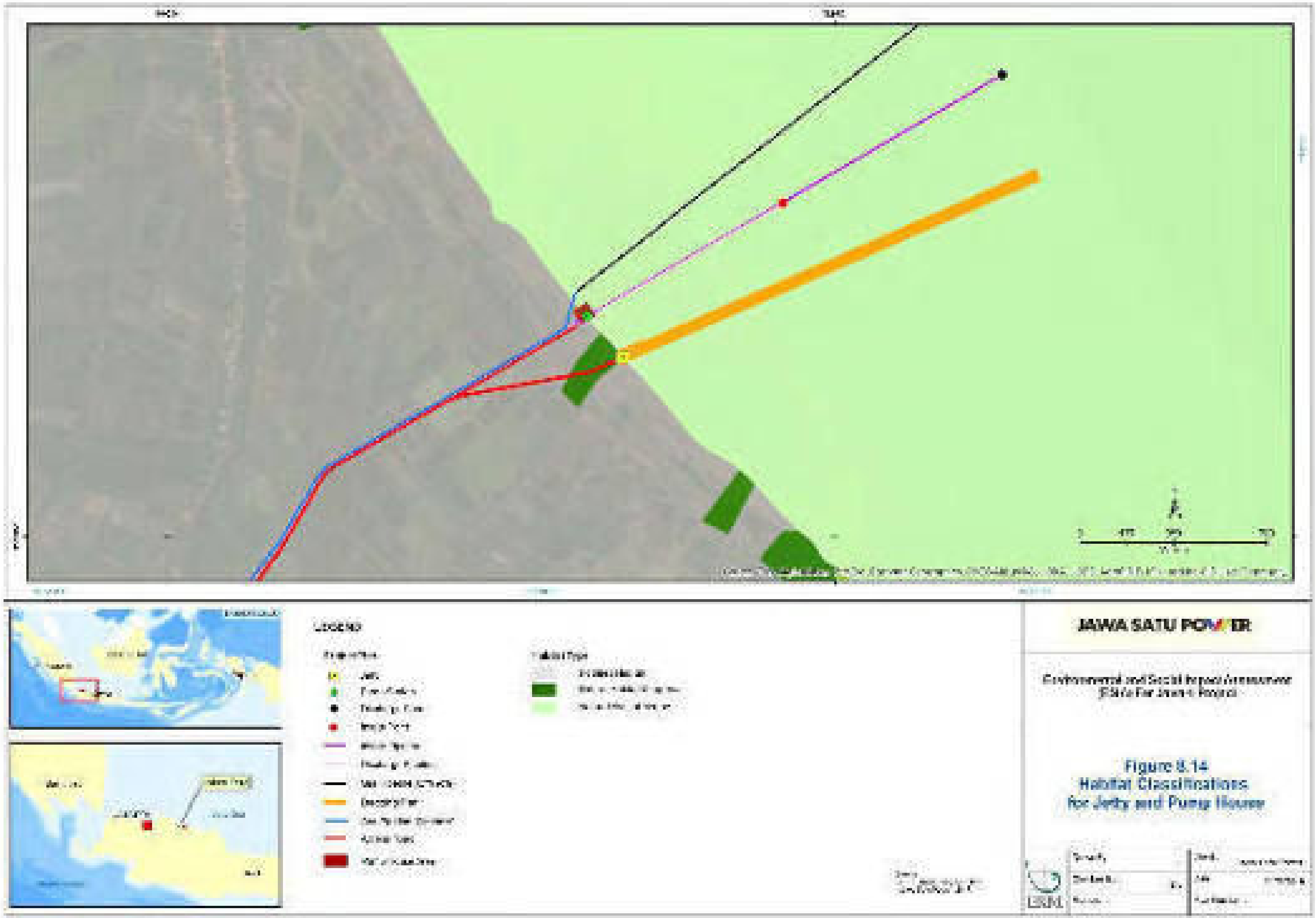


Figure 8-18 Habitat Classifications for Jetty and Pump House



8.9.3.2 *Avoidance Measures Adopted*

Chapter 4 sets out the decision making and technical constraints associated with the 0.33 ha mangrove clearing that will be required during the construction activities at the jetty and pump house area. The area of mangrove habitat to be impacted is in a location that is associated with the road that adjoins the jetty. This area cannot be avoided as the jetty and pipeline alignment are required to be constructed away from the existing adjacent pipelines and the chosen landing point is the only feasible location for this to occur.

The following avoidance measures have been recommended:

- Site-level avoidance areas of mangrove habitat located along the shoreline is to occur should be avoided during construction of the pipeline and jetty (0.33ha). These measures are to include: restricting clearance, vegetation protection fencing, steepening of road batters to reduce the areas of mangroves cleared.

8.9.3.3 *Impact Assessment*

The significance of impacts associated with terrestrial biodiversity using the assessment of significance during construction activities are presented in **Table 8-73**.

The sensitivity of the Critical Habitat (Javan Coastal Zone EBA) is considered to be **High**. Clearing of vegetation and impacts to habitats is considered to be a direct impact to biodiversity values.

The sensitivity of Natural Habitats is considered to be **Medium**. The sensitivity of Modified Habitats are considered to be **Low**.

The magnitude of effect is likely to be small as it will effect only a small area of habitat, but without the loss of viability/function of the habitat. The overall impact is therefore likely to be **Minor** for Natural Habitat and **Negligible** for Modified Habitat before Mitigation Measures.

Table 8-73 Assessment of Impacts from Loss of Habitat

Evaluation of Significance		Sensitivity/Vulnerability/ Importance of Resource/Receptor	
		Modified Habitat	**Natural Habitat**
		Low	**Medium**
Magnitude of Impact	**Negligible**	Negligible	Negligible
	Small	**Negligible**	**Minor**
	Medium	Minor	Moderate
	Large	Moderate	Major

8.9.3.4 *Mitigation Measures, Management and Monitoring*

It is recommend that the following mitigation measures be applied in relation to habitat impacts during construction:

- No clearing of mangroves is to occur outside of the Project area;
- Clearing vegetation outside of designated areas will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation;
- The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to unauthorised clearing of vegetation, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations;
- The planned vegetation clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing;
- Use of the access road should be restricted to construction vehicles only. Checkpoints should be used to manage access and inspect vehicles for vegetation (including firewood) taken from the Project Area;
- All land rehabilitation will be undertaken using native indigenous species. The area of landscaping within the Project area shall re-establish habitat values including re-establishing mangrove habitats along the foreshore area and coastal vegetation along the access road, CCGT plant and facilities; and
- A community program is to be established with adjacent landowners to replant mangrove forest along foreshore areas and re-establish coastal vegetation on non-utilised public land and private land (With consent of the land-owner) within the Javan Coastal Zone EBA between the Muara Gembang – Tanjung Sedary KBA and the Muara Gimanuk KBA. This program will re-establish habitat within the EBA suitable for the endemic bird trigger species.
- The Project is also developing a Biodiversity Action Plan to offset this loss of mangrove area.
- Consultation will be undertaken with the local fishing community utilising the mangrove area for shrimp breeding to understand the level of impact and what, if any compensation is required.
- Following construction the mangrove area utilized for the fabrication of the offshore intake and discharge pipe can be reinstated as it will not be utilized during the operational phase. However the remaining ara wil be

required to ensure the operational ability of the jetty in the event of an emergency.

8.9.3.5 *Monitoring Measures*

The following monitoring measures are recommended:

- Regular (weekly) checks during construction are to occur along all project boundaries to ensure compliance with clearing within marked boundaries;

- Records are to be kept and regularly reviewed (3 monthly) for implementation of the workforce training program for fauna/flora awareness;

- Records are to be kept and regularly reviewed (3 monthly) of all personnel entering and exiting the project area through checkpoints, including results of all random inspections undertaken for poached flora/fauna;

- Monitoring if rehabilitation success/failure is to occur on all replanting sites. Monitoring is to consist of regular inspections (3 monthly) to determine plant establishment. Where plant establishment is determined to have failed, reestablishment is to occur;

- A regular social engagement (12 monthly) survey is to occur to gauge the socialisation of conservation measures, including the coastal revegetation program.

8.9.3.6 *Assessment of Residual Impact*

In view of the implementation of mitigation measures, the residual impact is to reduce to **Negligible** for Natural Habitat.

Biodiversity offsets are considered necessary to compensate for habitat losses to meet the requirement for no-net loss of biodiversity values under the ADB SPS. An assessment of the required offset and candidate offset areas is contained in **Annex J**.

8.9.4 *Assessment of Impacts - Disturbance or Displacement of Fauna*

8.9.4.1 *Description of Relevant Baseline Conditions*

The disturbance and displacement of resident fauna species within the footprint will primarily be caused by light, noise and vibration impacts during construction. This impacts are considered to be indirect impacts caused by the use of project machinery and equipment.

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

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

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

Although temporary, the construction schedule is expected to be relatively short and not to span multiple breeding seasons. Noise, light and vibration disturbance are unlikely to occur at all locations simultaneously and will be localised. Terrestrial fauna likely to be disturbed include all resident species, including mammals and herpetofauna identified in the Project area. All mammal and herpetofauna species identified are of low conservation significance (LC on the IUCN Red List). These species are likely to be disturbed through the operation of machinery, clearing activities and erection of barriers. It is not considered that disturbance of these species is of concern as they are widely distributed and of stable or widespread populations.

Fifteen (15) bird species are listed as Protected under Indonesian legislation. Four (4) birds have an extinction risk status of VU or NT, including three (3) endemic birds within the Javan Coastal Zone EBA. These birds will be temporarily displaced from the Project area during construction and are likely to return to areas rehabilitated during operation. Some minor disturbance impacts to these species may occur from construction activities, including along the Transmission Line during construction. Impacts are expected to reduce during operation. These birds are listed in **Table 8-74**.

Table 8-74 Conservation Significant and Indonesian Listed Protected Bird Species in the Project Area

No	Scientific Name	Common Name	IUCN	Ind. Listing
1.	*Alcedo atthis*	Common Kingfisher	LC	P
2.	*Anthreptes malacensis*	Brown-throated Sunbird	LC	P

No	Scientific Name	Common Name	IUCN	Ind. Listing
3.	*Ardea alba*	Great Egret	LC	P
4.	*Ardeola speciose*	Javan Pond Heron	LC	P
5.	*Bubulcus ibis*	Cattle Egret	LC	P
6.	*Egretta garzetta*	Little Egret	LC	P
7.	*Egretta sacra*	Pacific Reef Egret	LC	P
8.	*Halcyon chloris*	Collared Kingfisher	LC	P
9.	*Himantopus leucocephalus*	White-headed Stilt	LC	P
10.	*Nectarinia jugularis*	Olive-backed sunbird	LC	P
11.	*Nycticorax caledonicus*	Rufous Night Heron	LC	P
12.	*Plegadis falcinellus*	Glossy Ibis	LC	P
13.	*Rhipidura javanica*	Pied Fantail	LC	P
14.	*Todirhamphus chloris*	Collared kingfisher	LC	P
15.	*Centropus nigrorufus*	Javan Coucal	VU	-
16.	*Charadrius javanicus*	Javan Plover	NT	-
17.	*Anhinga melanogaster*	Oriental Darter	NT	-
18.	*Zosterops flavus*	Javan White Eye	VU	-

Notes:

P: Protected

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

8.9.4.2 *Avoidance Measures Adopted*

Application of noise mitigation measures as outlined in *Section 8.6 Acoustics and Vibration* to reduce impacts to fauna during construction will be applied. These measures ensure compliance with relevant standards for noise and vibration.

8.9.4.3 *Impact Assessment*

The significance of impacts associated with terrestrial biodiversity during construction activities are discussed and presented in **Table 8-75**.

The magnitude of effect due to disturbance and displacement of fauna in terrestrial habitats is likely to be **Small** as the effect will not cause a substantial change in the population of the species present, or other species dependent on them during construction.

The overall magnitude of this impact is therefore **Negligible** for Least Concern species and Near Threatened/ Vulnerable species.

Table 8-75 Assessment of Impacts on Disturbance and Displacement of Fauna

Evaluation of Significance		Sensitivity/Vulnerability/ Importance of Resource/Receptor	
		Least Concern	Near Threatened/ Vulnerable
		Low	Moderate
Magnitude of Impact	Negligible	Negligible	Negligible
	Small	**Negligible**	**Negligible**
	Medium	Minor	Major
	Large	Moderate	Major

8.9.4.4 *Mitigation Measures*

It is recommended that the following mitigation measures be applied in relation to habitat impacts during construction:

- A *Fauna Shepherding Protocol* (**Annex J)** is be used in the project area to ensure that any flora and fauna have vacated the area prior to any clearance work; and

- Additional mitigation measures are outlined below in relation to the impacts from potential collision with the transmission line to the Indonesian Protected and conservation significant bird species.

8.9.4.5 *Monitoring Measures*

The following monitoring measures will be applied during construction:

- Records are to be kept and regularly reviewed (3 monthly basis) during construction on the application of the *Fauna Shepherding Protocol.*

8.9.4.6 *Assessment of Residual Impact*

In view of the implementation of mitigation measures, the residual impact is to remain as **Negligible** for terrestrial species considered as Least Concern, Near Threatened of Vulnerable on the IUCN Red List.

8.9.5 *Assessment of Impacts – Temporary and Permanent Barrier Creation, Edge Effects and Fragmentation*

8.9.5.1 *Description of Relevant Baseline Information*

Construction activities relating to linear infrastructure have potential to create a temporary barrier to fauna movement (for some fauna groups). This includes construction of the access roads, the transmission line and other infrastructure. Most other Project components are discrete areas that may be navigated around by fauna that may be moving through. The construction of access roads and transmission line will primarily be within Modified Habitat, however the Project area is located within the Javan Coastal Zone Endemic Bird Area. Temporary barriers within the EBA may disrupt the movement of endemic birds along the coastline. This is likely to be temporary during construction and reduce during operation.

Temporary and permanent barrier creation will occur during construction. This will include the erection of fences and hoardings around construction sites, and also construction of linear infrastructure (such as the access road and transmission line). This may impact the movement of fauna within the landscape, particularly bird species.

Edge effects are an indirect impact of land clearing during construction and throughout operation and can have temporary and permanent impacts. Where vegetation clearing occurs, adjacent vegetation and habitats can be exposed to changes in noise, light (natural or artificial), dust, humidity and temperature factors as well as increased competition from predators and invasive species. The impact of edge effects to habitat value and forest composition has been widely recognised as a contributor to habitat degradation and impacts to biodiversity. In extreme cases the effects have potential to alter the habitat characteristics of the ecotone and influence suitable habitat for native flora and fauna (including threatened species).

Both Natural and Modified Habitats surrounding the Project area may be temporarily impacted due to Project construction from dust and pollution. This will be most pronounced along the transmission line and road construction routes where vehicle movements along dirt roads will likely increase dust impacts. The primary impact will be dust deposition on flora within close proximity of construction sites.

Fragmentation of habitats can occur where currently linked habitats are disconnected through the construction of Project components. Fragmentation reduces the continuity of habitat and hence the ability for fauna to move within and between habitats patches. The resulting impact can cause reductions in foraging and breeding habitats. Species with limited home ranges may have a reduction in available area, leading to conflict over resources or negative interactions over territories.

Fragmentation of existing habitats within the project area is not considered to be a significant impact as the infrastructure design does not lead to isolation of habitat patches and is primarily within Modified Habitat. The area of mangroves along the immediate shoreline which is considered to be Natural Habitat will have a reduction in connectivity along the shoreline due to the construction of the access road and jetty. This is considered to be a minor impact as the area of habitat loss of mangroves is estimated to be 0.33 ha.

8.9.5.2 *Avoidance Measures Adopted*

Avoidance measures for temporary and permanent barrier creation, edge effects and fragmentation are not possible to be applied. The project footprint and design requires the construction of an access road, pipeline and jetty facilities that cannot be moved or recessed in order to avoid these impacts. The erection of barriers and fences is required in order to control access to the site for workers and local people.

8.9.5.3 *Impact Assessment*

The significance of impacts associated with terrestrial biodiversity during construction activities are discussed and presented in **Table 8-76**.

The sensitivity of terrestrial species to disturbance and displacement is considered to be **Low** for all Least Concern, Near Threatened and Vulnerable species.

The magnitude of effect due to disturbance and displacement of terrestrial habitats is likely to be **Small** as the effect will not cause a substantial change in the population of the species present, or other species dependent on them during both construction.

The overall magnitude of this impact is therefore **Negligible** for Least Concern, Near Threatened and Vulnerable Species.

Table 8-76 Assessment of Impacts from Barrier Creation on Fauna

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

8.9.5.4 *Mitigation Measures*

It is recommended that the following mitigation measures be applied in relation to habitat impacts during construction:

- The use of fencing and hoarding during construction in the Javan Coastal EBA is to be kept to a minimum around Project construction sites;
- Measures to control dust are to be utilised to limit generation of dust and hence deposition onto vegetation surrounding construction areas;

- Planting of native indigenous flora, including mangroves along the shoreline adjacent to the road and jetty construction sites is to occur to reduce impacts to connectivity along the shoreline; and

- Appropriate rehabilitation of disturbed areas using native vegetation is to occur to facilitate movement of fauna species.

8.9.5.5 Monitoring Measures

The following monitoring measures will be applied during construction:

- Records are to be kept and regularly reviewed (3 monthly basis) during construction on the application of the fencing and hoarding implementation;

- Regular inspections (weekly during construction) during the dry season to determine the level of dust deposition on vegetation surrounding the Project Area. Where excessive dust on vegetation is identified, and rain is not forecast within the next 5 days, vegetation should be washed using a water truck.

- Records are to be kept and regularly reviewed (3 monthly basis) on the planting of indigenous flora and fauna on disturbed areas; and

- Monitoring if rehabilitation success/failure is to occur on all replanting sites. Monitoring is to consist of regular inspections (3 monthly) to determine plant establishment. Where plant establishment is determined to have failed, reestablishment is to occur.

8.9.5.6 Assessment of Residual Impact

In view of the implementation of mitigation measures, the residual impact is to remain as **Negligible** for terrestrial species considered as Least Concern, Near Threatened or Vulnerable on the IUCN Red List.

8.9.6 Assessment of Impacts – Temporary Degradation of Habitat during Construction Phase

8.9.6.1 Description of Relevant Baseline Information

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

Dust

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

Run-off

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

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

Invasive Species

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

Specific impacts to biodiversity values is expected to be minimal along the transmission line route as this section of the Project is in Modified Habitat. Some impacts to avifauna may occur due to strung wires.

The construction of the power plant and associated facilities will occur in Critical Habitat (Javan Coastal Zone EBA). This area is highly modified however and localised impacts are likely occur to habitats from: soil compaction by the use of vehicles; dust deposition on vegetation; and the temporary disturbance of fauna from around the construction site (from noise and light).

Contaminated runoff from construction sites may also enter waterways, including the Cilamaya River and Java Sea. Contaminated water from sediments can impact aquatic ecosystems through changes in light penetration, smothering of vegetation and localised mortality of fauna.

The introduction of invasive species onto the site can contribute to changes in species composition and disturb the integrity of Natural Habitat areas. The following invasive species were identified at the Project area (**Table 8-77**).

Table 8-77 Invasive Species Identified at the Project Area

No	Taxonomic group	Species	Habitat	Status	Location in Project Area
1.	Animalia	*Cipangopaludina chinensis*	Freshwater	Native to Indonesia	BL/PL
2.	Plantae	*Alternanthera philoxeroides*	Terrestrial	Introduced	3,4,5, and BL/PL
3.	Plantae	*Chromolaena odorata*	Terrestrial	Introduced	BL/PL
4.	Plantae	*Leucaena leucocephala*	Terrestrial	Introduced	1,2,5, and BL/PL
5.	Plantae	*Mikania micrantha*	Terrestrial	Introduced	BL/PL
6.	Plantae	*Mimosa pigra*	Terrestrial	Introduced	2,4, and BL/PL
7.	Plantae	*Psidium guajava*	Terrestrial	Introduced	5
8.	Plantae	*Syzygium cumini*	Terrestrial	Native to Indonesia	3 and BL/PL

8.9.6.2 Avoidance Measures Adopted

The following avoidance measures will be applied to the Project:

- Application of mitigation measures as outlined in **Section 8.4** *Air Quality*; **Section 8.6** *Acoustics and Vibration*; and **Section 8.8** *Surface Water Quality* will be applied to reduce impacts to fauna and flora during construction. These measures ensure compliance with relevant standards.

8.9.6.3 Impact Assessment

The significance of impacts associated with terrestrial biodiversity during construction activities are discussed and presented in **Table 8-78.**

The sensitivity of Natural Habitats is considered to be **Medium**. The sensitivity of Modified Habitats are considered to be **Low**.

The magnitude of effect is likely to be small as the degradation of habitat will effect only a small area of habitat, but without the loss of viability/function of the habitat.

The overall magnitude of this impact is therefore **Minor** for Natural Habitat and **Negligible** for Modified Habitat before Mitigation Measures.

Table 8-78 Assessment of Impacts on Degradation of Habitat during Construction

Evaluation of Significance		Sensitivity/Vulnerability/ Importance of Resource/Receptor	
		Modified Habitat	**Natural Habitat**
		Low	**Medium**
Magnitude of Impact	**Negligible**	Negligible	Negligible
	Small	**Negligible**	**Minor**
	Medium	Minor	Moderate
	Large	Moderate	Major

8.9.6.4 Mitigation Measures

It is recommend that the following mitigation measures be applied in relation to habitat impacts during construction:

- Sediment and erosion control measures are to be used in all areas of construction to minimise soil contaminated runoff entering waterways. These measures are to be outlined in a *Sediment and Erosion Control Plan*;
- All disturbed soil surfaces are to be rehabilitated and native flora species are to be planted within areas under the Projects control. These species are to be suitable habitat for bird species listed in the Javan Coastal Zone EBA;
- Existing populations and the introduction of new invasive species into Natural Habitats and Critical Habitats are to be managed. These measures are to be outlined in an *Invasive Species Management Plan* and include measures such as:
  - The provenance of any fill material brought onto the site is to be checked regarding invasive species contamination;
  - Vehicle wash down procedures are to be used to reduce the transmission of invasive species into and from the Project area(s);
  - Control measures are to be utilised in areas of Natural Habitat and Critical Habitat;

- All light sources are to be directed away from areas of Natural Habitat where feasible.

8.9.6.5 *Monitoring Measures*

The following monitoring measures will be applied during construction:

- Records are to be kept and regularly reviewed (3 monthly basis) during construction on the application on the implementation of the *Sediment And Erosion Control Plan*; and

- Records are to be kept and regularly reviewed (3 monthly basis) during construction on the application on the implementation of the *Invasive Species Management Plan.* Monitoring is to include inspections of the site on a monthly basis during construction in areas of natural habitat to identify and eradicate any invasive species.

8.9.6.6 *Assessment of Residual Impact*

In view of the implementation of mitigation measures, the residual impact is to reduce to **Negligible** for Natural Habitat and Modified Habitat.

The permanent loss of Natural Habitat is estimated to be 0.33 ha of mangrove habitat. The mitigation measures will reduce the extent of overall impact.

8.9.7 Assessment of Impacts - Mortality: Vehicle Strike, Hunting and Poaching

8.9.7.1 *Description of Relevant Baseline Information*

Mortality of individual fauna may occur during construction due to vehicle or machinery strike or falling debris during clearing activities; and worker influx and hunting/poaching of extant fauna.

During construction, vehicle and machinery use may strike fauna within the Project area, however this is likely to impact livestock rather than species of conservation concern. Clearance activities within the Java Coastal Zone EBA (Critical Habitat) however may impact upon species of conservation concern, although these are likely to be birds.

Hunting and poaching by local people and the workforce may impact on species of conservation concern, especially birds captured for the bird trade that may occasionally visit the Project area. These species include the Javan White Eye (*Zosterops flavus*), Tenggara Hill Myna (*Gracula venerate*) and the Javan Pied Starling (*Gracupica jalla*).

8.9.7.2 *Avoidance Measures Adopted*

The following avoidance measure is recommended:

- Pre-construction with the local community on hunting/poaching activities is to occur according to the Community Engagement Program. The purpose of this approach is to inform and educate the community regarding conservation and identify alternative livelihoods for people reliant on the wildlife trade.

8.9.7.3 *Impact Assessment*

The potential impacts during construction will remain during operation.

The significance of impacts associated with terrestrial biodiversity during construction activities are discussed and presented in **Table 8-79**.

The sensitivity of terrestrial species to fauna mortality from vehicle strike, hunting and poaching is considered to be **Low** for all Least Concern, Near Threatened and Vulnerable species.

The magnitude of effect due fauna mortality from vehicle strike, hunting and poaching is likely to be **Small** as the effect will not cause a substantial change in the population of the species present, or other species dependent on them during construction.

Table 8-79 Assessment of Impacts from Mortality: Vehicle Strike, Hunting and Poaching

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

8.9.7.4 *Mitigation Measures*

It is recommended that the following mitigation measures be applied in relation to habitat impacts during construction:

- Hunting and poaching will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation;

- The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to hunting and poaching, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations; and

- All vehicles are to maintain a speed of a maximum of 40km/hr within work sites to reduce the risk of fauna strike.

8.9.7.5 Monitoring Measures

No additional monitoring measures are recommended.

8.9.7.6 Assessment of Residual Impact

In view of the implementation of mitigation measures, the residual impact is to remain **Minor** significance.

8.9.8 Assessment of Impacts - Degradation of Habitat during Operations Phase

8.9.8.1 Description of Relevant Baseline Information

Minor residual impacts for all construction phase impacts are likely remain during operation. Additional impacts due to degradation of habitat and mortality are likely to be different during operation and hence are reassessed for operational phase impacts.

Degradation of habitat during operation will occur due to air, noise and water discharges into the environment.

Impacts due to air, noise and water emissions during operation can cause impacts to biodiversity values such as: deposition of particulates on vegetation; leaf necrosis; disturbance of fauna from close proximity to noise sources (such as the CCGT plant) and increases in flows and pollution impacting aquatic values in the Java Sea and Cilamaya River.

Compliance with relevant standards will reduce the impacts on biodiversity values from air, noise and water pollution.

8.9.8.2 Avoidance Measures Adopted

The following avoidance measures will be applied to the Project:

- Application of noise mitigation measures as outlined in **Section 8.4** *Air Quality*; **Section 8.6** *Acoustics and Vibration*; and **Section 8.8** *Surface Water Quality* will be applied to reduce impacts to fauna and flora during construction. These measures ensure compliance with relevant standards.

8.9.8.3 Impact Assessment

The significance of impacts associated with terrestrial biodiversity during operation activities are discussed and presented in **Table 8-80.**

The sensitivity of Natural Habitats is considered to be **Medium**. The sensitivity of Modified Habitats are considered to be **Low**.

The magnitude of effect is likely to be small as the degradation of habitat will effect only a small area of habitat, but without the loss of viability/function of the habitat.

The overall magnitude of this impact is therefore **Minor** for Natural Habitat and **Negligible** for Modified Habitat before Mitigation Measures.

Table 8-80 Assessment of Impacts on Degradation of Habitat during Operations

Evaluation of Significance		Sensitivity/Vulnerability/ Importance of Resource/Receptor	
		Modified Habitat	**Natural Habitat**
		Low	**Medium**
Magnitude of Impact	**Negligible**	Negligible	Negligible
	Small	**Negligible**	**Minor**
	Medium	Minor	Moderate
	Large	Moderate	Major

8.9.8.4 Mitigation Measures

No additional measures are necessary than those outlined in the impacts to air, water and noise.

8.9.8.5 Monitoring Measures

No additional monitoring measures are recommended.

8.9.8.6 Assessment of Residual Impact

In view of the implementation of mitigation measures, the residual impact is to remain **Minor** significance.

8.9.9 Assessment of Impacts - Mortality: Avifauna Infrastructure Strike

8.9.9.1 Description of Relevant Baseline Information

Impacts to fauna during operation may persist with potential impacts to infrastructure causing local mortality of individuals. This is most likely to occur with avifauna striking the transmission line during construction and operation.

Whilst no bat species were detected during surveys, it is likely that bats would forage over the rice paddies during dawn and dusk. Individuals may collide with the transmission line, causing mortality of individuals. Similarly, bird species may collide with the transmission line during flight.

8.9.9.2 *Avoidance Measures Adopted*

Avoidance measures for mortality: avifauna infrastructure strike are not possible to be applied. The design of the transmission line requires the erection of poles and wires that will be a risk to avifauna.

8.9.9.3 *Impact Assessment*

The sensitivity of terrestrial species to fauna mortality from avifauna strike with infrastructure is considered to be **Low** for all Least Concern, Near Threatened and Vulnerable species.

The magnitude of effect due fauna mortality from avifauna infrastructure strike is likely to be **Small** as the effect will not cause a substantial change in the population of the species present, or other species dependent on them during construction.

The overall magnitude of this impact is therefore **Negligible** for Least Concern, near Threatened and Vulnerable Species.

Table 8-81 Assessment of Impacts from Avifauna Infrastructure Strike

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

8.9.9.4 *Mitigation Measures*

It is recommended that the following mitigation measures be applied in relation to habitat impacts during construction:

- Use of bird deflectors on the length of the power line. The deflectors will increase line visibility by thickening the appearance of the line for easier detection by avifauna;
- Moveable markers of contrasting colours (e.g. black and white) that protrude above and below the line, and be placed 5-10 m apart;

- Removing the thin neutral or earth (shield) wire above the high voltage transmission lines where feasible, and where this is not possible, marking the line to make it more visible;

- Minimising the vertical spread of power lines. Having lines in a horizontal plane reduces collision risk;

- Habitat manipulation to influence flight activity and bird behaviour, e.g. tree lines under the high voltage lines to increase visibility;
- Insulating cables close to poles, at least 70 cm on both sides and around perching areas, and up to at least 140cm; and

- Hanging insulators under cross arms and poles, provided the distance between a likely perch (mainly the transmission tower crossarm) and the energised parts (conductors) is at least 70 cm.

8.9.9.5 *Monitoring Measures*

The following monitoring measures are recommended:

- Regular inspections of the transmission line routes (3 monthly) during construction is to occur to identify any fauna mortality that has occurred. Where patterns in species mortality or conservation significant species are identified, advice from a suitably qualified person should be sought to alter mitigation measures to reduce future potential impacts.

8.9.9.6 *Assessment of Residual Impact*

In view of the implementation of mitigation measures, the residual impact remains of **Minor** significance.

8.9.10 ***Assessment of No-Net-Loss of Biodiversity Values***

Biodiversity offsets are designed to compensate for the residual biodiversity losses due to the Project. They are defined as (BBOP 2012):

"*Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure and ecosystem function and people's use and cultural values associated with biodiversity.*"

ERM has utilised a biodiversity offset metric to assess the requirements to achieve no-net-loss of biodiversity values. The analysis is contained in **Annex J**.

From this analysis, the required range of areas of mangroves for difference condition classes to achieve a no-net-loss of biodiversity values for the habitat would be:

- 1.65ha of Natural condition mangroves; or
- 1.25ha of Modified condition mangroves; or
- 0.90ha of Degraded condition mangroves.

An assessment will be required to be undertaken of the proposed candidate offset site to determine the condition and hence available area to achieve a no-net-loss of biodiversity values. The chosen offset site is likely to contain a range of condition types and this will affect the final size of the offset site chosen. As required by the offset rules, it is intended that the site also be connected with other areas of natural habitat, areas of conservation interest or protected areas.

These requirements will be contained within the *Biodiversity Offset Plan* prepared for the chosen offset site.

8.9.11 Options for Biodiversity Offsets

ERM has identified a range of options to deliver the required biodiversity offsets for the Jawa 1 Project. The following options have been identified based on stakeholder consultation, discussions with relevant experts and research undertaken by ERM. These options relate to the delivery of offsets as required by IFC PS6.

- Option 1: Replanting and management of mangrove habitat along the coastal zone to the West of the Project Area

- Option 2: Replanting and protection of mangrove habitat within habitat identified for the Javan White Eye (*Zosterops flavus*) to the East of the Project Area

The next steps to achieve the required outcome from the biodiversity offset assessment are outlined in **Annex J.** It is estimated that an approximate time frame of 18 months is required to identify, secure and commence management of the biodiversity offset.

A summary of the Project's compliance against ADB's SPS on critical habitat is presented in **Table 8-82.**

Table 8-82 ADB SPS Critical Habitat Compliance Table

Critical habitat criteria	Description	Criteria Met (with justification)
Areas with high biodiversity value	Internationally recognised areas, Key Biodiversity Areas, Nationally Protected Areas or areas of high biodiversity significance outside the protected area system. Endemic Bird Areas are not not recognised as an internationally recognised area and are considered as important for habitat-based bird conservation.	Areas of high biodiversity value were not identified within the Project Area. Two Protected Areas were identified in proximity to the Project area, being the Gunung Burangrang Nature Reserve which is 54km to the East of the Project Area. The Project Area is within the Javan Coastal Zone Endemic Bird Area. Trigger species for the EBA were identified 5km to the East of the Project area (Javan White Eye) and within the Project Area (Javan Plover) (which is located within the defined Discrete Management Unit [DMU] of the Project).
Habitat required for the survival of critically endangered or endangered species	Using the IFC Guidance note definitions, habitat required for the survival of CR and EN species is considered to be: a) Habitat required to sustain ≥ 10 % of the global population of a CR or EN species /sub /species and where there known regular occurrences of the species and where habitat could be considered a discrete management unit for the species. b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species. c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally-important concentrations of Red-listed EN species where that habitat could be considered as a discrete management unit for the species/subspecies. d) Habitat of significant importance to CR/EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.	The Critical Habitat screening assessment and surveys undertaken for the Project Area and DMU identified one Endangered species that was detected within the DMU approximately 80 west of the Project area. No other Cr or EN species was determined to be present or likely present within the DMU. This species, *Meiglyptes tristis* White-rumped Woodpecker is not considered to trigger critical habitat under the criterion as the species is widespread and the DMU is not considered as being 1/10 globally for the species. The population is also not considered to be regionally important nor important for the long term survivability of the species.

Critical habitat criteria	Description	Criteria Met (with justification)
	e) As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.	
Areas having special significance for endemic or restricted-range species	Using the IFC Guidance note definitions, habitat required for the survival of endemic or restricted range species is considered to be: (a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 % of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species. (b) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 % but < 95 % of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment. (c) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. (d) For species with large but clumped distributions, a provisional threshold is set at ≥ 5 % of the global population for both *It should be noted that an endemic and restricted range species is defined by the IFC as one that possesses an extent of occurrence of 50,000 km2 (pers. comms). Plant species may qualify as endemic if has ≥95% of its global range inside the country or region of analysis.*	One endemic/restricted range species was identified within the DMU for the Project. This species is the Javan White Eye (*Zosterops flavus*) (IUCN VU. The species triggers Critical Habitat as the species has a range of <50,000km^2. The species was detected 5km to the East of the Project Area.

Critical habitat criteria	Description	Criteria Met (with justification)
	terrestrial and marine species. (e) Source sites that contribute ≥ 1 % of the global population of recruits.	
Sites that are critical for the survival of migratory species	Using the IFC Guidance note definitions, habitat required for the survival of migratory and congregatory species is considered to be: (a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 % of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species. (b) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 % but < 95 % of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment. (c) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. (d) For species with large but clumped distributions, a provisional threshold is set at ≥ 5 % of the global population for both	The Critical Habitat screening assessment and field surveys did not identify any migratory or congregatroy species that met the CH thresholds.

Critical habitat criteria	Description	Criteria Met (with justification)
	terrestrial and marine species. (e) Source sites that contribute ≥ 1 % of the global population of recruits.	
Areas supporting globally significant concentrations or numbers of individuals of congregatory species	See above.	
Areas with unique assemblages of species or that are associated with key evolutionary processes or provide key ecosystem services	The IFC definitions have been issued to assess whether unique assemblages of species associated with key evolutionary processes have been identified: The criterion is defined by: a) the physical features of a landscape that might be associated with particular evolutionary processes; and/or b) Sub-populations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history. The latter includes evolutionarily significant units and evolutionarily distinct and globally endangered species.	There are no physical features within the AoI that are known to be associated with evolutionary processes. When considering the habitat within the AoI, the natural habitat areas would not be considered to substantially contribute to the biological values of the DMU that may sustain endemic populations (if present). Similarly, the species assessments did not identify any species subpopulations known to be phylogenetically or morphogenetically distinct to be relying the habitat of the AoI. As a result it not considered likely that the Project Area and AoI would be considered important in the conservation of Key Evolutionary Processes
Areas having biodiversity of significant social, economic, or cultural importance to local communities.	Ecosystem Services were prioritized according to a priority matrix ranking two criteria: • Importance of the ecosystem service to the beneficiary which considers the intensity of use, degree of dependence and the importance expressed by the project affected communities; and • Irreplaceability of the ecosystem service, which refers to the availability of alternatives, the accessibility, cost and appetite for those alternatives as discussed with the beneficiary.	The following priority ecosystem services have been identified and will be assessed against the impact assessment procedures. • Food: wild-caught fish and shellfish & aquaculture • Freshwater • Species and areas valued globally as of high conservation value (Javan White Eye) • Natural spaces that maintain species populations and protect the capacity of ecological communities to recover from disturbances. (Mangrove communities)

Critical habitat criteria	Description	Criteria Met (with justification)
	The results of the assessment was based on data collected during field observations.	

8.10 WASTE MANAGEMENT

Impacts to waste management infrastructure from the construction phase of the Project are anticipated from the construction and operation of the CCGT power station, transmission line and the substation, FSRU and pipeline outfall.

A holistic approach has been taken to assessing the impacts from waste arising recognising that the infrastructure that will be used is likely to be common to all Project features (e.g. local landfill sites, recycling facilities, hauliers).

As the Project is in the early stages of planning comprehensive details of waste management plans from the waste source to its final disposal point are not fully confirmed. As such, the assessment of waste impacts has taken into account the information provided to date and the understanding of the waste industry in the Project area. It will be essential to ground truth this information in advance of the construction phase.

8.10.1 Potential Sources of Impacts

8.10.1.1 Construction Phase:

The construction activities will generate solid and liquid hazardous and non-hazardous wastes that will require off-site disposal. Anticipated wastes include:

- Solid construction waste (e.g. packaging waste; scrap metals, waste wood, redundant formwork; offcuts; fabrication waste; and pallets), storage & disposal;

- Excavated waste from site levelling works and construction of the pipeline route;

- Domestic waste generated by the construction workforce (including paper, plastics and putrescible wastes);

- Biomass from site clearance activities including waste from the transmission line and pipeline routes; and

- Hazardous waste including used paint, engine oils, hydraulic fluids and waste fuel, spent solvents from equipment cleaning activities, and spent batteries or spent acid/alkali from the maintenance of machinery on-site.

8.10.1.2 Operations:

The operational activities are expected to generate solid and liquid hazardous and non-hazardous wastes that require off-site disposal:

- Domestic waste generated by the operations workforce (including paper, plastics and putrescible wastes);
- Waste materials such as steel, excess cables etc. associated with routine and non-routine maintenance; and
- Hazardous waste including used paint, engine oils, hydraulic fluids and waste fuel, spent solvents from equipment cleaning activities, and spent batteries or spent acid/alkali from the maintenance of machinery on-site.

8.10.2 *Assessment Approach and Criteria*

The legal framework in Indonesia under which waste from the Project needs to be managed is shown in **Figure 8-19.**

Figure 8-19 Indonesian Waste Management Framework

A full summary of the legislation governing waste management in Indonesia is provided in **Annex F**.

Waste impacts are also assessed, reviewed, discussed and presented with reference to the *IFC PS3: Resource Efficiency and Pollution Prevention* as well as the *ADB SPS* both of which are underpinned by the following WBG Environment Health and Safety Guidelines:

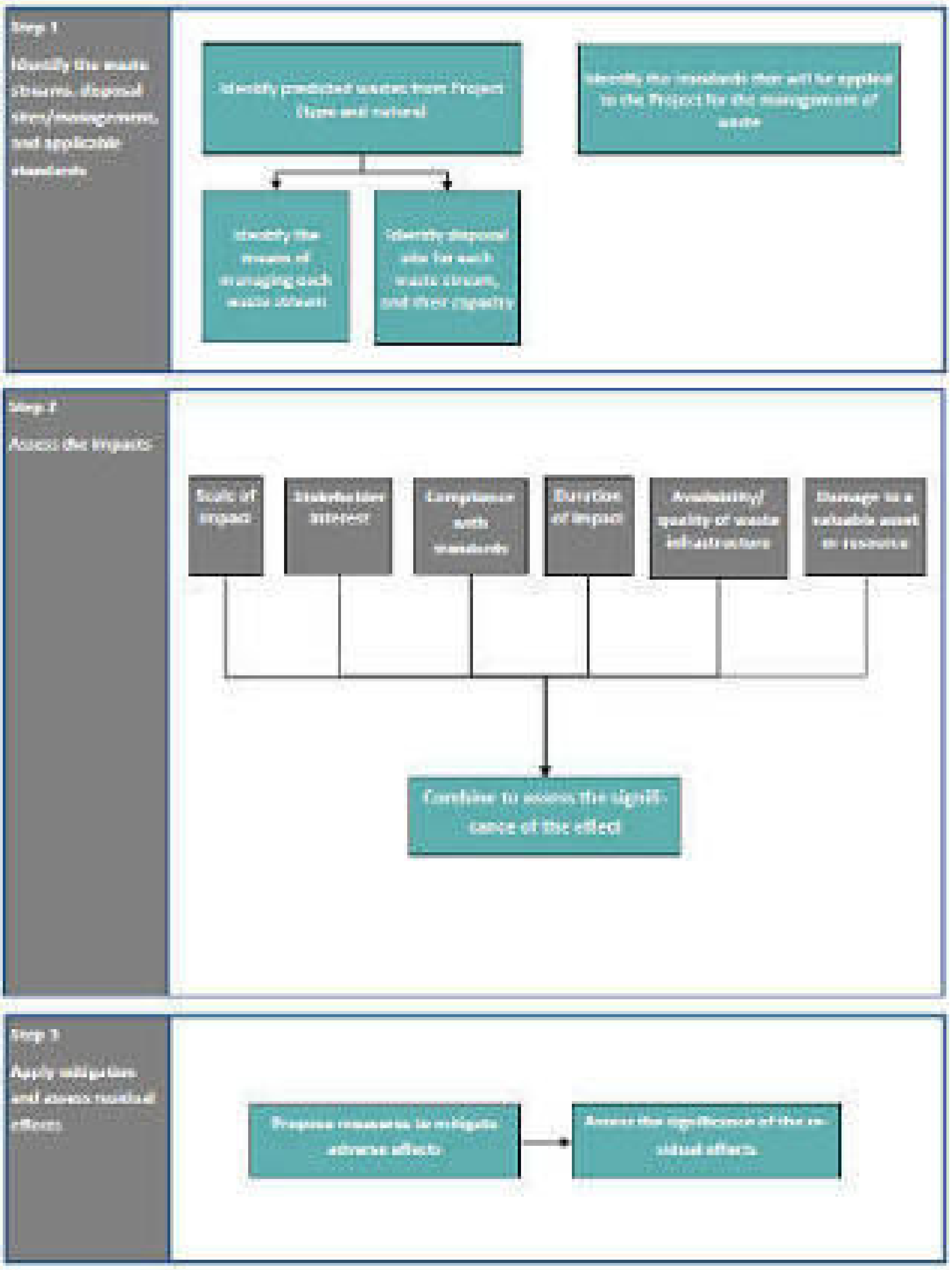
- *World Bank IFC General EHS Guidelines, 2007;*
- *World Bank IFC EHS Guidelines for Thermal Power Plants, 2008, and 2017 (in Draft)*;
- *World Bank IFC EHS Guidelines for Electric Power Transmission and Distribution, 2007.*

The typical approach taken to the assessment of wastes from any Project is as follows:

- Identify the type and nature of waste being produced;
- Confirm the means of managing these waste with the Project Proponent;
- Identify any off-site waste management facilities that will be used and:
  - Try to demonstrate that capacity exists for the identified wastes;
  - Describe how the sites will be assessed for compliance with the relevant environmental standards relating to waste management.
- Propose measures to monitor waste management activities and ensure a duty of care is maintained for waste from its origin to its final disposal in line with the applicable legal framework.

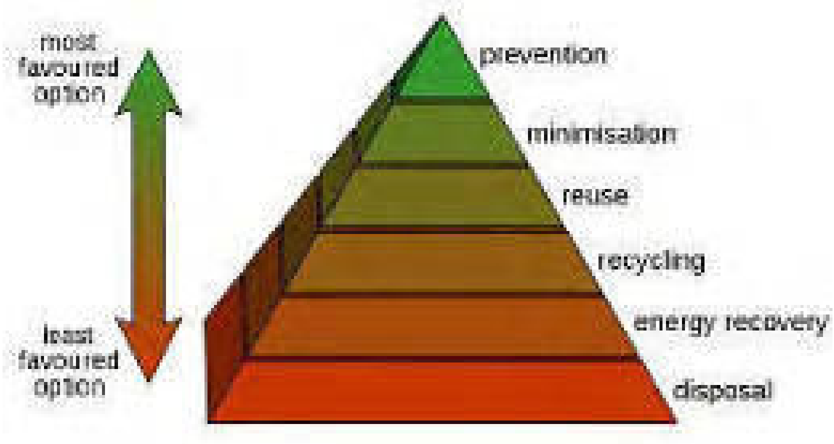
The approach to assessing waste impacts is shown in **Figure 8-20**.

Figure 8-20 Assessing Waste Impacts



The principles of the waste hierarchy should be applied to all wastes with emphasis placed on waste avoidance, waste reduction, reuse of waste, waste recovery and finally disposal.

Figure 8-21 Waste Hierarchy



The assessment of potential impacts related to waste in this section is based on the environmental baseline data, socio-economic baseline data and the information available from the Sponsor at the time of writing.

Judgements and assessments have been made based on professional knowledge and previous experience of ERM. Should there be significant changes in factors such as assumed input data, engineering design of waste management and treatment components of the Project, or agreed assessment criteria, the elements of this impact assessment and associated management, mitigation and monitoring measures may be needed to reflect these changes

This standard requires an assessment of the waste generated and avoidance and minimisation measures proposed to be utilised as part of the basic Project description.

This includes an assessment of the measures on how to best avoid or minimise all waste stream, put in place resource recovery, recycling and/or reuse measures where avoidance is not feasible, and as a final resort how remaining waste will be treated and disposed of in an environmentally sound manner.

8.10.3 Assessment of Impacts – Construction Phase

The following quantities of wastes are anticipated by the Project in the construction phase.

Table 8-83 Construction Phase Wastes

Waste Type	*FSRU*	*Jetty and Pipeline*	*CCGT*	*Transmission*	*Substation*
Construction Solid Wastes	Nil[1]	600 kg/ per day[4]			
Excavation Waste	Nil[1]	Nil[2]	Nil[2]	N/A	N/A
Domestic Waste	Nil[1]	N/A[5]	80 t/month[3]	N/A[5]	N/A[5]

Hazardous Waste	Nil[1]	135 kg / month[6]

[1] The FSRU is due to be constructed off-site and therefore there will be no waste created in Indonesia as part of its construction
[2] wastes excavated during the installation of the pipeline onshore will be used to backfill the pipeline trench during reinstatement. Similarly excavated soil at the CCGT site will be used in site levelling works.
[3] assumption that each worker generates a waste volume of 0.65 kg/day (Indonesian standard SNI – 19.3983.1995).
[4] Previous experience of this type of Projects suggests that a Project with a workforce of around 600 would produce about 600 kg of solid waste per day during construction
[5] domestic waste will arise from the workers accommodation which is planned to be located at the CCGT site.
[6] The Project anticipates around 135 kg of hazardous waste per month during construction across all sites.

FSRU

The FSRU construction is taking place outside of Indonesia and therefore there are no direct waste impacts anticipated.

Jetty and Pipeline

Wastes from the excavation of the pipeline route will be set aside for use in its reinstatement after the pipe has been installed. It is anticipated that most of the excavated soil will be reused in the pipeline route however, any surplus this will be directed to the CCGT Power Plant area and used in the site levelling activities if the Project programme allows. No sediment is removed during marine dredging for the jetty and pipelines and this is discussed in **Section 8.13.2**.

CCGT Power Plant

Based on experience with similar projects, the total approximate quantities of non-hazardous and hazardous waste that could be a potential source of impact during this stage include:

- 600 kg/day of solid (non-hazardous) waste; and
- 135 kg/month hazardous waste.

The waste generated from construction workforces of approximately 3,500 will be approximately 2.27 t/day or 68 t/month, with an assumption that each worker generates a waste volume of 0.65 kg/day (Indonesian standard SNI – 19.3983.1995).

The site levelling works for the CCGT Power Plant area requires approximately 879,719 m^3 of soil for backfilling purposes therefore it is anticipated that any waste soils created during the works at other Project features will be used in the site levelling activities as a priority, before virgin soils are imported to the site.

Transmission Line

Biomass from the creation of the 1000 m^2 transmission line footprints is the most prominent waste from the transmission line construction. There will be a requirement to remove any biomass and the top layer of topsoil to install the transmission line towers.

It is anticipated that any useable soils will be routed to the CCGT Power Plant area for use in the site levelling works if the programme allows.

Substation

It is anticipated that site levelling of the substation site will be required however there is no indication of any wastes associated with this construction.

The Project has specified the Jalupang Landfill, in Cikampek District as the disposal site for waste generated during construction. It is located about 24 km south of the CCGT Power Plant area. The Project will, with its contractors, carry out an audit of the landfill site to determine if it is suitable to receive wastes from the Project. This audit will be documented in a Waste Management Plan (WMP). If it transpires that the landfill site does not meet the relevant criteria for the wastes the Project intends to send to it, alternative arrangements will be sought by the Project through its contractors.

A framework for hazardous waste management has yet to be developed by the local authorities. Nevertheless, the Project will create a WMP for the construction phase that includes provisions for the appropriate management of hazardous wastes. All hazardous waste streams will be identified by the key contractors in their preparatory works, prior to the commencement of the construction phase. For all hazardous wastes, the WMP will identify appropriately licenced waste hauliers and disposal facilities in the Jawa region.

During construction, the EPC contractor is responsible for appropriate handling and waste disposal. Waste will be managed within the requirements of the applicable legal framework and lenders guidelines.

Impacts from waste management are likely to be confined to the Project areas and the waste infrastructure in the locale of the Project.

At this stage, as the disposal routes for all wastes have not been fully identified or assessed, it is not possible to categorise the sensitivity of the area as low. However, in the course of the planning stage for the Project, the EPC contractor will be able to establish if sufficient suitable waste disposal capacity exists and this impact could potentially be reduced. Presently, it is acknowledged that waste infrastructure of the type required by the Project does exist in and around the area.

Given the location of the Project and its proximity to the waste infrastructure, the overall sensitivity to waste management impacts is considered to be medium. The magnitude of the impacts is considered to be medium. The Project construction appears to have no significant waste stream that would place undue pressures on waste infrastructure in the region. The impact significances has been assessed as **Moderate** on account of the uncertainty of the waste disposal routes.

The significance of potential impacts to waste infrastructure during the construction phase are assessed in **Table 8-84.**

Table 8-84 Assessment of Impacts on Waste Management Infrastructure

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

8.10.3.1 *Mitigation Measures, Management and Monitoring*

In order to manage the wastes from the Project appropriately a few key steps should be followed by the Proponent and the EPC contractor and should be completed in advance of financial close.

Waste Management Plan

The Project and its EPC contactor should develop a full WMP. A waste inventory that details all wastes anticipated by the construction works, the frequency at which they will occur and the timing in the Project programme, is needed.

The waste inventory will be aligned with the waste disposal sites in the area that are licensed to accept the types of waste the construction phase will create, following the 3Rs ethos (i.e. reduce, reuse and recycle).

Presently the EPC has not selected the facilities for disposal of Project wastes (hazardous and non hazardous). **Table 8-85** summarises the current facilities that the Project may consider as disposal options.

Table 8-85 Summary of Local Potential Waste Facilities

Regency	Type of Waste	Operator	Location	Capacity
Karawang	Non-hazardous Waste	Final Processing Plant (*Tempat Pemrosesan Akhir* – TPA) Jalupang *non hazardous waste usually managed by Local Environment or Sanitary Agency prior to being disposed to final landfill	Wancimekar Village, Kotabaru District, Karawang Regency	Total area: 7.5 hectare
	Hazardous Waste	PT. Tenang Jaya Sejahtera	JL. Raya Tarum Barat (TB) KM. 6-7 Kutamekar Ciampel Karawang	Certified. Waste transportation and waste treatment. Waste: 1. Fly Ash and Bottom Ash 2. Furnace, Steel Slag and Iron Slag 3. Paint Sludge and WWTP Sludge 4. Used Ink and Toner 5. Sand Faundry/Blasting 6. Dust Grinding/Collector http://www.tenangjaya.co.id/p/pengolahan-limbah-b3.html
Bekasi	Non-hazardous Waste	Final Processing Plant (*Tempat Pemrosesan Akhir* – TPA) Burangkeng *non hazardous waste usually managed by Local Environment or Sanitary Agency prior to being disposed to final landfill	Burangkeng Village, Setu District, Bekasi Regency	Total area: 11 hectare – news (February 2017) reported that Environment Agency of Bekasi Regency proposed the expansion of TPA Burangkeng to be 20 hectare

Regency	Type of Waste	Operator	Location	Capacity
	Hazardous Waste	PPLI (PT Prasadha Pamunah Limbah Industri)	MM2100 Industrial Area Block A No.1, Jalan Kalimantan, Cibitung, Gandamekar, Cikarang Bar., Bekasi Regency	Certified. Waste transportation and waste treatment. Waste: 1. Acid Waste 2. Aerosol Can 3. Alkaline Waste 4. Asbestos 5. Battery Waste 6. Blasting Waste 7. Bleaching Earth 8. Burning Residue 9. Catalyst Waste Etc. http://www.ppli.co.id/services/waste-profile/
	Hazardous Waste	PT PUTHEH Jasa	Sakura Regency, Jalan Bunga Sakura Raya Blok J-1/8A Jatiasih, Bekasi, Jawa Barat 17423	Certified. Waste transporter only. http://puthehjasa.com/pelayanan-pt-putheh-jasa/
Cilegon	Hazardous Waste	PT Wastec Internasional	HO: Majapahit Permai, Block A-110, RT.14/RW.8, Petojo Sel., Gambir, Central Jakarta Facility address: Jalan Australia 1 Kav. 1/2, Warnasari, Citangkil, Cilegon, Banten Province	Certified. Waste transportation and waste treatment. Waste: 1. Explosive waste 2. Flammable waste 3. Reactive waste 4. Toxic waste Etc. http://wastecinternational.co.id/menu/Introduction-to-Hazardous-Waste.html

The inventory will also be used to determine the scale of service required to manage the waste from the Project including container types (bins, skip), frequency of collection, storage times, etc. This information should be mapped to the Project area to ensure that the correct containers and capacities are deployed at the correct locations.

A system for documenting waste movements should be created. A trip ticket or waste transfer note system will be used to document all waste types leaving the Project area, their haulier, source, proposed disposal site etc. These tickets should be produced as counterfoil to create a full audit trail.

A programme of waste facility audits should be proposed to assess the credentials of would be waste hauliers, treatment facilities and disposal sites. A site audit should be conducted by the Project Proponent or its EPC contractor in advance of using any site / haulier for waste disposal, to establish if the site / haulier is operating within the bounds of its licence, the law and to a standard acceptable to the Project.

The WMP should be in place well in advance of the start of construction to demonstrate that sustainable waste management has been incorporated into the Project construction phase. The WMP will evolve during the construction phase and should be a 'live' document, adapted for the operation phase.

Specific items to be included in the WMP or to be carried out under it guise include:

- Providing training to all workers on the waste management system of the Project;

- Implement proper storage of the construction materials and wastes to minimise the potential damage or contamination of the materials;

- Implement construction materials inventory management system to minimise over-supply of the construction materials, which may lead to disposal of the surplus materials at the end of the construction period;

- Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimise odour nuisance);

- Store wastes in closed containers away from direct sunlight, wind and rain and systematically to allow inspection between containers to monitor leaks or spills;

- Ensure that liquid waste storage areas have impermeable floors and containment, of capacity to accommodate 110% of the volume of the largest waste container;

- All wastes will be disposed of by authorised third- party disposal contractors;
- Concrete waste of inert nature will be stored in a laydown area near the concrete batching plant and will be reused where possible; and
- Any bitumen waste will be stored separately in a lined area to be disposed of by licensed contractors.

8.10.3.2 Assessment of Residual Impact

Formulation and execution of a satisfactory WMP will result in the impact from waste management reducing to **Minor** significance. Until such time as the WMP has been accepted, the impact significance should remain as **Moderate**.

8.10.4 Assessment of Impacts – Operations Phase

During the Operation of the Project there will be wastes generated from a range of Project activities noted in **Chapter 4**. The amounts of waste anticipated by the Project from the different aspects of its operation are set out in **Table 8-86.**

Table 8-86 Operation Phase Wastes

Waste Type	*FSRU[1]*	*Pipeline*	*CCGT**	*Transmission*	*Substation*
Operation and Maintenance Solid Wastes	382 m^3 (~100t) / annum[2]	Negligible	1,250kg /day	Negligible	Negligible
Domestic Waste	15 kg/ day	Nil	60 kg / day	Nil	50 kg / day
Hazardous Waste	550 m^3 / annum	Negligible	Negligible	Negligible	Negligible
Sewage sludge[3]		Nil	700kg	Nil	0.03 m^3/day for septic tank[4]

Note:
[1] Information provided via email by Exmar March 2017.
[2] Compacted volumes based on information provided by the Project proponent. All compacted waste will be brought ashore for disposal.
[3] All other wastewater will be discharged to the Java Sea.
[4] Sewage sludge from substation will not be discharged into the Java Sea.
*Obtained from Samsung on March 12 2018

FSRU

Apart from any wastes that can be disposed overboard wastes generated aboard the FSRU will be stored on the ship until such time as a suitably sized load is available for transportation to the shore base. At this time an appropriate contractor for transporting and disposing of the waste will be secured and used to manage the waste on behalf of the Project. A workforce of 48 will be based at the FSRU. Domestic wastes will be compacted prior to being brought ashore. Putrescible (food) wastes will be macerated and released overboard in accordance with MARPOL Annex V[1]. Hazardous wastes (lubricant oils, chemicals, etc.) will be stored in appropriate containers aboard the FSRU. The storage area will have secondary containment to prevent spillage.

Pipeline

The pipeline may have a small amount of waste from its maintenance but it is anticipated that this will be returned to the maintenance base, most likely located at the CCGT Power Plant area. Cleaning of the pipeline will be undertaken by a programme of 'pigging'. Pigging involves the passing of a cleaning module through the pipeline under pressure to remove the build-up of contaminants. A small amount of wash-down waste will be generated during pigging but most likely captured and discharged via the pigging stations.

CCGT Power Plant

A total of 95 workers will be employed to operate the CCGT Power Plant. The generation of domestic waste is estimated at (about 60kg) with an assumption that each worker generates a waste volume of 0.65 kg/day (Indonesian standard SNI – 19.3983.1995). The domestic solid waste will be handed over to suitably licensed third parties and transported periodically (probably weekly) to the local landfill site.

The wastes from the Project during the operation phase will include hazardous waste (i.e. used paint, engine oils, hydraulic fluids and waste fuel, spent solvents from equipment cleaning activities, and spent batteries or spent acid/alkali from the maintenance of machinery on-site). These wastes will be generated in small quantities and it is expected that the waste processors in the Jawa region will have capacity to accept them for processing / disposal. This will have to be confirmed when the WMP is finalised with the EPC contractor and the Project Proponent.

The majority of process effluents will be treated and discharged to the Jawa Sea and therefore should not impact the local waste infrastructure. Sewage

[1] As the FSRU is located more than 3 nautical miles offshore the vessel is permitted to discharge food (putrescible) waste if treated through maceration to particle sizes of less than 25mm.

sludge from the sewage treatment plant will be chlorinated in an effluent tank and discharged to the Cilamaya irrigation canal. The sludge will be sent to sludge thickener and then removed by licensed local hauler.

A small amount of solid waste will be removed from the screens in the wastewater treatment plant. Treated effluent is passed through series of mesh screens or equivalent to remove contamination prior to discharge. This waste will be periodically removed and sent to landfill.

An oil interceptor will also be used at the wastewater treatment plant to remove oil at times when the concentration exceeds 10 mg/l. The oil separator will be emptied periodically by vacuum tanker and sent for further processing at an appropriately equipped and licensed oil treatment facility.

Transmission Line

If maintenance of vegetation is required at the transmission line towers, CCGT site perimeter, within the CCGT site or along the pipeline route it is likely that these wastes will be left in situ to decompose naturally.

Substation

The substation will be operated by a total workforce of 76 persons. Domestic waste generated by the workers is estimated at about 50kg / day with an assumption that each worker generates a waste volume of 0.65 kg/day (Indonesian standard SNI – 19.3983.1995). This waste will be disposed periodically (weekly) at the local landfill site.

Any hazardous wastes generated at the substation will be stored on-site and collected periodically by licensed hauliers. It is not anticipated that hazardous wastes will arise in significant quantities at the substation during the operation phase.

During operation, the operating company is responsible for appropriate handling and waste disposal. The waste management shall be in accordance with the applicable guidelines and the WMP that will be developed by the Project.

The significance of potential impacts to waste infrastructure during the operation phase is assessed in **Table 8-87**.

Potential impacts would be limited to the locale of the Project area with the exception of some hazardous wastes that may require transportation to larger population centres to find appropriate disposal services, most likely to Jakarta.

Given the understanding of the available waste infrastructure in the Project area the sensitivity of the resource is considered to be medium. The magnitude of the impact is also considered to be medium based on the Project understanding of the wastes it will produce during its operation.

The impact significance has been assessed as **Moderate.**

Table 8-87 Assessment of Impacts on Waste Management

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

8.10.4.1 *Mitigation Measures, Management and Monitoring*

In order to reduce the impact significance to an acceptable level it is recommended that the Project builds upon the WMP created during the construction phase and extends it to apply to the operation phase.

The WMP will include:

- An inventory of the wastes anticipated by the Project;
- Identification of the disposal routes the Project plans to use for its waste in the operation phase;
- A programme of audit for the waste infrastructure and waste hauliers the Project intends to use;
- Site rules for waste management including segregation, storage and packaging requirements for each waste type;
- Mapping of waste facilities on site including distribution of waste receptacles at strategic locations aboard the FSRU, along the pipe line route, at the CCGT power station and the substation.

Further items to be included in the WMP are:

- An induction regime for Project staff highlighting the waste management system and how wastes are to be managed on-site;
- Provide bins for the segregation and proper storage wastes to minimise the potential releases to the environment or contamination of other materials;

- Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimise odour nuisance);
- Hazardous waste store should be segregated to avoid the co-storage of incompatible waste types;
- Store wastes in closed containers away from direct sunlight, wind and rain and systematically to allow inspection between containers to monitor leaks or spills;
- Ensure that storage areas have impermeable floors and secondary containment, of a capacity to accommodate 110% of the volume of the largest waste container; and
- Hazardous wastes will be disposed of by authorised third- party disposal contractors.

8.10.4.2 Assessment of Residual Impact

Formulation and execution of a satisfactory WMP will result in the impact from waste management reducing to **Minor** significance. Until such time as the WMP has been created and approved the impact significance will remain as **Moderate**.

8.11 LANDSCAPE AND VISUAL

8.11.1 Potential Sources of Impacts

Project activities that may have an impact on visual impact during the construction and operation phases include:

Construction Phase

Visual Impacts brought about by construction activities associated with the project will comprise:

- Clearing of vegetation associated with the establishment and construction of the pipeline corridor;
- Construction of the Jetty and access road;
- Preparation and construction works for the CCGT, Transmission Line supporting tower footings and Substation; and
- Construction lighting.

Access roads constructed by the project will be visual similar to those that already exist in close proximity to all Project areas.

Operations Phase

Visual impacts during the operational project phase will comprise:

- Jetty, above ground components of the pumping station;
- CCGT and associated lighting;
- New transmission lines; and
- Substation.

8.11.2 *Assessment and Approach*

There are no global standards or assessment requirements for visual assessment of infrastructure projects. This assessment does however respond to the requirements of *Performance Standard 3, Resource Efficiency and Pollution Prevention* of the IFC Guidelines. Performance Standard 3 seeks to avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities, where pollution includes visual impacts.

In the absence of firm guidance on which to prepare visual assessment, this assessment has therefore been prepared under ERM's Global ESHIA framework. This methodology has been applied to many infrastructure projects through the Asia Pacific region.

The significance of the impacts has been assessed using the approach and methodology as described in **Annex G.** The assessment methodology adopted for assessing the visual impact of the project is outlined below.

Define the Visual Components of the Project

Describe the key components of the Project that may contribute to visual impact during the construction and operation phases of the Project.

Establish study area /Viewshed

Define the study area for visual assessment of the Project.

Landscape Units and Sensitivity

Determine areas of visual sensitivity within the view shed and the ability of those areas to accommodate the visual change of the Project.

Seen Area Analysis

The Project is located in agricultural plains of Karawang and Bekasi Regencies of West Java, Indonesia. The landscape surrounding the Project is flat with little topographical relief, which may afford screening of the Project. It is therefore assumed that the Project is potentially visible throughout the viewshed the identified zones of visual influence.

Assessment of Publicly Accessible Viewpoints

The visual assessment of the Project is determined by considered a selection of viewpoints, which provide for the range of view angles, distances and settings towards the Project. Visual Impact Assessment is based on four criteria; visibility, distance, and landscape character & viewer sensitivity and viewer number.

- **Visibility:** Project visibility can be affected by intervening topography, vegetation and buildings.

- **Distance:** Visibility and scale of project infrastructure decreases as distance increases. This is considered by Zones of Visual Influence (ZVI) where an indication of impact based solely on distance is provided for.

- **Landscape character and viewer sensitivity:** The character of the landscape around the site and adjacent to the viewing location will influence the ability of the project changes to be absorbed within existing change. That is, a landscape such as farmland is considered of low sensitivity, whereby a pristine landscape such as a national park is considered highly sensitive. Similarly, a greater sensitivity to visual change is afforded to a residential area or township than that of an industrial landscape.

- **Number of viewers:** The level of visual impact decreases where there are fewer people able to view the Project. Alternatively, the level of visual impact may increase where views are from a recognised vantage point. Viewer numbers from a recognised vantage point would be rated as high.

The ratings of each criterion are not numerically based and cannot be simply added together and averaged to arrive at an overall rating. These four criteria need to be considered in the assessment of each viewpoint.

The overall effect of the Project at each viewpoint will be assessed by evaluating the value of each of those criteria, ranking those as being either low, moderate, or high, and subsequently making an assessment as to the overall effect by balancing each of those criteria.

Scale of Effects

The overall visual impact of the Project when assessed from each viewpoints will use the following scale of effects:

- ***Negligible*** – minute level of effect that is barely discernible over ordinary day to day effects.
- ***Low adverse effect*** – adverse effects that are noticeable but that will not cause any significant adverse impacts.
- ***Moderate adverse effect*** – significant effects that may be able to be mitigated/remedied.
- ***High or unacceptable adverse effect*** – extensive adverse effects that cannot be avoided, remedied or mitigated.

A detailed description of the scale of effects is provided in **Annex G** of the technical report.

Mitigation Measures for Publicly Accessible Viewpoints

Landscape mitigation can positively contribute to visual impacts from sensitive viewing locations by screening or filtering views the Project, thereby reducing the visual impact.

8.11.3 Assessment of Impacts – Construction Phase

Major construction activities will include:

- Clearing of vegetation;
- Excavation and general earthworks (including topsoil stripping, excavation, filling, topsoil spreading and rehabilitation works);
- Building construction;
- Drainage installation (including, where required, measures to protect water quality and groundwater flows);
- Power connection;
- Equipment fabrication and installation; and
- Landscaping and rehabilitation of redundant construction areas.

The major areas that will be visible would be the earthworks and temporary structures such which may include material stockpiles, laydown areas and concrete batching plants.

There are no landscape techniques that can be employed to mitigate the visual impacts associated with the construction of the Project. However best practice construction management would be employed to maintain construction areas to the minimum required.

Construction Impacts, although highly visible, will be relatively short in duration and will cease following commissioning of the Project.

The overall magnitude of this impact is therefore **Small**, resulting in a **Negligible** impact significance.

Table 8-88 Assessment of Visual Impacts on Landscape during Construction

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

8.11.3.1 Mitigation Measures, Management and Monitoring

Given the impact significance is low, no further mitigation is needed for visual impact of construction activities.

8.11.3.2 Assessment of Residual Impact

The overall visual impact of the Project, that is a balanced consideration of the visual criteria of distance, viewer number and landscape sensitivity are considered, would be **Minor**.

8.11.4 Assessment of Impacts – Operation Phase

The Project will be located within an "Agricultural Plain" that is flat and with little topographical variation. This landscape type is one that has a low sensitivity to visual change and is one that can accommodate the visual change proposed by the Project.

The landscapes within the project viewshed are not rare or unique. There are no protected areas or landscapes that would attract a high level of visual sensitivity in the region, particularly the beaches running along the water's edge.

The landscape is bisected by many roads and tracks which provide access between villages and towns throughout the region. These roads area largely elevated above the surrounding agricultural plains and are punctuated by roadside vegetation. When travelling along many roads, this vegetation filters or screen views to the surrounding landscape and towards the proposed project. Views from these areas are over a highly modified landscape that, in many instances already includes infrastructure. For these reasons the overall visual impact from roads and tracks would be **Minor**.

There are approximately 35 villages within the area that, based on distance and the Zones of Visual Influence have the potential to have a high level of visual impact. The visual assessment determined that for the majority of views from within villages to the surrounding landscape and the Project are filtered or screened by buildings, structures and vegetation within the villages. Further, many views from these areas already include infrastructure such as power poles, lights or towers.

Due to the existing screening afforded from many areas within villages, views over a landscape that has a low sensitivity to visual change and the inclusion of infrastructure in these views the visual impact from many of these area would be **Minor**.

Table 8-89 Assessment of Visual Impacts on Landscape during Operations

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

8.11.4.1 Mitigation Measures, Management and Monitoring

Landscape planting is a suitable mitigation option for sensitive viewing locations such as residential properties or fixed viewpoints.

Planting may be designed to either screen or significantly reduce the visual dominance through filtering. For viewing locations where a high or un-acceptable level of visual impact may occur that has not been identified by this assessment, this assessment has also determined that landscape mitigation and screening would assist to reduce these impacts.

8.11.4.2 Assessment of Residual Impact

The overall visual impact of the Project, that is a balanced consideration of the visual criteria of distance, viewer number and landscape sensitivity are considered, would be **Minor**.

8.12 MARINE WATER QUALITY

8.12.1 *Potential Sources of Impacts*

Project activities that may have an impact on seawater quality include:

- Temporary decline in water quality as a result of earthworks, piling and backfilling activities and silt-laden surface runoff;
- Discharge of hydrotest during pre-commissioning of the offshore pipeline;
- Discharge of wastewater generated from the FSRU and other vessels;
- Operational Discharge of Process Cooling Water from FSRU and CCGT Power Plant to the sea; and
- Alteration of coastal processes and sedimentation from presence of the jetty.

8.12.2 *Assessment Approach and Criteria*

The legal framework and applicable guidelines of relevance to seawater quality is listed below:

- *World Bank IFC EHS Guidelines for Ports, Harbors and Terminals, 2017;*
- *World Bank IFC EHS Guidelines for Liquefied Natural Gas Facilities, 2017*; and
- *World Bank IFC EHS Guidelines for Offshore Oil and Gas Development, 2015*; and
- *International Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1978 (MARPOL 73/78*).

The criteria for sensitivity and magnitude of the impact to seawater quality are defined in **Table 8-90** and **Table 8-91**.

Table 8-90 Sensitivity Criteria for Seawater Quality

Sensitivity	Definition
Low	• Existing water quality is good and the ecological resources that it supports are not sensitive to a change in water quality
Medium	• Existing water quality show some signs of stress and/ or supports ecological resources that could be sensitive to change in water quality
High	• Existing water quality is already under stress and/ or the ecological resources it supports are very sensitive to change

Source: ERM, 2012a

Table 8-91 Magnitude Criteria for Impacts to Seawater Quality

Magnitude	Definition
Negligible	• No discernible changes in water quality or changes considered within the range of natural fluctuations.
Small	• Slight change in water quality expected over a limited area with water quality returning to background levels within a few metres; and/ or • Discharges are well within benchmark effluent discharge limits.
Medium	• Temporary or localised change in water quality with water quality returning to background levels thereafter; and/ or • Occasional exceedance of benchmark effluent discharge limits.
Large	• Change in water quality over a large area that lasts over the course of several months with quality likely to cause secondary impacts on marine ecology; and/ or • Routine exceedance of benchmark effluent discharge limits.

Source: ERM, 2012a

Note a detailed assessment of impacts on salt and fresh water fish is presented in *Chapter 9* from a livelihoods perspective.

8.12.3 Assessment of Impacts - Degradation of Marine Water Quality from Surface Water Run-Off to Seawater from Coastal Preparation and Construction Works

Earthworks, piling and backfilling activities will be conducted at the jetty area. This has the potential to result in an increase of surface water run-off from exposed soil and stockpiles on land, particularly following heavy rains, which could have potential impacts to adjacent water bodies including the adjacent creek and seawaters.

Surface run-off from the Project area could contain high levels of suspended sediments (SS). It may also contain contaminants washed out during rainstorms such as from accidentally spilled fuels (e.g. petroleum, gasoline and waste oil) or leaks from machinery (e.g. lubricants). Accidental spills are addressed in non-routine/unplanned events in **Chapter 10**.

8.12.3.1 Impact Evaluation and Significance

Intertidal seawater quality monitoring was conducted at six (6) locations within the vicinity of seawater intake and outfall facilities (*ERM, 2017*; *IEE, 2016; Pöyry, 2016b*). Additionally, 11 seawater samples were analysed. This includes four (4) surrounding the FSRU location, two (2) along the pipelines and five (5) within the vicinity of Project area. Relatively high turbidity was recorded at the survey locations and an exceedance against the Indonesian Standard was recorded.

The chemical analysis results indicate a high influence of organic matter on nearshore water quality. This is likely to be attributed to discharges from nearby rivers and streams. Total Organic Matter (measured by BOD_5) exceeded the quality standard at all sampling sites with significant exceedances measured at most locations. Other exceedances for parameters such as

Ammonia and Nitrates were also recorded (*ERM, 2017; IEE, 2016; Pöyry, 2016b*). Exceedances in many cases (such as for Oil & Grease, Zinc and Copper) were significant.

Seawater plankton monitoring was also conducted at six (6) locations. The index based on diversity ranged from < 0.6 and indicated that the waters around the proposed Project site indicate heavily pollution (*Pöyry, 2016b*).

There will be periods when heavy rains occur during land clearing activities and may occur before erosion mitigation measures have been implemented. At such times, surges of highly turbid water may drain into the adjacent river and directly into the onshore and nearshore environment adjacent to the construction sites. Eroded soil may impact water resources by reducing water quality through increased TSS and potentially causing elevated siltation of aquatic habitat marine species. As such, site clearance is expected to result in temporary or localised change in water quality, short-term elevation of suspended solids and potential increased concentrations of contaminants in the receiving waters.

The sensitivity of degradation of marine water quality from surface water run-off to seawater from land clearing and preparation works is considered to be **Medium.** The magnitude of effect due to surface water run-off to seawater from land clearing and preparation works is likely to be **Medium** due to the exceedances of quality standards of the measured seawater quality (turbidity, organics, ammonia, phosphate and nitrates), and the impacts of surface run-off will contribute only a small amount to the existing water quality.

The overall significance of this impact is therefore **Moderate** for seawater quality from surface water run-off to seawater from land clearing and preparation works.

Table 8-92 Assessment of Impacts Seawater Quality from Surface Water Run-Off to Seawater from Land Clearing and Preparation Works

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

8.12.3.2 *Mitigation Measures, Management, and Monitoring*

It is recommended that the following mitigation measures be applied in relation to seawater quality from surface water run-off to seawater from land clearing and preparation works:

- Stockpiles to be separated into topsoil and sub-soil and be located at least 10 m from any surface water source and groundwater well or 50 m from Cilamaya canal;

- Construction of drainage ditches and retention ponds to collect water run-off to reduce flows.

- Develop a Construction Sediment and Erosion Management Plan including erosion control measures such as limitation of gradients on earthworks, installation of sediment traps along water drainages including silt fences, and vegetation traps, sediment barriers and geotextile curtains.

- Prompt temporary or permanent stabilisation and reinstatement of earthwork areas will be conducted to reduce the amount of exposure time and manage potential for wind/water erosion impacts leading to loss of sediment and potential entry into water courses.

8.12.3.3 Assessment of Residual Impact

In view of the implementation of mitigation measures, the residual impact to seawater quality is expected to be **Minor.**

8.12.4 Assessment of Impacts - Degradation of Marine Water Quality from Pipeline Hydrotest Dewatering

Discharge of hydrotest water will occur during the offshore pipeline pre-commissioning. Prior to commissioning, the structural integrity of the subsea pipeline will be determined using a hydrostatic pressure test (hydrotest), in which the pipelines are filled with seawater i.e. approximately 10,000 m^3, pressurised above the intended operating pressure and monitored for leaks or pressure loss over a specified time period. Additives such as oxygen scavengers and biocides will be added as a preventative measure to control the risk of potential corrosion and microorganism growth in the pipes.

Chemical selection will be based on environmentally-friendly chemicals within the recommendations of the ESDM Ministry. The proposed chemical for use as a biocide is Tetrakis (Hydroxymethyl) Phosphonium Sulphate (THPS). THPS is a water-soluble, degradable, non-accumulative component, which has low toxicity, in addition to being water-soluble.

The seawater used in a hydrostatic test is ±10,038 m^3 for seawater supply pipe of 1 m in diameter. A total of seawater of ±4.148 m^3 is used for supply pipes and seawater discharge pipe of 1.0 m and 0.9 m in diameter. Dosage will be calculated based on materials supplier guidelines but example dose rates for hydrotest purposes recommended by the manufacturer are 67 to 667 ppm, (depending on water quality and test duration).

After a test is completed, the pressure is released and the pipelines dewatered by pushing a 'pig' device through the line. During dewatering, the pig will push the water from the ORF to the offloading platform; water will be dispose of to the Java Sea at the FSRU.

8.12.4.1 *Impact Evaluation and Significance*

The discharge of hydrotest water may cause acute toxicity to marine biota in the immediate surrounds of the discharge, if exposed to toxic concentrations over time. Biocide is the predominant chemical of concern as it is identified as having the highest toxicity to marine receptors (INPEX 2010). Excluding biocide from hydrotest water is not feasible given the need to limit activity of corrosion inducing microbial and bacterial micro-organisms in the water to preserve long-term pipeline integrity.

THPS is a water-soluble, degradable, non-accumulative component, which has low toxicity, in addition to being water-soluble. The US EPA ratified it in 1995 with zero toxicity and awarded it with US Green Chemical prize due to its properties of high efficacy and low toxicity.

In the UK North Sea, THPS is ranked as Gold (lowest hazard of toxicity hazard rating) under the Offshore Chemical Notification Scheme (OCNS) list of notified and ranked products[1]. The OCNS requires bioaccumulation and biodegradation data, and aquatic toxicity data from three trophic levels (algae, crustacea and fish) to predict the potential ecosystem risk and, in turn, rank the product by Hazard Quotient (HQ). The OCNS uses the Chemical Hazard and Risk Management (CHARM) model to calculate the ratio of Predicted Effect Concentration against No Effect Concentration (PEC:NEC). This is expressed as a Hazard Quotient (HQ), which is then used to rank the product. Products ranked as Gold are permitted for controlled discharge.

THPS is reported to rapidly break down in the environment through hydrolysis, oxidation, photodegradation, and biodegradation; with the degradation products shown to possess a relatively benign toxicology profile. Furthermore, THPS does not bioaccumulate and therefore, offers a much-reduced risk to higher life forms[2].

The significance of impacts associated with hydrotest dewatering is presented in **Table 8-93**. Dispersion of hydrotest water, similar in density to seawater, is expected to be rapid, minimising the potential for longer-term exposure effects. The sensitivity of marine water quality from pipeline hydrotest dewatering is considered to be **Medium**.

[1] https://www.cefas.co.uk/cefas-data-hub/offshore-chemical-notification-scheme/

[2] https://www.epa.gov/greenchemistry/presidential-green-chemistry-challenge-1997-designing-greener-chemicals-award

Any toxicity effects from the discharged pollutants typically only impact on marine biota that happen to travel or remain entrained within the discharge plume for an extended period (INPEX 2010). The magnitude of effect due to pipeline hydrotest dewatering is likely to be **Small** as the effect will not cause any long-term change in water quality and any effects on marine biota would only occur if exposed to toxic concentrations over time.

The overall significance of the impact of pipeline hydrotest discharge on water quality is therefore **Minor**.

Table 8-93 Assessment of Impacts on Marine Water Quality from Pipeline Hydrotest Dewatering

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

8.12.4.2 *Mitigation Measures, Management and Monitoring*

The following mitigation measures are required:

- Chemicals used in hydrotesting will be selected with consideration for their potential ecotoxicity and will use the lowest toxicity practicable for preserving pipeline integrity

8.12.4.3 *Assessment of Residual Impact*

The residual impact to water quality from the discharge of pipeline hydrotest water is considered to remain **Minor**.

8.12.5 *Assessment of Impacts - Degradation of Marine Water Quality from Wastewater and Process Cooling Water Discharges from the CCGT Power Plant Outflow Pipeline during Operations*

Wastewater will be produced at the CCGT Power Plant and discharged to sea. The wastewater will be a combination of water from the Waste water treatment System (WWTS) (equipped with oil separator, neutralisation pond, and normal waste holding pond) which receives waste from WTP and the main boiler process; the Sewage Treatment Plant (STP) and the cooling water from the cooling tower blowdown.

The discharge point will be located 1 km from shore, releasing the water 0.5 m above the seabed. Processed products are parameters of pH, free chlorine, zinc (Zn), Phosphate, BOD, COD, TSS, oil-fat, ammonia and total coliform.

However, free chlorine and COD parameters are not present in the seawater parameters. Zinc and ammonia are not waste parameters of Power Plant in accordance with the water balance. Discharges will be treated to ensure parameters meet IFC and Indonesian discharge standards with inline meters incorporated into the system design to ensure monitoring and compliance. A comparison against applicable IFC and Indonesian effluent standards is provided in Annex A. As such the Project will be in compliance and effluents subject to applicable discharge standards are not discussed further.

For parameters of temperature and salinity however, consideration is given to baseline conditions in the receiving environment and this is further discussed below.

8.12.5.1 *Temperature of Cooling Water Discharge from Power Plant*

Elevated seawater temperatures have the potential to cause alteration of the physiological processes (especially enzyme mediated processes) of exposed marine biota (*Wolanski, 1994*). These alterations may cause a variety of effects, ranging from behavioural response (including attraction and avoidance behaviour), minor stress and potential mortality for prolonged exposure.

The applicable IFC standard for thermal power plants states that thermal discharge should be designed to ensure that discharge water temperature does not result in exceeding relevant ambient water temperature standards outside a scientifically established mixing zone[1]. The guidelines go on to state that the effluent should result in a temperature change of no more than 3°C at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors, and assimilative capacity. The mixing zone may be established by local regulatory agencies or through the project's EA process.

Under Indonesian legislation, *Appendix III Decree of the Minister of Environment and Forestry No.51 Year 2004 Sea Water Quality Standards for Marine Biota* establishes a limit of ± 2°C temperature change from baseline value, but does not establish a distance for this to be achieved. Threshold temperature ranges for specific habitats are also defined within the Indonesian standards as:

1. Coral Reef: 28-30°C;

[1] https://www.ifc.org/wps/wcm/connect/9a362534-bd1b-4f3a-9b42-a870e9b208a8/Thermal+Power+Guideline+2017+clean.pdf?MOD=AJPERES

A mixing zone is an established area where water quality standards can be exceeded as long as acutely toxic conditions are prevented and all beneficial uses, such as drinking water, fish habitat, recreation and other uses are protected.

Mixing zone boundaries are usually determined through a mass-balance or mathematical modelling approach. Mass-balance calculations essentially involve defining the effective volume of the receiving water and calculating the amount of a substance that can be discharged into that volume to achieve a desired concentration.

2. Mangrove 28-32°C; and
3. Seagrass: 28-30°C.

It is noted that no seagrass was found during the baseline surveys of the project location. The intertidal zone contains mangrove habitats and the closest coral structures are approximately 5 km from the outfall pipeline.

Where a scientifically established mixing zone is not defined, 100 m from the point of discharge is commonly accepted as a representative distance and has been applied by IFC.

An effluent dispersion model was undertaken using the predicted Project discharges. The main purpose was to verify that the intake/outfall positions were optimised with respect to the following criteria:

- Potential recirculation is minimised and quantified; and
- Proper mixing of the discharge in order to ensure compliance with relevant environmental standards.

The model had the following data inputs:

- Hydrodynamic model presented in the environmental setting;
- The modelling assumed the power plant will be operating continuously at 100% load, considered a conservative view given the expected load for the CCGT will be 60%;
- To reduce the increase of temperature from the cooling towers blowdown, wastewater will be taken from the cool side of the towers;
- Waste water discharge of 3,761 tons/hour;
- Outfall temperature of 32°C;
- Ambient sea water temperature of 29.56°C~29.5°C; and
- Applicable standard of 27.56°C -31.56°C (using upper range of baseline) based on Indonesian regulation of ± 2°C temperature change and no more than 32.56°C under the IFC effluent guidelines.

The distribution of the heated wastewater of the Power Plant was modelled over a 1 year period to using west and east seasonal conditions. The calculation of the impact magnitude is derived from the environmental conditions when the activity takes place (model results) minus the baseline environmental setting at point sampling coordinates. The impact magnitude of the modelling results is presented in **Table 8-94**. Based on an average plot of the outfall to 1 km from the northwest, southeast and north during the west and east seasons, it is shown that at 100 m, the temperature of the heated wastewater discharge has met the thermal standard from the IFC EHS Guidelines for Thermal Power Plants and the more stringent Decree of the Minister of Environment No. 51 Year 2004 on Sea Water Quality Standards for Marine Biota, as presented in **Figure 8-22** to **Figure 8-25**.

Table 8-94 Modelled Impact Magnitude of Seawater Temperature Increase from the Water Cooling System of Power Plant Operations

Locations	Temperature (°C)		
	Baseline Environmental Setting (°C)	Impact Magnitude (°C)	Resultant Environmental Condition (°C)
MW7 6°8' 24.972" S 107°39' 31.039" E	29.4	0	29.4
MW8 6°11' 43.114" S 107°46' 1.082" E	28.6	0	28.6
MW9 (river mouth) 6°12' 42.798" S 107°38' 43.760" E	29.6	0	29.6
MW10 (river mouth) 6°11' 17.579" S 107°37' 41.734" E	30.3	(+)1.26	31.56
MW11 6°10' 29.186" S 107°37' 58.171" E	29,3	0	29,3
MW12 6°11' 8.187" S; 107°38' 58.241" E	29.1	0	29.1
MW13 (Pipeline 1) 6°11' 3.045" S 107°40' 55.203" E	28.9	0	28.9
MW14 (Pipeline 2) 6°9' 32.545" S 107°42' 31.316" E	29	0	29
MW15 (FSRU Outlet) 6°8' 8.738" S 107°44' 34.104" E	28.7	0	28.7
MW16 (LNG-FSRU) 6°9' 6.069" S 107°44' 37.908" E	28.5	0	28.5
MW17 6°10' 29.291" S 107°38' 42.672" E	28.9	0	28.9
MW7 6°8' 24.972" S 107°39' 31.039" E	29.4	0	29.4

Locations refer to the sampling stations as illustrated in Chapter 7 and described in Annex B Environmental Baseline Surveys Results

The modelling result of magnitude size of the increase in seawater temperature impact from the heated wastewater disposal is presented in **Table 8-95**.

Table 8-95 Area of Impact Magnitude of the Highest Temperature Increase from Water Cooling System of Power Plant Operations Activities

Season	High Tide	Low Tide	Average
West	0.98 km^2 dominant direction to the northwest	0.61 km^2 dominant direction to the northwest	0.80 km^2 dominant direction to the northwest
East	0.71 km^2 dominant directions to the northwest and southwest	0.67 km^2 dominant directions to the northwest and southwest	0.69 km^2 dominant directions to the northwest and southwest

Figure 8-22 Average Temperature of Seawater in West Season by Distance from the Discharge Point

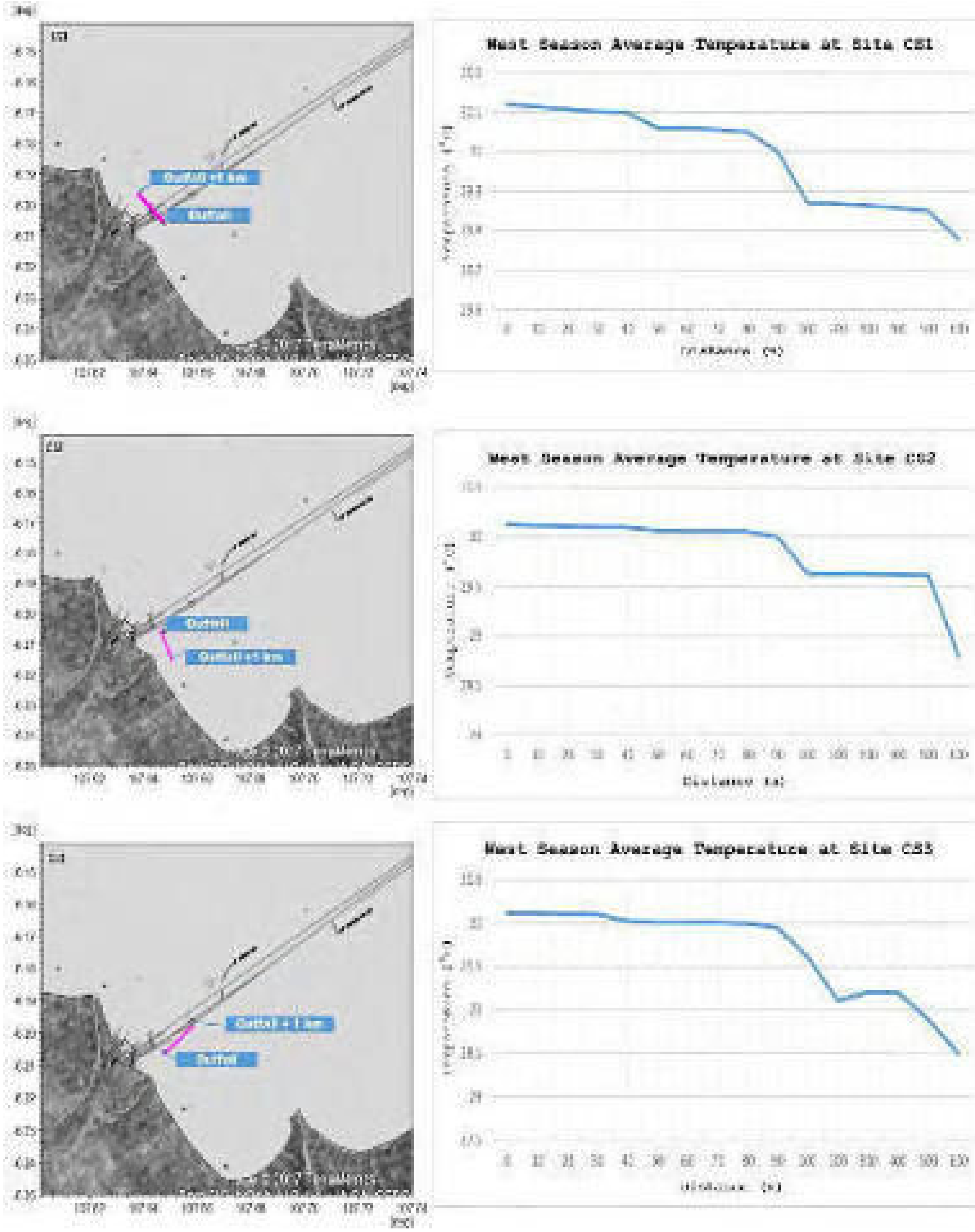


Figure 8-23 Average Temperature of Seawater in East Season by Distance from the Disposal Point

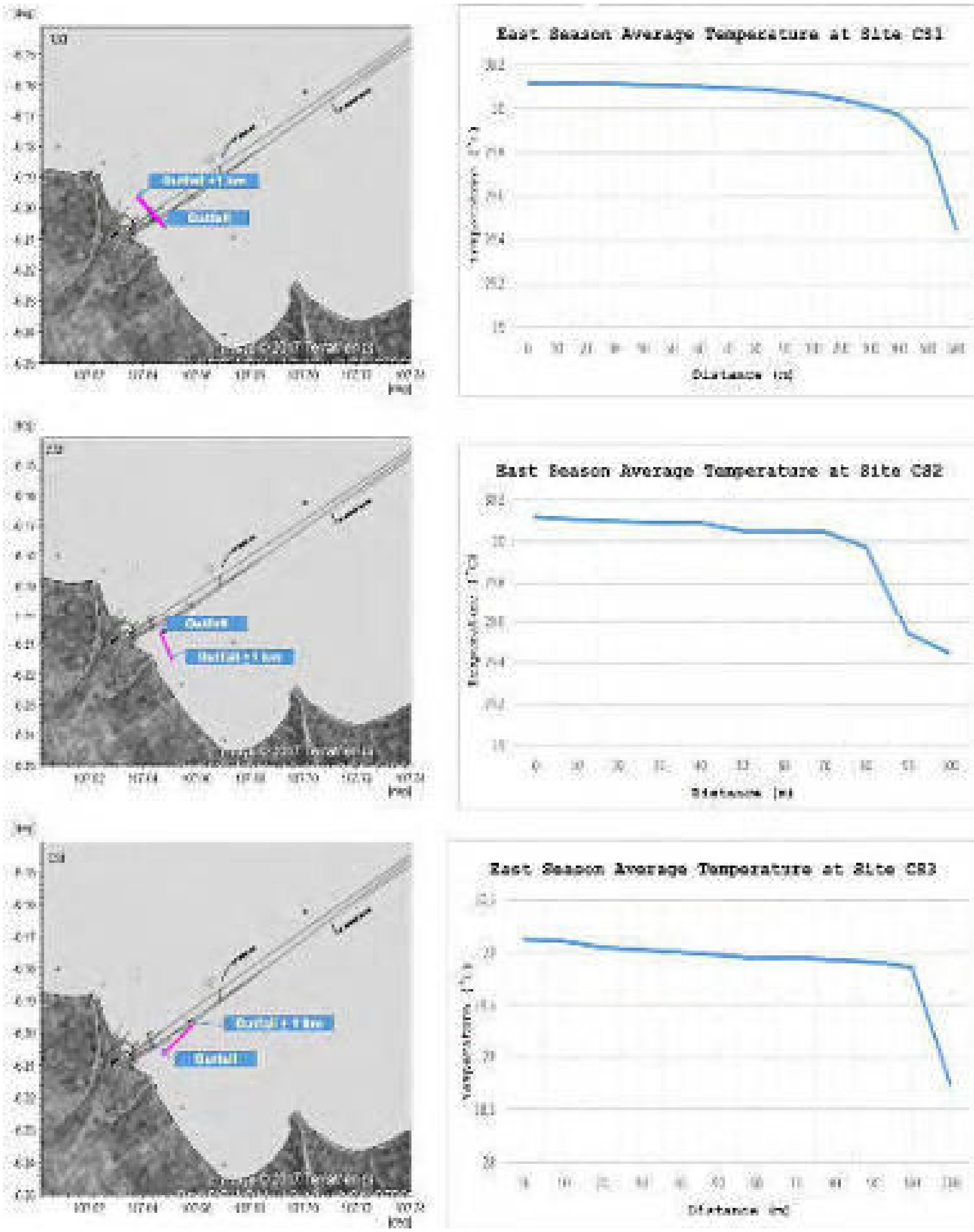


Figure 8-24 Modelled Distribution of Power Plant Heated Effluent West (wet) Season

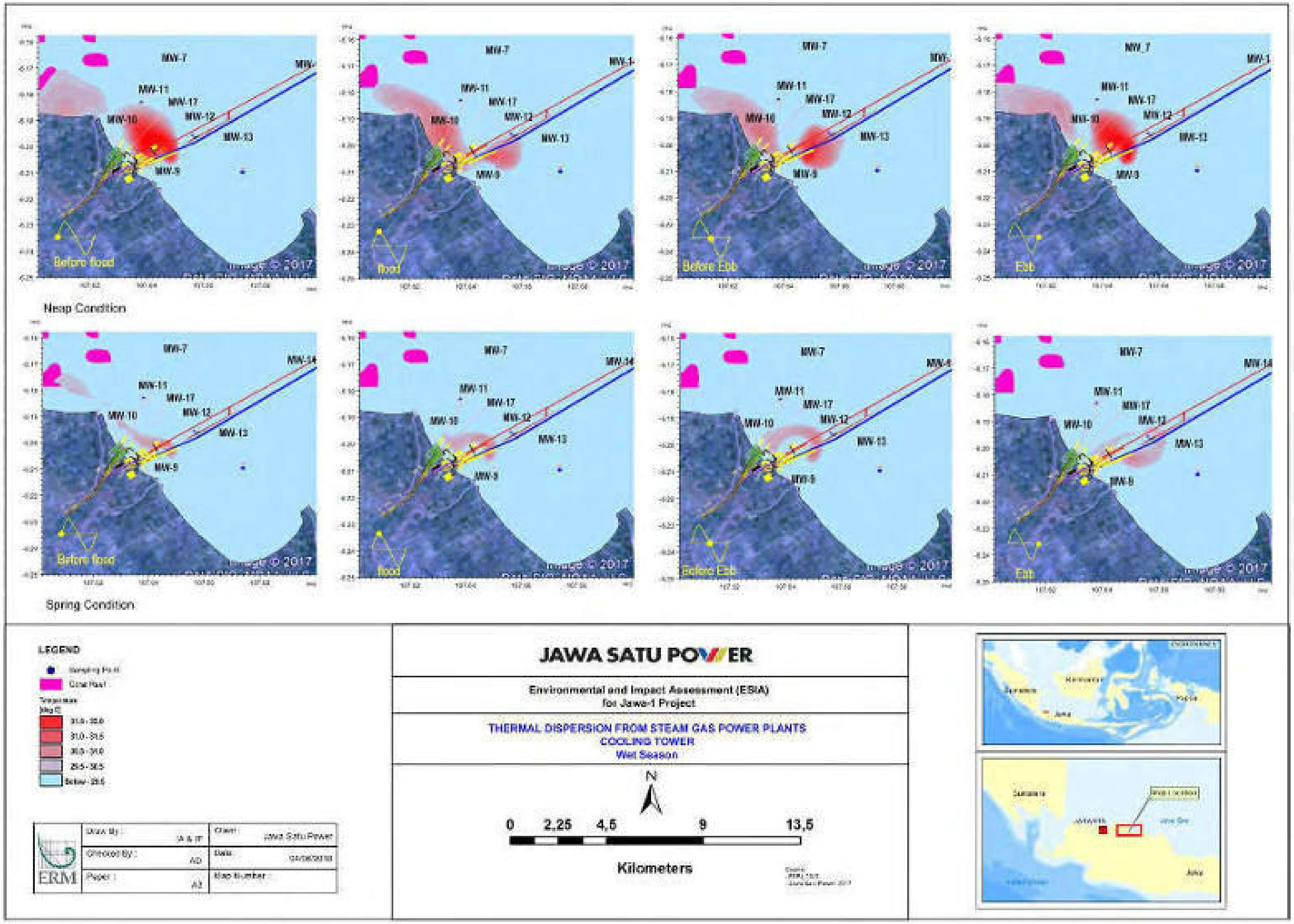
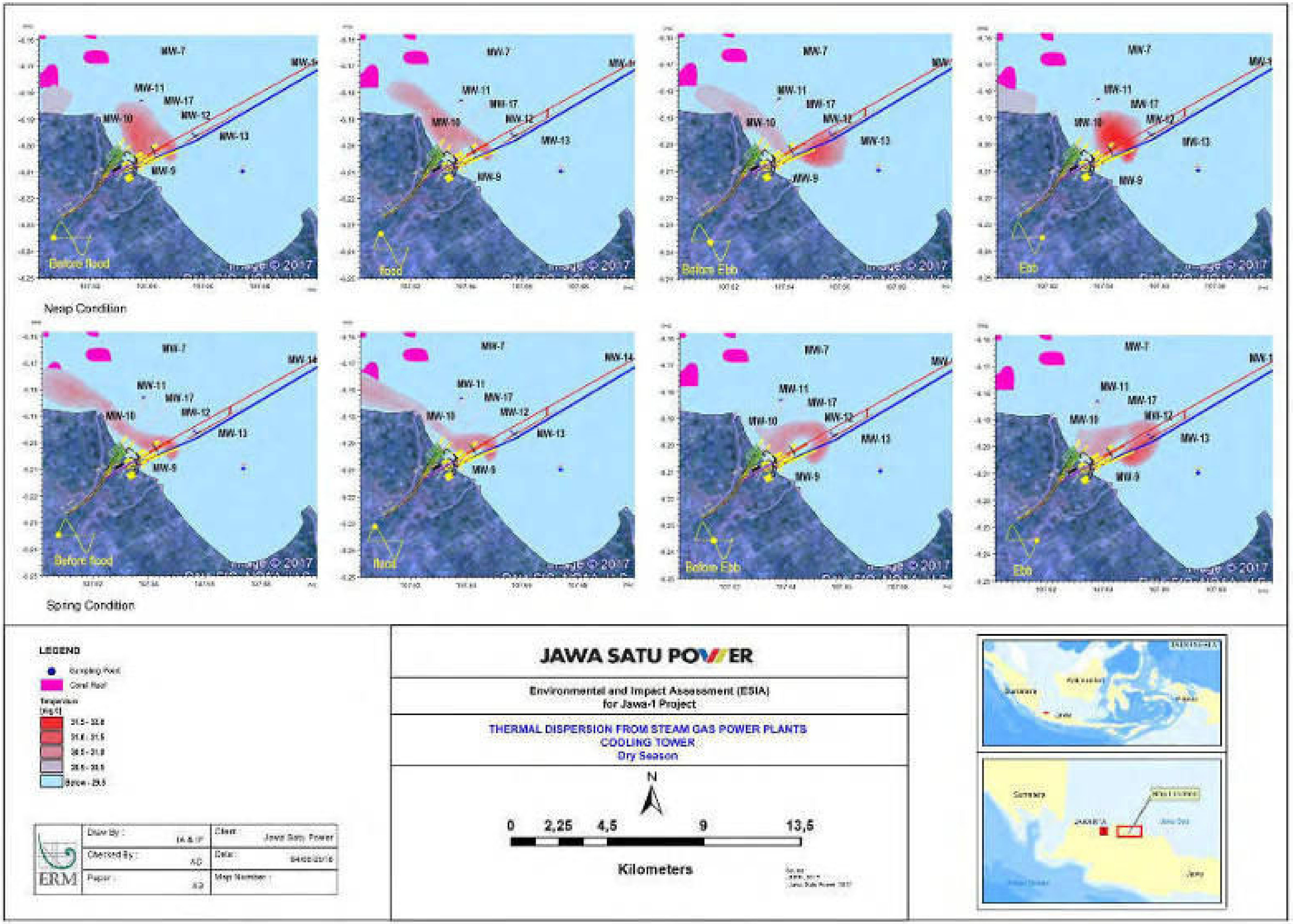


Figure 8-25 Modelled Distribution of Power Plant Heated Effluent East (dry) Season



8.12.5.2 *Salinity*

The discharge of the Power Plant cooling water has the potential to elevate salinity in the receiving waters which if sufficient can decrease seawater quality and impact marine biota. Marine species have an ability to tolerate variations in salinity and this is judged to be the case in the project area as salinity is influenced by fresh water discharge from the irrigation channels and canal, albeit with the potential to lower salinity during high discharge events.

The baseline environmental condition of seawater salinity measurement in the Project location in 2018 ranged from 30-32‰ with the closest samples with data being stations MW19 (31‰) and MW20 (30‰). The nature and extent of increased salinity on habitats and marine flora and fauna is dependent on the salt tolerance of those species. Habitats such as seagrass for example are known to be sensitive to salinity changes, whereas mangroves typically inhabit intertidal zones where salinity is variable due to tidal influences.

Blowdown from the cooling towers contributes the largest component of wastewater from the project. The cooling tower blowdown effluent is basically seawater, with increased salinity. To reduce the salinity of cooling tower blowdown waters, the maximum cycle of concentration in the system will be limited to a 1.4 ratio. That is, based on the seawater intake salinity of 31‰, cooling tower discharge water will have a maximum salinity of 43.4‰.

There are no applicable IFC or Indonesian regulatory effluent discharge limits for salinity for thermal power stations. MoEF Decree no. 51 Year 2004 Annex III for aquatic biota does specific a salinity condition of 33-34‰ and this has been used as the basis to assess potential impact, with consideration of the coral habitats located approximately 5 km away from the discharge location.

There is a range of published research on the impacts of increased salinity in marine environments from desalination plants. For the Power Plant effluent however, effluents are mixed from al discharge sources. The cooling water thermal discharge is more buoyant than the ambient sea water because of its elevated temperature and the discharge tends to float to the ocean surface. The elevated salinity in the discharge is less buoyant which causes the effluent to sink. The result of these combined factors in the heat and salinity dissipation process accelerates the effluent mixing and blending into the ambient seawater[1]. This mixing is enhanced by the discharge of the effluent through a diffuser placed on the end of the outfall pipeline.

To obtain the magnitude of impact, modelling of seawater salinity distribution from the wastewater disposal of the Power Plant cooling system operations was conducted using a 2D transport module with data inputs as follows:

[1] https://watereuse.org/wp-content/uploads/2015/10/Seawater_Concentrate_WP.pdf Watereuse Association Desalination Committee. Seawater Concentrate Management White Paper, May 2011

1. Hydrodynamic model presented in the environmental setting;
2. Intake seawater salinity: 31‰
3. Cooling water tower outlet salinity: 43.4‰; and
4. Wastewater discharge: 3,761 tons/hour.

Salinity distribution of the Power Plant wastewater disposal was simulated for a period of 1 year to obtain samplings representing west and east seasons. The calculation of the impact magnitude is derived from the environmental conditions when the activity takes place (model results) minus the baseline salinity of seawater. The impact magnitude of the seawater salinity increase is 0.78-1.98‰ at a radius of <600 m. The impact magnitude is presented in **Table 8-96.**

Table 8-96 Impact Magnitude on Salinity Increase from the Cooling Towers Activities

Location	Salinity (PSU)		
	Environmental Setting	Impact Magnitude (Increased Salinity)	Resultant Environmental Condition (°C)
MW9 (river mouth 2) 6°12' 42.798" S 107°38' 43.760" E	31	0.89	31.89
MW10 (river mouth 2) 6°11' 17.579" S 107°37' 41.734" E	31	1.98	32.98
MW11 6°10' 29.186" S 107°37' 58.171" E	31	1.03	32.03
MW12 6°11' 8.187" S 107°38' 58.241" E	31	1.67	32.67
MW13 (Pipeline 1) 6°11' 3.045" S 107°40' 55.203" E	31	0.87	31.87
MW17 6°10' 29.291" S 107°38' 42.672" E	31	0.78	31.78

Locations refer to the sampling stations as illustrated in Chapter 7 and described in Annex B Environmental Baseline Surveys Results

The size of impact distribution based on the simulation results of salinity increase due to the Power Plant wastewater disposal is presented in **Table 8-97**. The simulation results are provided in **Figure 8-26** and **Figure 8-27**.

Table 8-97 Size of Impact Magnitude on the Salinity Increase from the Effluent Discharge

	High Tide	Low Tide
West Season	9.6 km^2 to the northwest	7.3 km^2 to the northwest
East Season	10.2 km^2 to the northwest	8.1 km^2 to the northwest

According to Kinsman (1964) in Supriharyono (2007) and Pangaribuan et al. (2013), coral reef growth at the optimum salinity range of 25 – 40‰.

Based on the model transport of the salinity, concentration of dispersion salinity between 31-34‰. Overlayed with the location of coral reef, the salinity at the coral reef area is between 31-33.5‰ which meets the standard regulation MoEF Decree no. 51 Year 2004 Annex III for aquatic biota (33-34‰).

Figure 8-26 Distribution of Salinity Based on Distance in West Season and East Season

MW

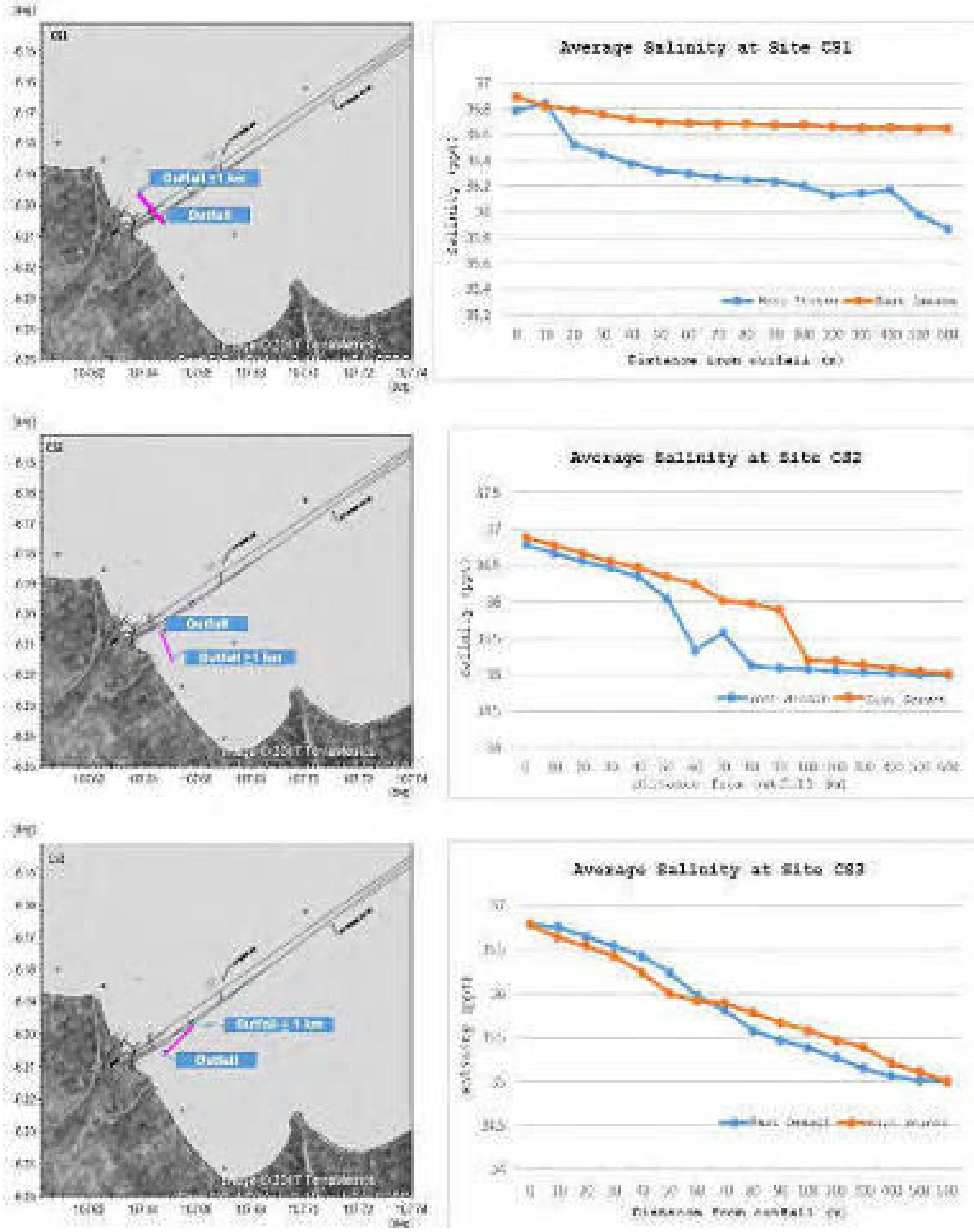
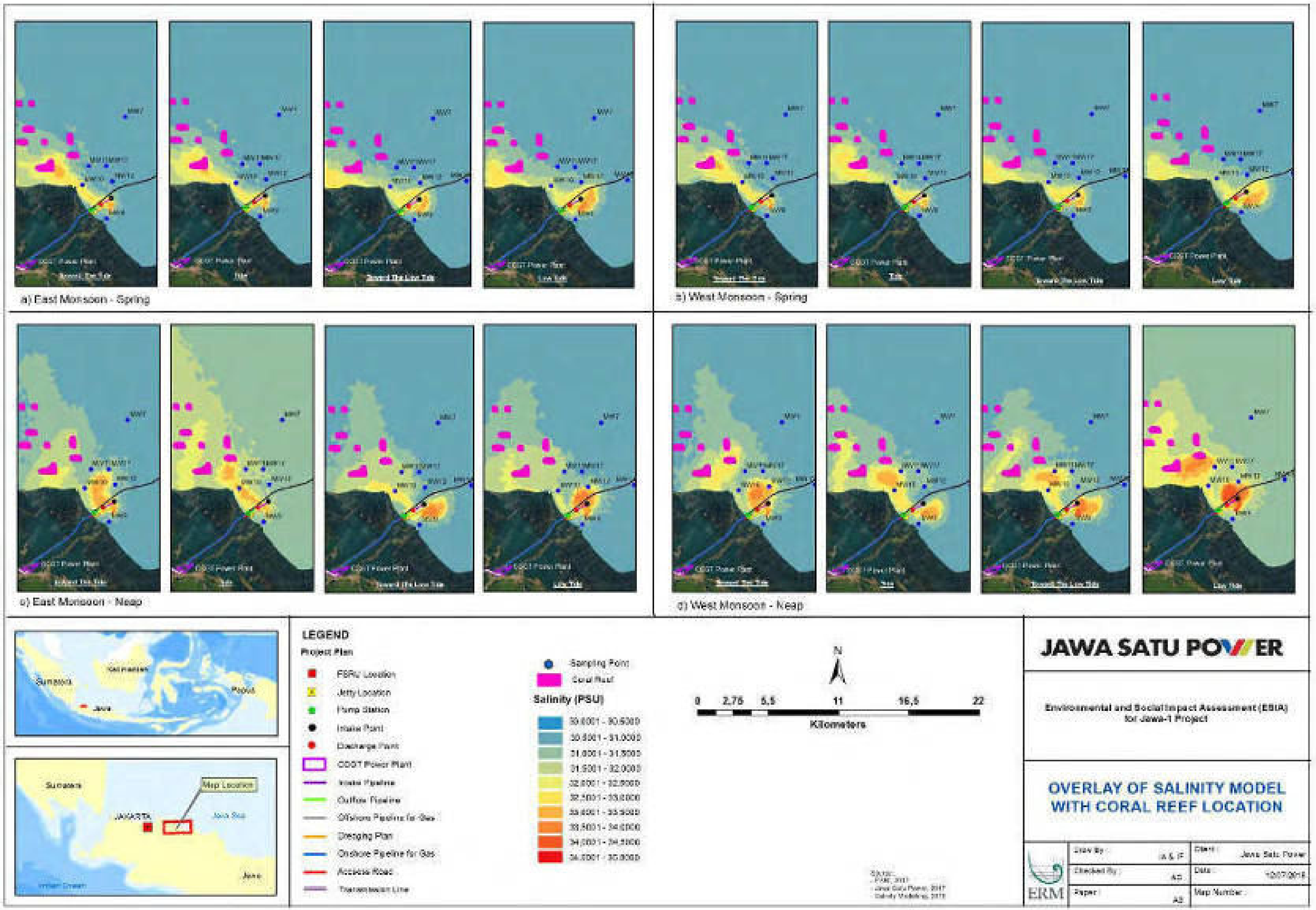


Figure 8-27 Distribution of Salinity Based on Distance from Discharge



8.12.5.3 *Impact Evaluation and Significance*

The Project will comply with IFC EHS Guidelines for wastewater discharge and Indonesian waste water quality, namely *The Decree of the Ministry of Environment No. 8 of 2009 (Waste Limits of Thermal Power Plant).*

The potential for thermal impacts and associated reduction in oxygen is limited due to the rapid reduction in temperature in receiving water and localised affected area in addition to the fact that only marine biota that happen to travel or remain entrained within the discharge plume for an extended period of time could be impacted by the discharge.

Most marine species are able to tolerate short-term fluctuations in salinity of 20-30 % (*Walker and McComb 1990*). Therefore, it is expected that any pelagic species (including marine mammals, marine reptiles, fish, sharks and rays) passing through the plume would not experience any adverse effects.

Research on the management of brine discharges to coastal waters reviewed extensive literature on the toxic effects of concentrates. The research notes that effects of desalination concentrate vary widely, depending on the organism, site, the biotic community at the site, the nature of the concentrate, and to what degree it is dispersed, with some benthic infaunal communities tolerant of effects of up to 10‰ increases, while others are affected by increases of only 2-3‰. None of the studies reviewed in that research indicated any impacts of elevated salinity levels less than 2-3‰[1]. The research mentions the preferred methods of discharge are from a multiport diffuser for "raw" effluents, or co-disposal with power plant cooling water or domestic wastewater that results in significant in-pipe dilution, which can be discharged via either a shoreline surface discharge (if positively buoyant) or through an existing multiport diffuser. This is the design case for the Power Plant effluent discharge.

Modelling shows that increased temperature and salinity effects from the Power Plant effluent discharge meet applicable standards. For temperature, this is less than 2°C within 100m from the outfall, meeting the IFC standard of no more than a 3°C elevation and *Appendix III Decree of the Minister of Environment and Forestry No.51 Year 2004 Sea Water Quality Standards for Marine Biota* of ±2°C temperature change from baseline value. For salinity, modelled increases are less than 2‰ which results in salinities less than the standard regulation MoEF Decree no. 51 Year 2004 Annex III for aquatic biota (33-34‰).

Discernible impacts to benthic communities are expected to be limited given the small predicted changes to baseline temperature and salinity, which are

[1] https://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/docs/dpr051812.pdf Southern California Coastal Water Research Project. Management of Brine Discharges to Coastal Waters Recommendations of a Science Advisory Panel. Technical Report 694. March, 2012

within the range of natural variation at this site where there are both marine and fresh water influences. Benthic invertebrates at the project site are typical of this region, where they may occur in waters with temperature and salinity ranges comparable to those predicted here. Worst-case impacts are, therefore, expected to be limited to potential minor alterations to benthic invertebrate species abundance and community structure (i.e. species richness, density) in the immediate vicinity of the point of discharge.

The sensitivity of marine water quality and biota to localised changes in temperature and salinity is considered **Medium.** However given the above modelling data the magnitude of the effects of waste water discharges from the CCGT Power Plant outflow pipeline are considered to be **Small**. Therefore the overall significance of the impact of waste water and cooling water discharge on water quality is therefore **Minor**.

Table 8-98 ***Assessment of Impacts of Wastewater and Cooling Water Discharges on Water Quality***

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

8.12.5.4 *Mitigation Measures, Management, and Monitoring*

The following mitigation measures are required:

- Wastewater and cooling water discharge will be conducted below the water surface, to increase dispersion;
- Pipeline outlet structure to include a diffuser to promote dispersion; and
- Monitoring of receiving water quality will be undertaken at the discharge location within three (3) months of operations commencing, and annually thereafter.

8.12.5.5 *Assessment of Residual Impact*

The residual impact to water quality from the discharge of waste water and cooling water on water quality is considered to be **Negligible**, given the above additional measures.

8.12.6 *Assessment of Impacts - Degradation of Marine Water Quality from Wastewater and Process Water Discharges from the FSRU and Vessels during Operations*

The FSRU and other operating vessels will discharge wastewater from time to time over the course of the operational activities. The FSRU and other operating vessels will discharge wastewater from time to time over the course of the operational activities. In accordance with MARPOL 73/78 requirements, all waste water discharges (i.e. sewage and oily water) will be treated prior to being discharged to sea, and assuming water treatment systems are in place and in good operational conditions, any impacts to seawater quality from these discharges is expected to be minimal and will be rapidly diluted. As these effluent parameters meet the discharge standards, they are in compliance and not discussed further.Heating of the LNG for the regasification process and operational of engine in FSRU will requires the use of seawater. The sweater used in the process will discharged back to the sea. The regasification process will discharge cold sea water with temperature 22.5°C and discharge volume of 8,100 m^3/h. At the same time, the engine room cooling water process also will discharge heated seawater with temperature 34°C and debit 2,060 m^3/h.

There are a number of in-built design considerations that are integral to the management of regasification and engine cooling water:

- Waste water and process water discharge will be conducted below the water surface. The heated (engine cooling) water will be discharged deeper and cooled (regasification) water discharged shallower to use the effluent buoyancy characteristics to increase dispersion (heated water is more buoyant than the receiving environment and will rise, whereas cooler water is naturally less buoyant and will sink).
- Depths of discharge points during both minimum and maximum FSRU draught during operations:
  - Depth of Engine Room SW outfall at minimum draught: 7.65 m;
  - Depth of Engine Room SW outfall at maximum draught: 10.3 m;
  - Depth of Regasification Room SW outfall at minimum draught : 0.35 m;
  - Depth of Regasification Room SW outfall at maximum draught: 3m.
- Discharge of engine cooling water is released from the bow and regasification water released from the stern on the same side of the FSRU.

8.12.6.1 *Impact Evaluation and Significance*

Applicable standards are the IFC EHS Guideline limit of no more than 3ºC temperature change at the end of the mixing zone, as well as the ±2ºC change defined in the seawater ambient standard regulation of *Minister of Environment No. 51 of 2004 Annex 3 for aquatic biota* and habitat threshold ranges, as discussed in **Section 8.12.5**.

As discussed previously, changes in seawater temperatures have the potential to cause alteration of the physiological processes (especially enzymemediated processes) of exposed biota (*Wolanski, 1994*). These alterations may cause a variety of effects, ranging from behavioural response (including attraction and avoidance behaviour), minor stress and potential mortality for prolonged exposure. The potential for thermal impacts and associated reduction in oxygen is limited due to the rapid reduction in temperature in receiving water and localised affected area in addition to the fact that only marine biota that happen to travel or remain entrained within the discharge plume for an extended period of time could be impacted by the discharge.

Baseline conditions of seawater temperature are 30.3 °C at the surface and 28.56 °C at a depth of 1.5 - 2 m. The *Decree of the Ministry of Environment No. 8 of 2009 (Waste Limits of Thermal Power Plant) - Annex I part C* allows a temperature variance of ±2 °C.

Modelling was undertake to show the difference in temperature at several locations between the baseline water temperatures and the expected temperatures during the FSRU Operation. The coordinate location of the mooring point of the FSRU are:

- 107.7413054990325 E, 6.140146 S;
- 107.7432517851290 E, 6.139273 S;
- 107.7450802211507 E, 6.142389 S;
- 107.7431339335460 E, 6.143532 S.

The modelling was undertaking to show the difference in temperature at several locations between the baseline water temperatures and the expected temperatures during the FSRU Operation. The model used is a 2D thermal dispersion module with model input data as follows:

1. Hydrodynamic model;
2. E/R Cooling water discharge temperature 34°C and debit 2,060 m3/h;
3. Regasification discharge temperature 22.5°C and debit 8,100 m3/h;
4. Regasification and engine cooling water released on the same side of the vessel;
5. Average draught discharge depths between maximum and minimum operational conditions assumed for engine cooling and regasification water discharge; and
4. Sea water ambient temperature of 28.5°C.

The model was simulate for 1-year to represent the west and east seasons. The prediction magnitude of impact is derive from the environmental conditions along the operation activity (model results) minus the baseline environmental setting at the sampling point coordinates. The result prediction magnitude of impact presented in **Table 8-99**.

Table 8-99 Impact Magnitude on Temperature Increase from FSRU Operations Discharges (LNG Regasification Process and Engine Cooling Water)

Location	Temperature (°C)		
	Environmental Baseline	Impact Magnitude	Resultant Environmental Condition (°C)
MW14 (pipeline 2) 0799792 E; 9318454S	28.5-30.3	0	28.5-30.3
MW15 (Outlet FSRU) 6°8' 8.738" S 107°44' 34.104" E	28.5-30.3	+0.38	28.88-30.68
MW16 (FSRU-LNG) 6°9' 6.069" S 107°44' 37.908" E	28.5-30.3	0	28.5-30.3

Locations refer to the sampling stations as illustrated in Chapter 7 and described in Annex B Environmental Baseline Surveys Results

The modelling results are illustrated in **Figure 8-28**. It was found that the colder regasification water effluent is more dominant than the engine room heated water discharge due to the discharge volume of cold water being much larger (x3.9 times). The movement of the effluent is dominant to the southwest and southeast following the tidal current patterns and monsoon conditions. The cold-water temperature at a distance of 15 m from the outfall reaches 27°C and the heated water temperature at 75 m distance decreased to 29.5 °C. This indicates that FSRU discharges in terms of both of hot and cold water complies with both the Indonesian regulations and IFC standards.

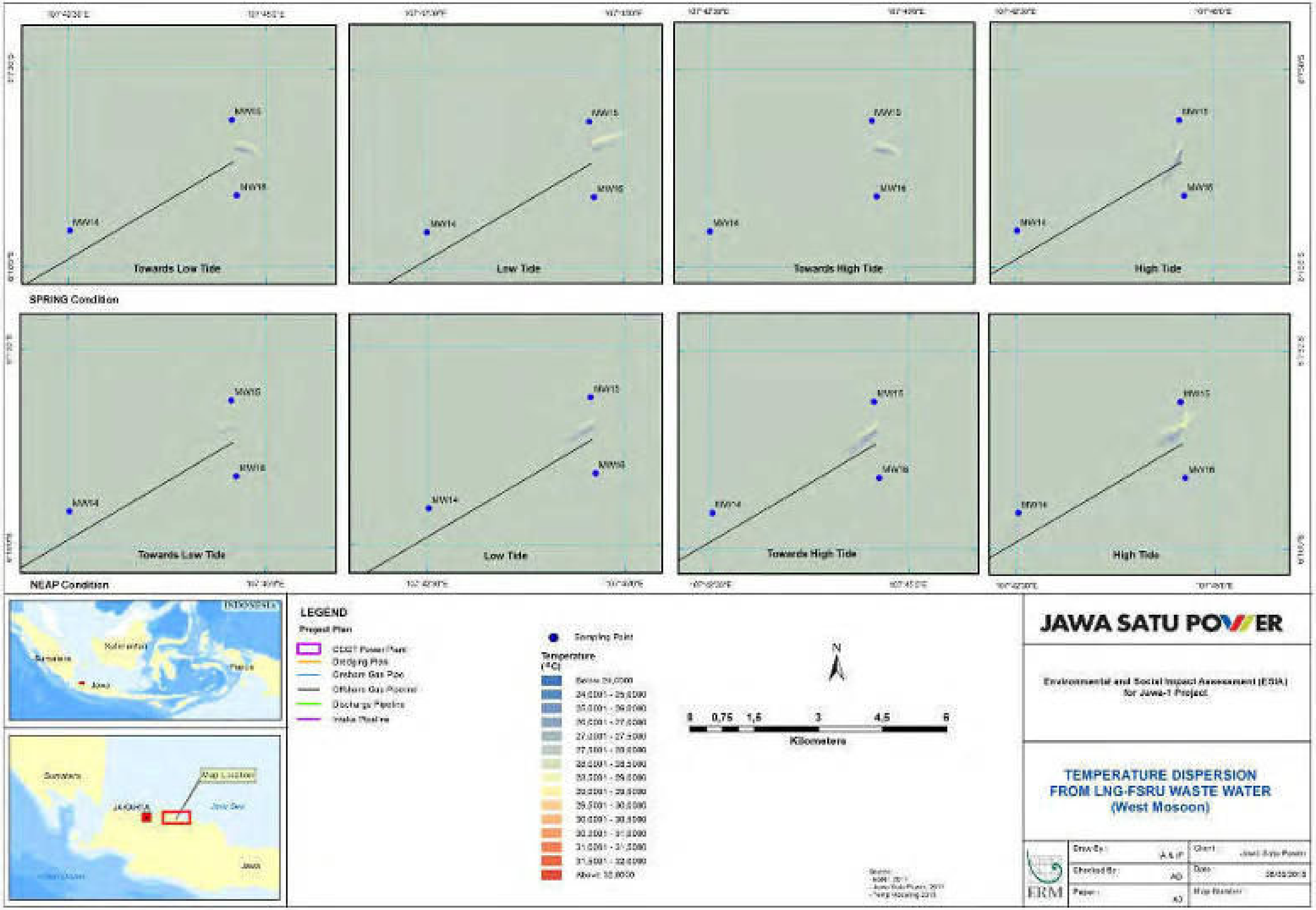
The average of distribution area of impact on each seasons at neap and spring predicted from the model simulation result. From the simulation in the east season the distribution of effluent is wider than in the west season. The largest distribution occurred in the east season of 81.29 m^2 (<100 m^2) with the dominant direction to west and east (**Table 8-100**).

Table 8-100 Area of Impact Magnitude of the Highest Temperature Increase from FSRU Operational Discharges during Model Runs

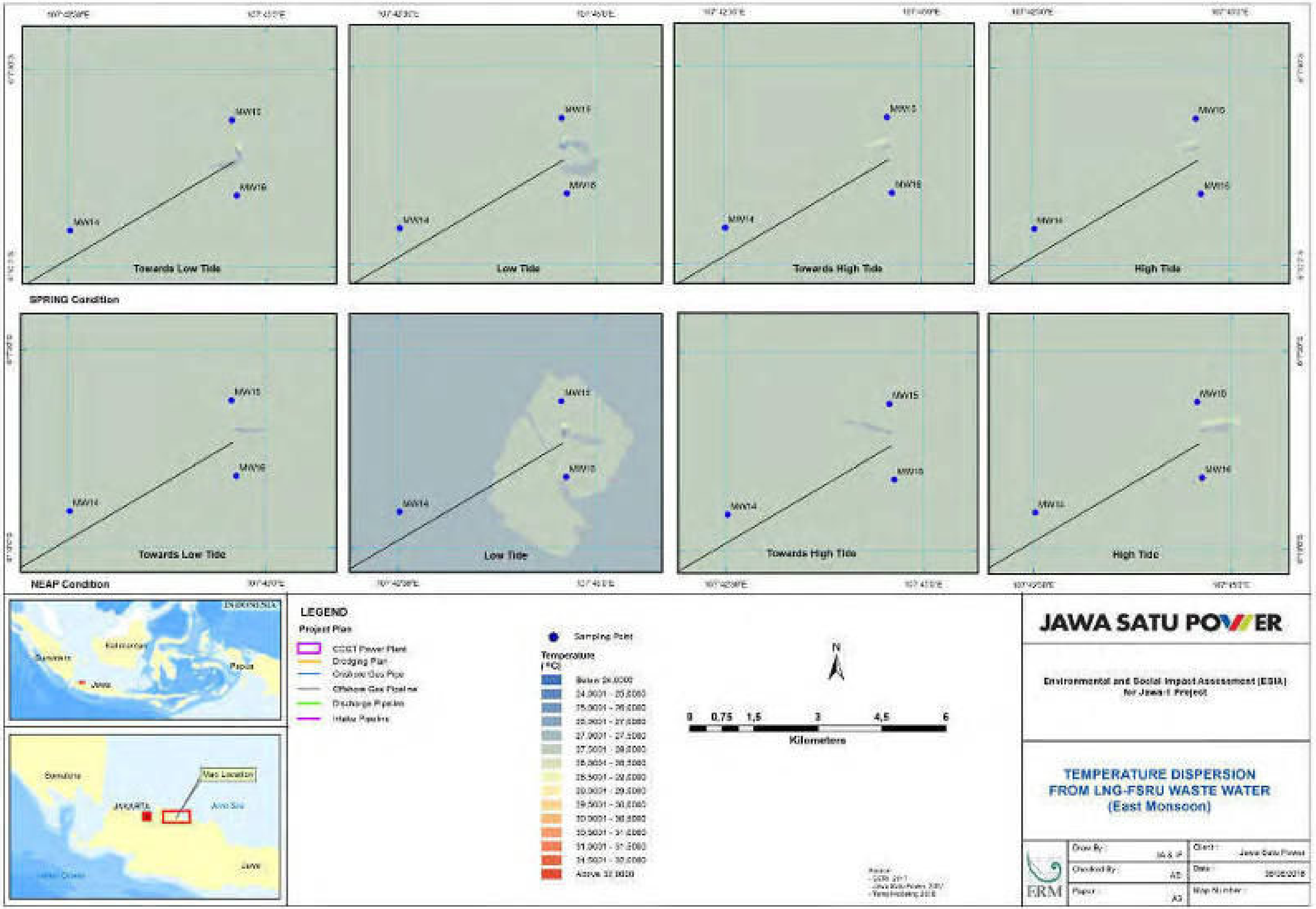
Season	Neap Tide	Spring Tide
West	25 m^2 to south west	75.29 m^2 to south west
East	75 m^2 to south - south east	81.29 m^2 to west - east

Figure 8-28 Modelled Distribution of FSRU Regasification and Engine Cooling Room

a) West Season



b) East Season



The sensitivity of marine water quality is considered to be **Small** (baseline temperature ranges are within limits for marine biota under the Indonesian standards indicating no signs of stress). The magnitude of the effects FSRU waste water and process water discharges on water quality are considered to be **Small** (Slight change in water quality expected over a limited area with water quality returning to background levels within a few metres). The overall significance of the impact FSRU waste water and process water discharges on water quality is therefore **Negligible**.

Table 8-101 Assessment of Impacts of FSRU Wastewater and Process Water Discharges on Water Quality

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

8.12.6.2 *Mitigation Measures, Management, and Monitoring*

No additional mitigation measures are required, but there will be:

- Monitoring of receiving water temperature around the discharge location and 100 m within three (3) months of operations commencing, and annually thereafter.
- Any potential exceedances in discharge standards will be addressed through corrective actions, which may include additional treatment or dilutions prior to discharge.

8.12.6.3 *Assessment of Residual Impact*

The residual impact to water quality from the discharge of waste water and cooling water on water quality is considered to remain **Minor**, given the above additional measures.

8.12.7 *Alteration of Coastal Processes and Sedimentation from Presence of the Jetty.*

The construction jetty will be left in place after startup of the CCGT operations to provide an option for transportation of large equipment to/from the site in the event of repair/replacement during operational maintenance.

There is the potential for the physical presence of the jetty to affect coastal processes, such as the longshore transport of sediment, influence water flow and result in local sediment scouring around the structure, increased deposition or downdrift erosion. The potential impacts depend on the design of the jetty and main wave and sediment transport direction at the Project location.

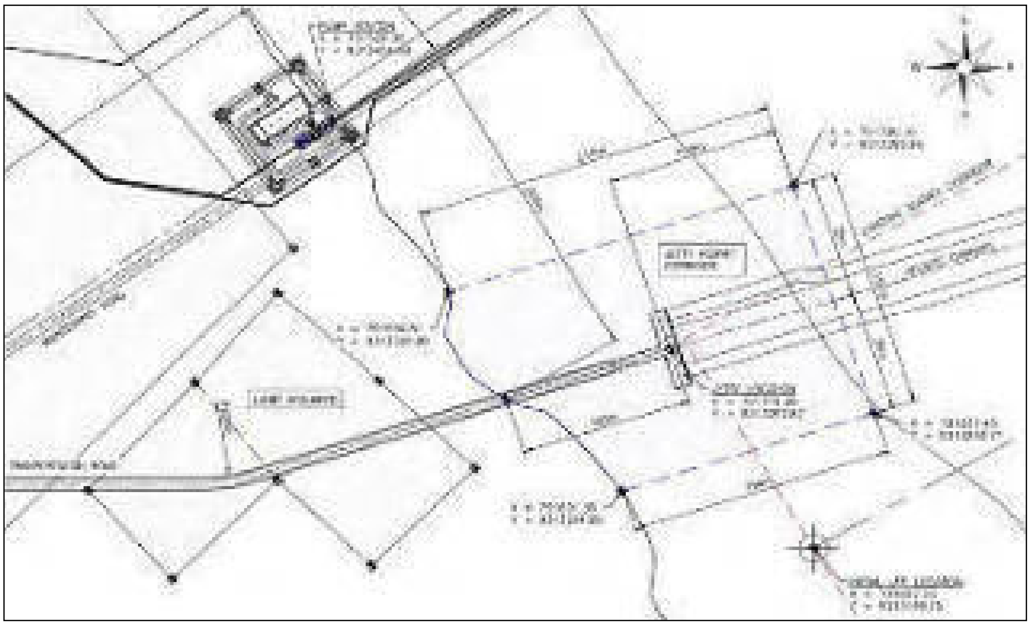
8.12.7.1 *Impact Evaluation and Significance*

The jetty design consists of a concrete pile structure, fronted by a steel sheet pile retaining wall. The total length of the jetty is 40 m and 6 m width, with a perpendicular T-shaped front of 50 m length (refer **Chapter 4**).

The concrete pile of 400mm outer diameter will have a total length of 24m embedded in the soil. The spacing of the piles will be 2m x 2m. On top of the piles at laid down area a concrete slab of about 30cm thickness will be poured.

The original position of the jetty was adjacent to the shoreline. The jetty location has been moved 100 m seaward from this original location, further from the drainage channel and reducing the amount of dredging required around the structure. The jetty structure is planned to be installed at an angle across a drainage channel, as shown in **Figure 8-29.**

Figure 8-29* *Construction Jetty Orientation



The piled structure and orientation of the jetty is judged not to substantially impede water flow and sediment movement at the coastal location. In addition, the short length of the jetty extends over the intertidal area, therefore the jetty would only be exposed to currents and sediment transport during short periods of high tide. During this period maximum current velocities measured in the baseline surveys 2017 (**Chapter 7**) reach 40 cm/s.

The proposed location is a low energy environment, which displays net deposition of sediment carried in the water discharge from the terrestrial environment into the marine zone. From the satellite image in **Figure 8-29**, it can be seen that the build-up of sediment at the nearby drainage channels appears more or less equal on either side. The coastal features do not indicate that there is a dominant direction of net sediment transport in one direction or the other.

Seaward of the jetty facing, the dredge channel may result in some gradual settlement into the dredge channel, however noting that sediments here are predominantly fine and in suspension, the jetty is not considered a barrier to longshore sediment transport.

Based on the above, any impacts to coastal processes and water quality are assessed to be localised and erosion impacts are unlikely to occur, particularly in the context of affecting baseline accretion rates. Some localised scour and/or sediment build up may occur in the immediate vicinity of the jetty but is unlikely to significantly influence the area beyond this. The magnitude is ranked as **Small**. Recognising the high TSS values observed from baseline sampling which exceed applicable Indonesian standards at sampling stations close to the irrigation channel and river outflows, the sensitivity of the environment is ranked as **Medium**, resulting in an impact of **Minor**.

Table 8-102 Assessment of Impacts of Jetty Presence on Coastal Processes, Sedimentation and Water Quality

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

8.12.7.2 *Mitigation Measures, Management, and Monitoring*

The EPC Meindo is required to conduct a detailed engineering design following Notice to Proceed (NTP) on the Project, which will include a sedimentation study to measure the sedimentation rate. Based on this and monitoring of the condition of the jetty and any sediment build up or localised erosion, corrective actions may be required.

8.12.7.3 *Assessment of Residual Impact*

The jetty presence represents a long-term potential impact for as long as the structure is in place. The magnitude of impact from placing a jetty structure in the nearshore zone will not be reduced to negligible and given the medium sensitivity ranking due to the high TSS characteristics of the location the significance will remain **minor**. Monitoring of changes in site conditions that potentially result from the jetty over the medium to long-term is the key measure to managing the potential impact.

8.13 MARINE BIODIVERSITY

8.13.1 Potential Sources of Impacts

Routine project activities that may have an impact on marine biodiversity include:

Construction Phase

- Direct loss and degradation of marine habitats and water quality from jetty construction, dredging and pipeline trenching;
- Degradation of marine habitats and ecological communities from invasive marine species (IMS);
- Direct mortality or injury of marine fauna from vessel movements; and
- Disturbance and displacement of marine fauna by underwater noise generated by pile driving activities, dredging and vessel activities during construction.

Operations Phase

- Direct mortality or injury of marine fauna from vessel movements;
- Direct mortality to marine fauna from seawater intake;
- Disturbance of marine fauna by operational underwater noise generated by FSRU operations, LNG tanker unloading and vessel activity; and
- Disturbance to coastal morphology and sediment transport from the presence of the jetty and dredge access channel.

Potential impacts to marine habitats from non-routine events are discussed in **Chapter 10**.

8.13.2 Assessment of Impacts - Direct Loss and Degradation of Marine Habitats and Water Quality from Jetty Construction, Dredging and Pipeline Trenching

The seabed sediments at the nearshore locations of the proposed jetty, jetty approach and intake and outlet pipelines are characterised by very soft clay to firm sandy silt (*Tigenco, 2016*). The sediments along the gas pipeline route and at the FSRU become progressively dominated by soft clay and silty clay with some coarser sediment and rock outcrops. At the greatest depths, sediments comprise stiff clay (CH) and sand (SP) (*Mahakarya, 2015a*). Benthic surveys completed nearshore and along the pipeline route indicate that there are no areas of corals in the Project area. The nearest corals are located approximately 5 km north-west from the pipeline route and these have been considered in the modelling assessment (refer below).

A range of infauna and epifauna were identified in the nearshore area, including species of *Polychaeta*, *Crustaceae*, *Pelecypoda*, *Nemertina*, *Oligochaeta*, *Sipuncula*, *Anthozoa* and *Echinodermata* (*ERM, 2018b*). Additionally, an abundance of *Nauplius sp*. was also recorded at several locations within the Project area namely at Cilamaya River estuary, nearshore and to the west of the proposed gas pipeline. Crustaceans were very well represented within the surveyed mangrove area and other species are expected to occur widely in sediment throughout the region. It is possible that endangered species of sea cucumber occur in this region, but the project area is not considered to be of significant importance for these species. The ecological quality status of benthic communities in the project area are classified as slightly disturbed.

Nearshore waters are turbid with relatively high concentrations of TSS and elevated levels of organics, oil and grease, zinc, copper, ammonia and nitrates above local water quality standards, likely to be a result of existing estuary discharges into the nearshore area. Waters along the offshore gas pipeline were also found to have elevated concentrations of phosphate and nitrate above local water quality standards.

The existing habitats at the proposed jetty and dredge channel location and the Area of Influence are considered to be Natural Habitat, but supports relatively depauperate soft-sediment benthic invertebrate communities and there are existing levels of pollution and disturbance. No Critical Habitat is present within the Area of Influence. The sensitivity of these Natural Habitats is considered to be Low.

Direct loss of benthic habitat will occur as a result of jetty construction and dredging of the jetty access channel, although sediments will be side cast onto adjacent seabed. Seabed disturbance will also occur as a result of pipeline trenching activities and installation of the FSRU moorings. Dredging and trenching activities are expected to result in localised increases in suspended sediments, potential mobilisation of contaminated sediments and deposition of sediment on the seabed adjacent to the areas of direct removal.

The impacts from pipeline installation and jetty installation/shore approach dredging are assessed in the following subsections. The applicable standards, sensitivity and magnitude criteria for the assessment of impacts to water quality are as previously discussed in **Section 8.12** (**Table 8-90** and **Table 8-91**) and is not repeated here.

8.13.2.1 Pipeline Installation and Trenching

Referring to the Regulation of The Minister of Transportation No.129 of 2016, the installation of subsea pipeline located at a depth of <20 m will be buried as deep as 2 m from the seabed. Pipeline trenching has the potential to reduce water quality through an increase of TSS in the surrounding waters. The subsea pipeline burial activity will be carried out from a depth of 0-20 m for the length of 14,000 m (14 km) using a post trenching method. The prediction of TSS dispersion assumes that the trencher used is a Jet Trenching Rov with a discharge debit 360 m^3/hour.

Impact Evaluation and Significance

The total volume of sediment transport predicted from a calculation of burial depth (2m)+ diameter of pipeline (20"/0.508 m) x pipe wide (0.508 m) X total length of burial pipe (14,000 m)= 17,836.90 m^3 (1.78 Ha).

Assuming that in a day a trencher machine moves to bury 20 join pipes (1 join = 12 m); then 1 day represents a distance of 240 m; therefore, the time to trench the pipeline over 14,000 m is 59 days. Thus, the volume of sediment transport within 1 day is 305.77 m^3 with a trencher working for about 8 hours/day. From the total sediment transport, there are two phases, i.e. the floating phase and the settling phase with a ratio of 50:50. The model simulated sediment transport with main inputs of the result of hydrodynamic modelling and the baseline condition of TSS=0 (simulation to see the magnitude of impact) simulated for 58 days over 2 seasons, to identify the movement of TSS if the construction is conducted during the west season or east season. Based on the simulation results, the magnitude of impact from the bursts of the trencher machine itself range from 0.2-1.9 mg/L, which is a floating phase or TSS, with the TSS values of all locations far below the quality standards. Impacts occur only along the pipe of the location of MW12, MW13, MW14, MW15, and MW16. The modelled magnitude of impacts are presented in **Table 8-103**.

Table 8-103 Prediction Magnitude of Impact TSS Parameter from Installation Subsea Pipeline Activities

Location	TSS Concentrations (mg/l)			Quality Standard (mg/l) *	
	Baseline Setting	Magnitude of Impact (TSS Increase)	Resultant Environmental Condition	Mangrove	Coral
MW12 (0793222;9315547)	12	0	12	80	20
MW13 (0796821;9315687)	50	3.0	53	80	20
MW14 (0799792;9318454)	<8	4.0	12	80	20
MW15 (0803583;9321011)	<8	0	<8	80	20
MW16 (0803691;9319248)	10	0	10	80	20

* *Decree of the Minister of Environment No. 51 of 2004 Quality Standard of Seawater for Marine Biota*

Locations refer to the sampling stations as illustrated in Chapter 7 and described in Annex B Environmental Baseline Surveys Results

Exceedances shown as highlighted

Based on the simulation, in the west season; TSS increases of <16.7mg/L are dominant on the coastal base pipe but for the east season, it is <6.7mg/L. The areas of the impact distribution over the 59 day period during the west and east seasons are presented in **Table 8-104**.

Table 8-104 Area and Trajectory of Elevated TSS from Pipeline Installation

Period	West Season (km^2)	East Season (km^2)
Day 1	0.09 km^2 around trenching location	0.09 km^2 around trenching location
Day 10	0.078 km^2 around trenching location	0.081 km^2 around trenching location
Day 20	0.067 km^2 around trenching location	0.072 km^2 around trenching location
Day 30	0.09 km^2 around trenching location	0.09 km^2 around trenching location
Day 40	0.081 km^2 around trenching location	0.078 km^2 around trenching location
Day 50	0.065 km^2 around trenching location	0.063 km^2 around trenching location
Day 59	0.008 km^2 around trenching location	0.003 km^2 around trenching location

The results of increased TSS dispersion from the burial subsea pipeline activities are presented in **Figure 8-30**.

Figure 8-30 Modelled TSS Elevations from Subsea Pipeline Installation in West Season

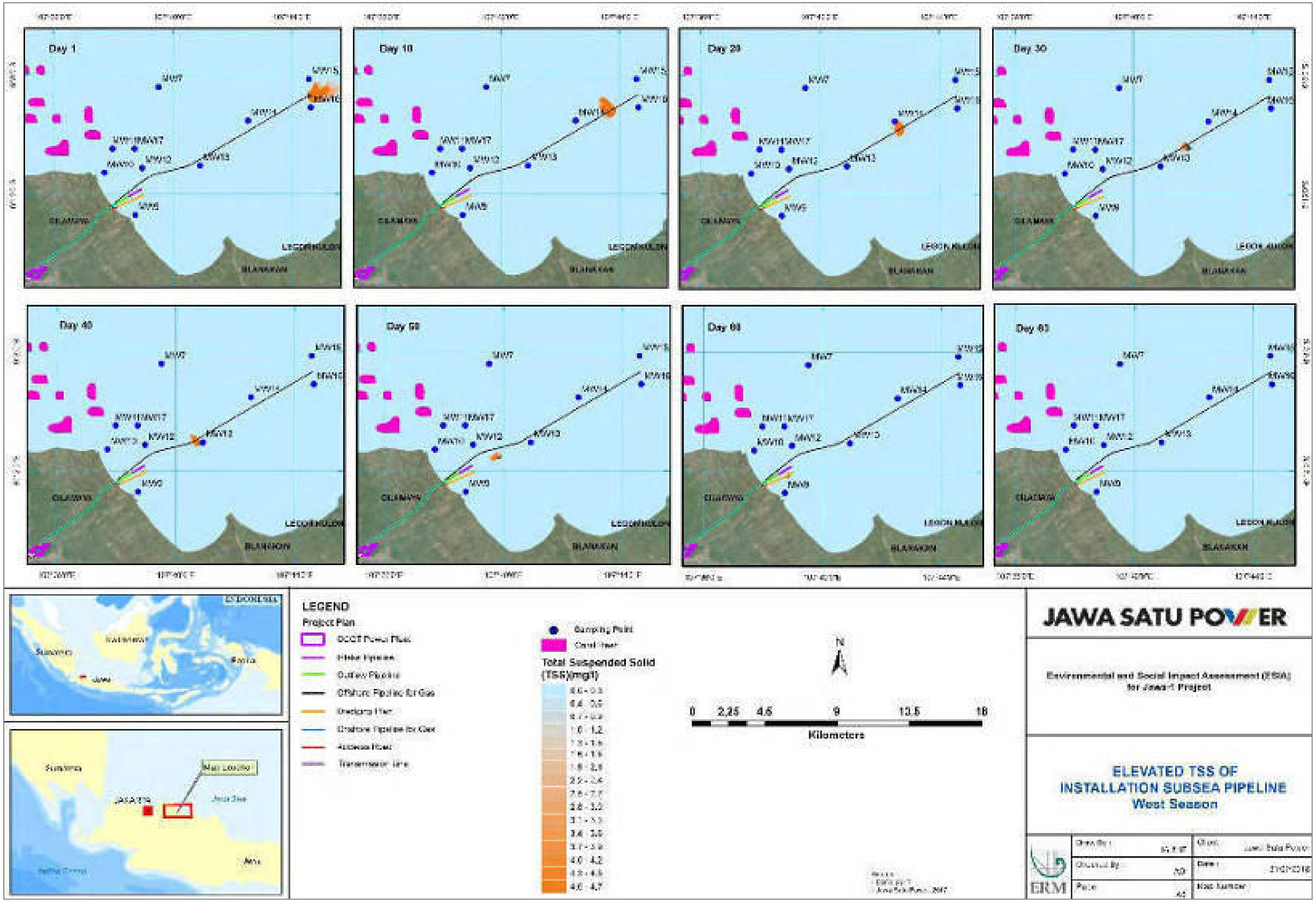
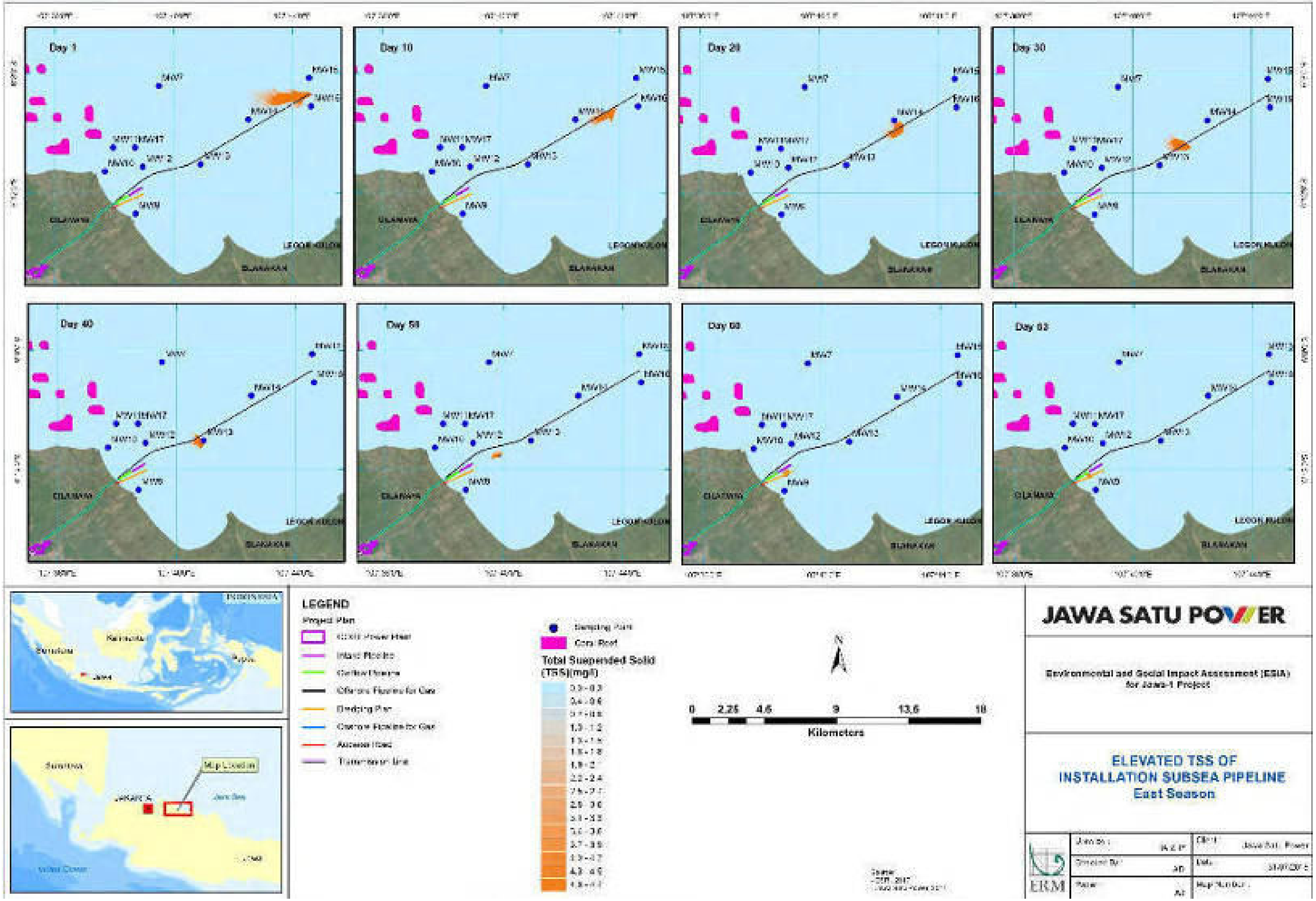


Figure 8-31 Modelled TSS Elevations from Subsea Pipeline Installation in East Season



Based on the above, any impacts to water quality from pipeline installation are localised (ranging from 0.09 km^2 to 0.003 km^2 around the trenching location) with TSS levels within the applicable standards; therefore magnitude is ranked as **Small**. The sensitivity of the seawater from measured TSS results is **low**, given water quality is good as indicated by baseline samples measuring below the standards. The resultant impact significant is ranked as **Negligible** overall.

Table 8-105 Water Quality Impact of elevated TSS from Pipeline Installation

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

Mitigation Measures, Management, and Monitoring

Given the negligible significance ranking, no further mitigation is required.

8.13.2.2 *Jetty and Shore Approach Dredging*

The Power Plant coastline topography varies greatly due to erosion and sedimentation of streams and beaches in the vicinity. The sedimentary texture of the seabed at the jetty area is dominated by fine sediments with a percentage of 73% to 92%.

The baseline setting of TSS conditions around the dredging location described based on measurement data in 2017, as presented in **Table 8-106**. The TSS parameter around the river mouths ranges from <8 mg/l to 50 mg/L. For sites in the river mouths MW9 and MW10, the baseline values of TSS parameter exceeded the regulated quality standard in the Decree of The Minister of Environment No. 51 of 2004 on the Quality Standards of Seawater for Marine Biota.

Table 8-106 TSS Baseline Setting

Location	TSS Measurement (mg/l)	Standard Limit (mg/l)	
MW7 (6°8' 24.972" S 107°39' 31.039" E)	<8	**Mangrove**	**Coral Reef**
MW8 (6°11' 43.114" S 107°46' 1.082" E)	<8	80	20
MW9 (6°12' 42.798" S 107°38' 43.760" E)	647*	80	20
MW10 (6°11' 17.579" S 107°37' 41.734" E)	142*	80	20
MW11 (6°10' 29.186" S 107°37' 58.171" E)	11	80	20
MW12 (6°11' 8.187" S 107°38' 58.241" E)	12	80	20
MW13 (6°11' 3.045" S 107°40' 55.203" E)	50*	80	20
MW17 (6°10' 29.291" S 107°38' 42.672" E)	11	80	20

Locations refer to the sampling stations as illustrated in Chapter 7 and described in Annex B Environmental Baseline Surveys Results

Decree of the Minister of Environment and Forestry No.51 Year 2004 Annex III Sea Water Quality Standards for Marine Biota

****Exceedance against standards highlighted***

Table 8-107 provides the sediment analysis results against the guideline standards.

Under the Australian and New Zealand Guidelines, the lower and upper Interim Sediment Quality Guideline (ISQG) is provided as a good basis for sediment quality assessment.

If the lower sediment quality guideline, the trigger value, for a particular contaminant is not exceeded, it is unlikely that it will result in any biological disturbance for organisms inhabiting that sediment. If the trigger value is exceeded, either management action is taken, or additional site-specific studies are recommended to determine whether this exceedance poses a risk to the ecosystem. Cadmium, lead, nickel results exceed the ANZECC/ARMANZ 2000 ISQG low value for several sampling locations but are within the high limit. There is a decision tree for assessing sediment quality and contamination and it is stated that exceedance of a trigger value is acceptable if it is at or below the normal background concentration for a site. The results presented in the aforementioned table are for baseline (no project) levels of sediment parameters.

Under the Canadian Guidelines, ISQGs are the lower value, referred to as the threshold effect level (TEL) and represents the concentration below which adverse biological effects are expected to occur rarely occur (i.e., fewer than 25% adverse effects occur below the TEL). The upper value, referred to as the probable effect level (PEL), defines the level above which adverse effects are expected to occur frequently (i.e., more than 50% adverse effects occur above the PEL). Heavy metals content analysis of the seabed sediment shows that several sampling stations show exceedances against ISQG (cadmium, copper, lead and mercury) but all stations/parameters are within the PEL values.

Table 8-107 Marine Sediment Monitoring (2017, 2018)

Parameter	Unit	MS3[a]	MS4	MS5	MS6	MS7	MS11	MS14[a]	MS15[a]	MS16[a]	MS17	ANZECC/ ARMANZ 2000		CCME 2002	
												ISQG – Low (Trigger Value)	ISQG - High	ISQG	(PEL)
Arsenic (As)	mg/kg	1.187	0.386	0.011	1.001	1.148	0.909	3.414	3.581	3.277	3.477	20	70	7.24	41.6
Cadmium (Cd)	mg/kg	0.33	1.30	1.20	2.90	2.60	1.75	3.68	3.22	0.64	3.85	1.5	10	0.7	4.2
Chromium (Cr)	mg/kg	<0.09	12.66	13.74	5.84	9.04	13.78	<0.09	<0.09	<0.09	<0.09	80	370	52.3	160
Copper (Cu)	mg/kg	6.51	16.76	22.01	19.72	20.53	17.40	22.27	26.76	31.94	14.88	65	270	18.7	108
Lead (Pb)	mg/kg	12.40	40.36	42.47	55.25	54.07	50.44	96.15	68.05	110.36	98.59	50	220	30.2	112
Mercury (Hg)	mg/kg	<0.004	0.030	0.023	<0.004	0.091	0.215	0.028	0.005	0.094	<0.004	0.15	1	0.13	0.7
Nickel (Ni)	mg/kg	22.33	25.49	31.24	50.54	34.58	26.90	29.95	39.53	5.87	36.82	21	52	-	-
Zinc (Zn)	mg/kg	61.74	95.2	101.59	93.29	96.03	85.04	149.69	102.34	112.26		200	410	124	271

Source: ERM. 2018b

[a] ***Stations in closest vicinity to jetty location***

Notes:

- Exceedance against standards highlighted
- There are no local Indonesian standards or IFC standards for marine sediment quality.
- Australian and New Zealand interim sediment quality guidelines i.e. ANZECC/ARMANZ 2000.
- Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CCME, 2002) normalised to mg/l.

Secondary data indicated the presence of coral assemblages in the area (shown as purple areas in *Error! Reference source not found.*. Coral reef observations were conducted in July 2017 and is presented in detail in **Annex P**. The observation was conducted to determine the presence of coral reefs in Cilamaya waters in the vicinity of the Project, near to the location of proposed submarine pipeline construction (effluent outflow pipe, seawater intake pipeline and gas pipeline). Based on the observation, there are no coral assemblages in the in the vicinity of these project facilities and this is supported by the sweater TSS sampling and analysis that shows high sedimentation in these waters. The locations of coral observations made during the survey are shown in ***Figure 8-32*** and illustrated in ***Figure 8-33***. No coral was observed at the other locations suggested by secondary data.

Based on the observation, from the total coral reefs coverage area of approximately 2,091.47 Ha, only 50.00 Ha or about 2% are considered in good conditions, with 42% considered moderate and 55% of coral reefs damaged. The Environmental Sensitivity Index of BP (2009) also shows that the coral reefs condition at the location is considered bad or poor due to water runoff effects from the land which causes high turbidity around the location. High concentration of sediment and nutrients draining from the land has caused disturbance of the coral habitat around the location. This is further discussed in **Annex P**.

Figure 8-32 Coral Assemblage Survey, 2017

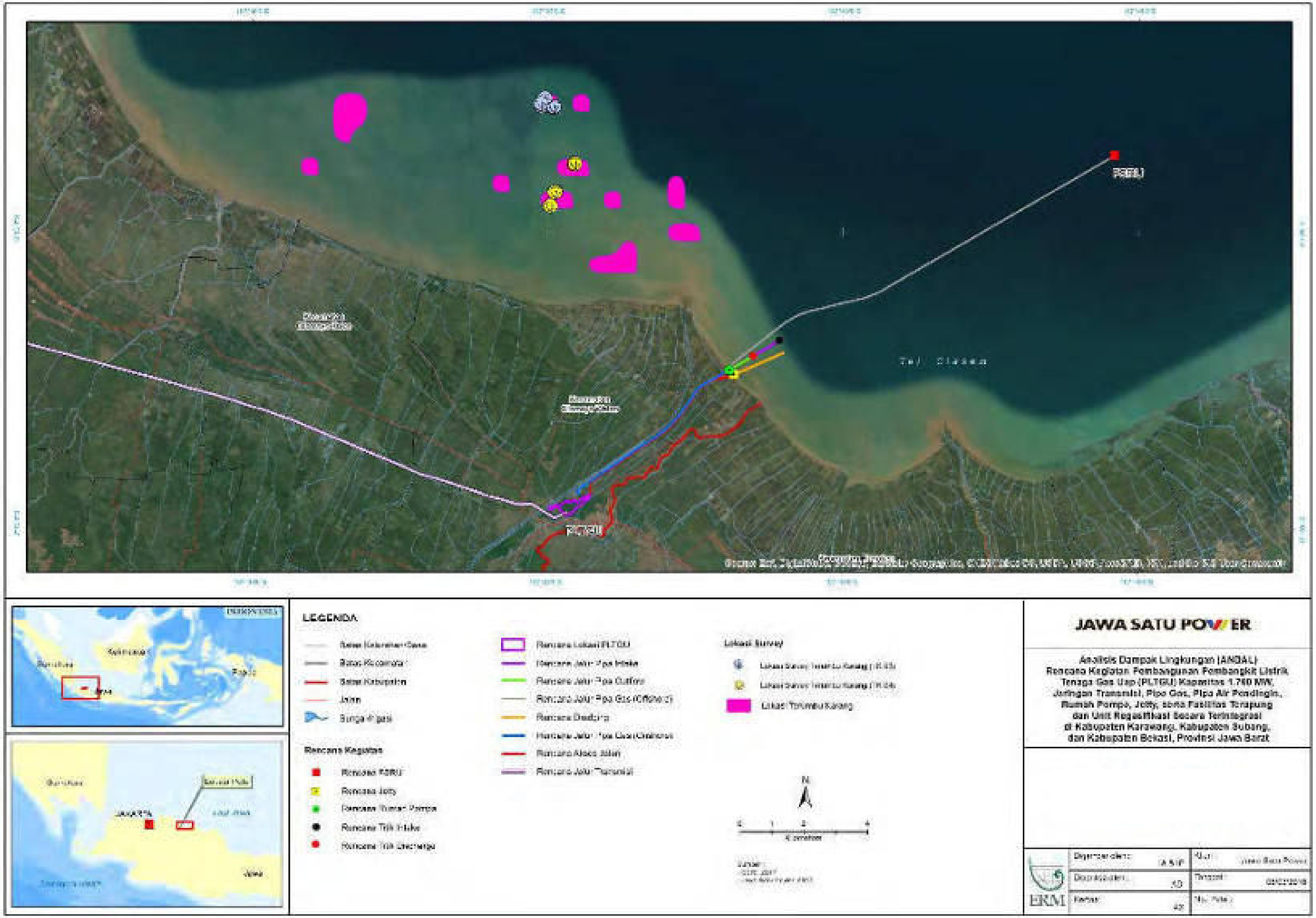
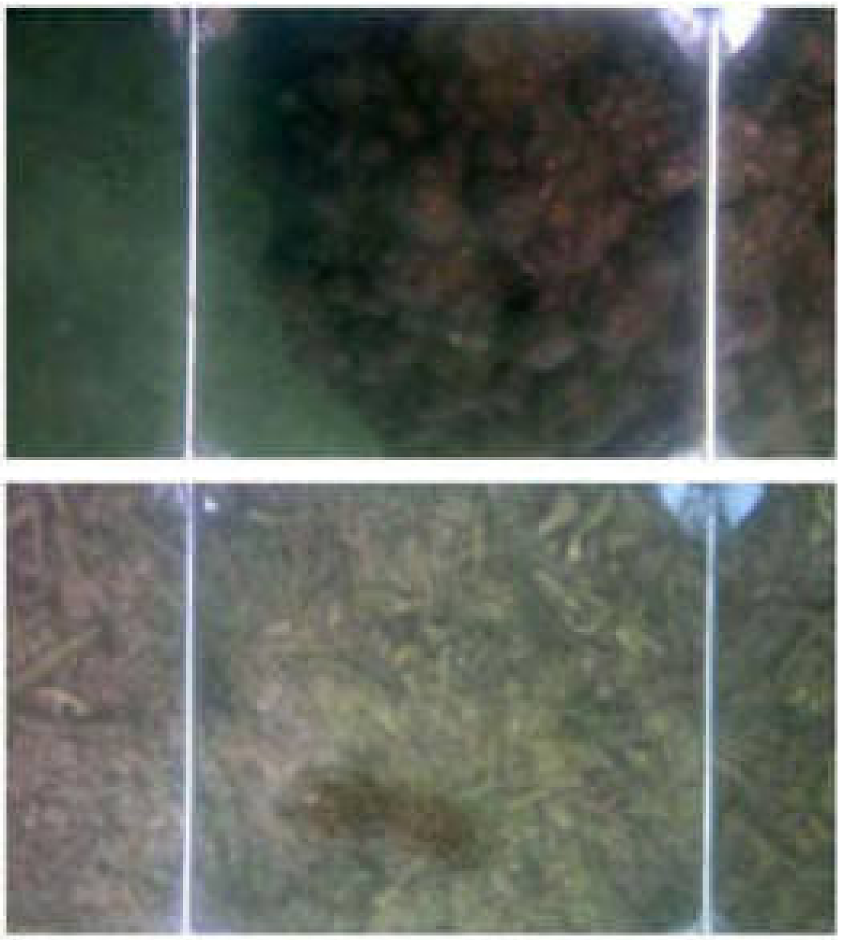
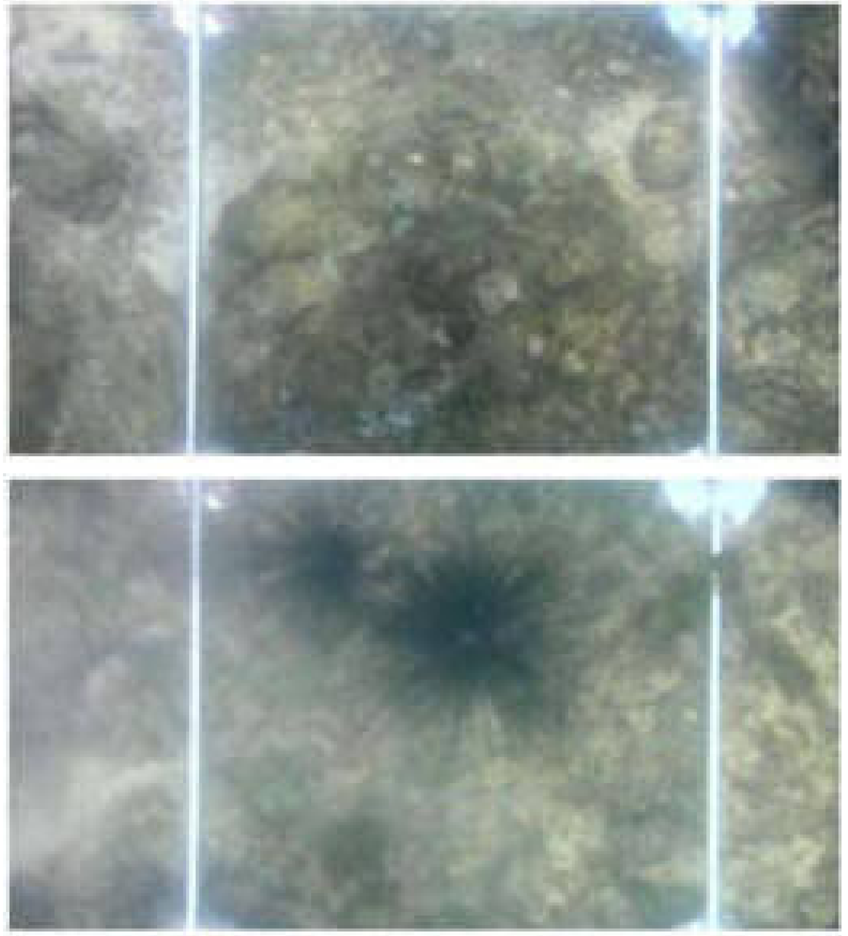


Figure 8-33 Coral Assemblage Observations, 2017

CR03 Station 1: Urchins and damaged coral



CR03 Station 2: Healthy coral patches with rubble



CR03 Station 4: Macro-algae and sea urchins

CR03 Station 5: Dead coral overgrown with algae

CR 04 Station 1: Sand and coral rubble

CR04 Station 2: Dead coral and algae

Dredging activities are required for the construction of the jetty and clearance of an access channel from the shoreline location. There are a number of options for dredging and the Project will adopt use of a floating barge and swamp back hoe, with the dredge material side-casted.

The original dredging plan was to achieve a 4 m water depth for the vessel draft. This resulted in an estimation of 80,000 m^3 of dredge material. The equipment mobilisation plan has been revised to reduce the amount of dredging required for the access channel by selecting a vessel with operating draft of 2.0-4.0 m and reducing the channel depth from the original plan of 4.0 m to 3.0 m at Lowest Astronomical Tide (LAT) conditions. Equipment offloading at the jetty is planned for Highest Astronomical Tide (HAT).

In addition, the original position of the jetty was adjacent to the shoreline. The jetty location has been moved 100 m seaward from this original location, further from the drainage channel and reducing the amount of dredging required around the structure. The amount of dredging required as a result of these changes is reduced to 45,981m^3 (57%).

Dredging activities for the construction of the jetty and the access channel will be conducted from the shoreline location of the jetty seaward to a water depth of – 3 m, with a total length of the access channel of 1,750 m. The dredging activities and placement of the dredging material is as follows:

1. The depth of the access channel will be -3.00 m on condition of the Lowest Astronomical Tide (LAT), without affecting the burden in activities with a shallow pull selected with the operating concept of 2.0-4.0 m.
2. Dredging up 1.00 m water depth by the Swamp Back Hoe to minimise the effects of turbulence generated by the Pontoon.
3. Dredging Material produced by the Swamp Back Hoe (up to a water depth of 1.00 m) will be disposed to the back of the jetty location.

The jetty installation and access channel trenching plan are provided in ***Chapter 4***.

During operations, the jetty will be left unused and will only be needed if major plant equipment needs changing. No maintenance dredging is planned, therefore this is not assessed further.

Impact Evaluation and Significance

The total volume of the dredging material is approximately 45,981 m^3, as shown in **Table 8-108**. Material from the location of the jetty ±0.0m to a water depth of -1.0m (20,202 m^3) will be transported by Swamp Back Hoe to near the coast (jetty area). The rest of the dredging material from the 1.00 to 3.00 m water depth (i.e. 989 m of total length and 25,778 m^3 of material), will be side cast with a maximum height of 0.5 m, which will be below sea level with a minimum of 1.50 in LAT. Material relocation by side casting involves the discharge of dredged material alongside the area of dredging by direct discharge of the dredger's grab. Side casting is commonly used for new works when the dredged formation is only temporary, such as in the case of the jetty and pipeline installation (GHG, 2006[10]).

Table 8-108 Dredging Volumes by Section

Section	Dimensions	Volume of Dredge Material (m^3)	Method
EL. ±0.0	78 m^2 x 234 m	18,252 m^3	Bring nearshore
EL. 1.0 to ±0.0	52 m^2 x 78 m	1,950 m^3	Bring nearshore
EL. -2.0 to -1.0	52 m^2 x 26 m	19,383 m^3	Side-cast
EL. -3.0 to -2.0	26 m^2 x 492 m	6,396 m^3	Side-cast
Total		**45,981m^3**	

A 2D Mud Dispersion model was conducted for both the wet season and the dry season to estimate the magnitude and extent of the dredge plume (elevated TSS above background concentrations) and the amount of sediment deposited. The sediment transport model used is the Community Sediment Transport Modelling System (CSTMS) package that was developed for ROMS. CSTMS was created by a group of sediment transport modellers lead by the USGS. The model was designed for realistic simulations of processes causing sediment transport in the coastal ocean (estuaries, nearshore regions, and the continental shelf)[11].

In order to obtain magnitude of impact then performed a simulation changes the thickness of sediment by using a 2D module Mud model dispersion data input were as follows:

1. Hydrodynamics Model;
2. The thickness of sediment on the initial conditions = 0;
3. Dredging material of 45,981 m^3, assuming the dredging will be 1,800 m^3/day (bucket grab 15 m^3/5 minutes) with dredging work 10 hours a day with total dredging period of 26 days.

There are two phases of the total sediment transport i.e. floating phase and settling phase with a ratio of 50:50. The floating phase contributes to increased suspended sediment (TSS levels) and the settling phase refers to the deposition of the remobilised sediment when it falls out of suspension in the water column. With the simulation of sediment transport with the main input hydrodynamics modelling result and initial conditions = 0 (simulation to predict the magnitude of impact)

[10] GHD (2006). Report for Notional Seaway Project Dredge Management Strategy, Queensland Government.

http://www.broadwatermarineproject.com.au/documents/4.3/Appendices/Appendix%20E%20Dredge%20Managment%20Strategy.pdf

[11] https://woodshole.er.usgs.gov/project-pages/sediment-transport/

which is modelled for 1 month (on the day of 27th there is no dredging input) considering different environmental conditions in the two seasons.

Based on the simulation result, the average magnitude of impact from the dredging activity ranged from 0.1-6.1 mg/L, which is the floating phase or as the TSS. However the fulfilment of the standard regulation limit influenced by the ambient condition of the TSS concentration in the location of the project plan.

The sampling location of MW9 and MW10, at the estuary of the river, exceeded the standard regulation limit of the Minister of Environment Decree No. 51 of 2004 attachment III for marine biota since at baseline conditions without the project. All baseline sampling locations are unaffected by the dredging activity, with the exception of location MW10 where TSS is elevated by 3.2 mg/l (***Table 8-109***).

Table 8-109 Prediction Magnitude of Impact Average of TSS Parameters from the Dredging Activity

Location	TSS Concentration (mg/l)			Standard Limit (mg/l)*	
	Baseline Setting	Magnitude of Impact (TSS Increase)	Resultant Environmental Condition	Mangrove	Coral Reef
MW7 6°8' 24.972" S 107°39' 31.039" E	<8	0.0	<8	80	20
MW9 6°12' 42.798" S 107°38' 43.760" E	647	0.0	647	80	20
MW10 6°11' 17.579" S 107°37' 41.734" E	142	3.2	145.2	80	20
MW11 6°10' 29.186" S 107°37' 58.171" E	11	0	11	80	20
MW12 6°11' 8.187" S 107°38' 58.241" E	12	0	12	80	20
MW13 6°11' 3.045" S 107°40' 55.203" E	50	0	50	80	20
MW17 6°10' 29.291" S 107°38' 42.672" E	11	0	11	80	20

* MoEF Decree No.51 year 2004 Annex III for Marine Biota

Exceedances highlighted

Locations refer to the sampling stations as illustrated in Chapter 7 and described in Annex B Environmental Baseline Surveys Results

Based on the simulation of the impact of the dredging activity and placement of the dredge material, the distribution of TSS only lasts for 26 days and after the input stops, the 28th day TSS is not recorded in the model area. The TSS distribution is dominant to the northwest and broader in the west (wet) season; this is due to the intensity and frequency of rain being greater than during the east (dry) season. The distribution of TSS lasts for 26 days and after the input stops, by day 28th TSS is not recorded in the modelled area. The results of TSS dredging modelling from the dredging and dredge placement activities are further presented in **Figure 8-34** to **Figure 8-37** and **Table 8-110**.

Figure 8-34 TSS Distribution at West (Wet) Season Day 1-12

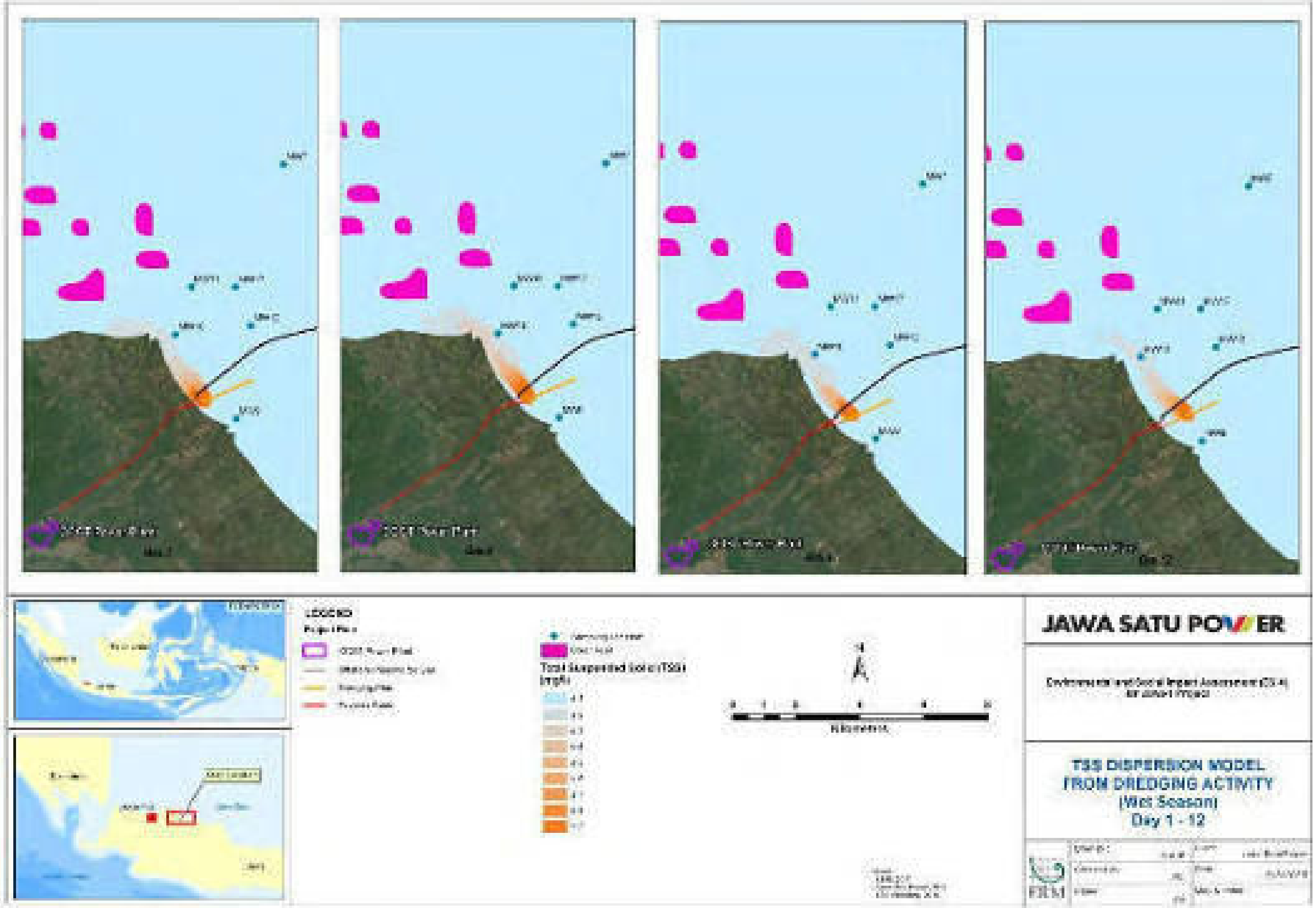


Figure 8-35 TSS Distribution at West (Wet) Season Day 16-28

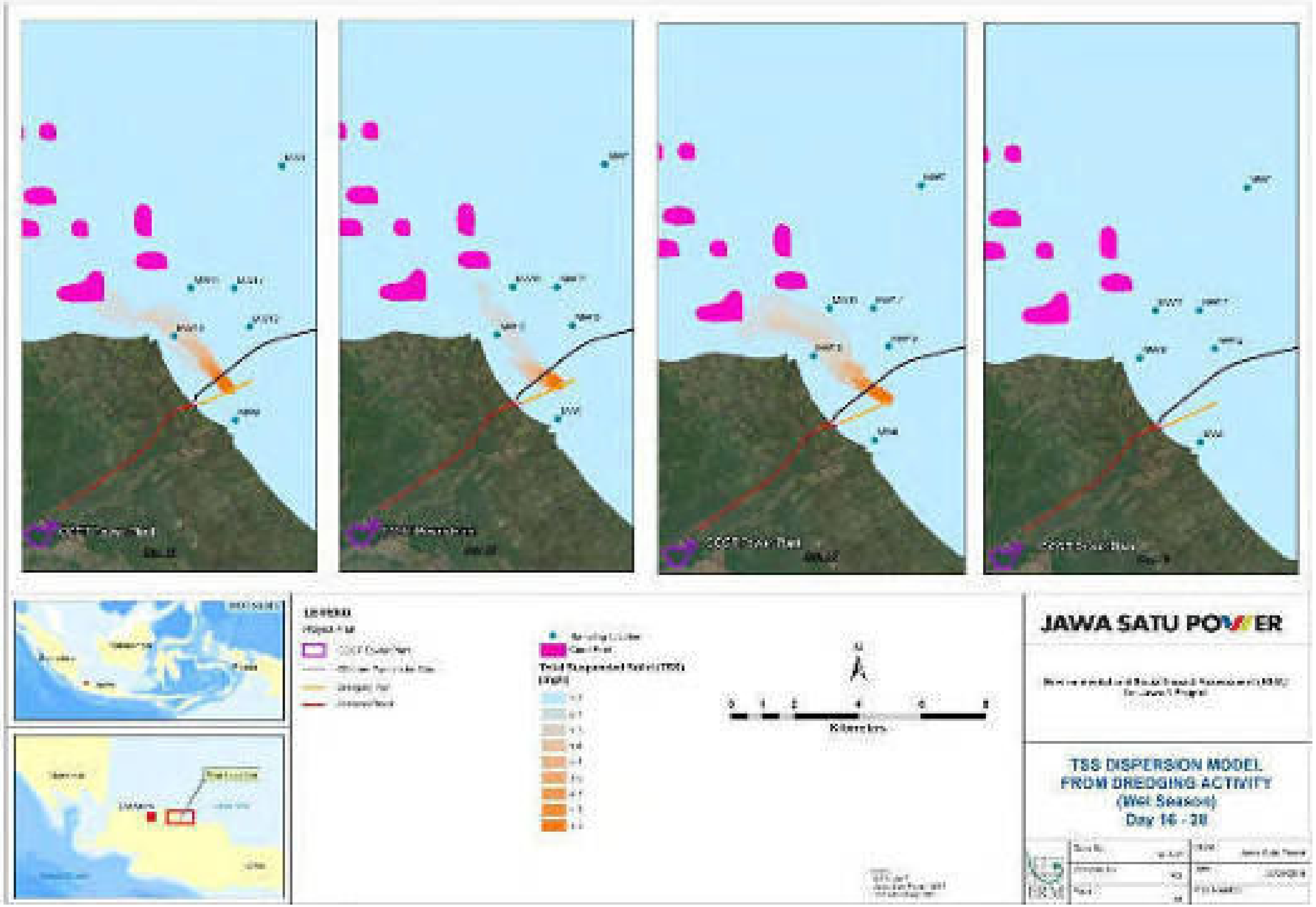


Figure 8-36 TSS Distribution at East (Dry) Season Day 1-12

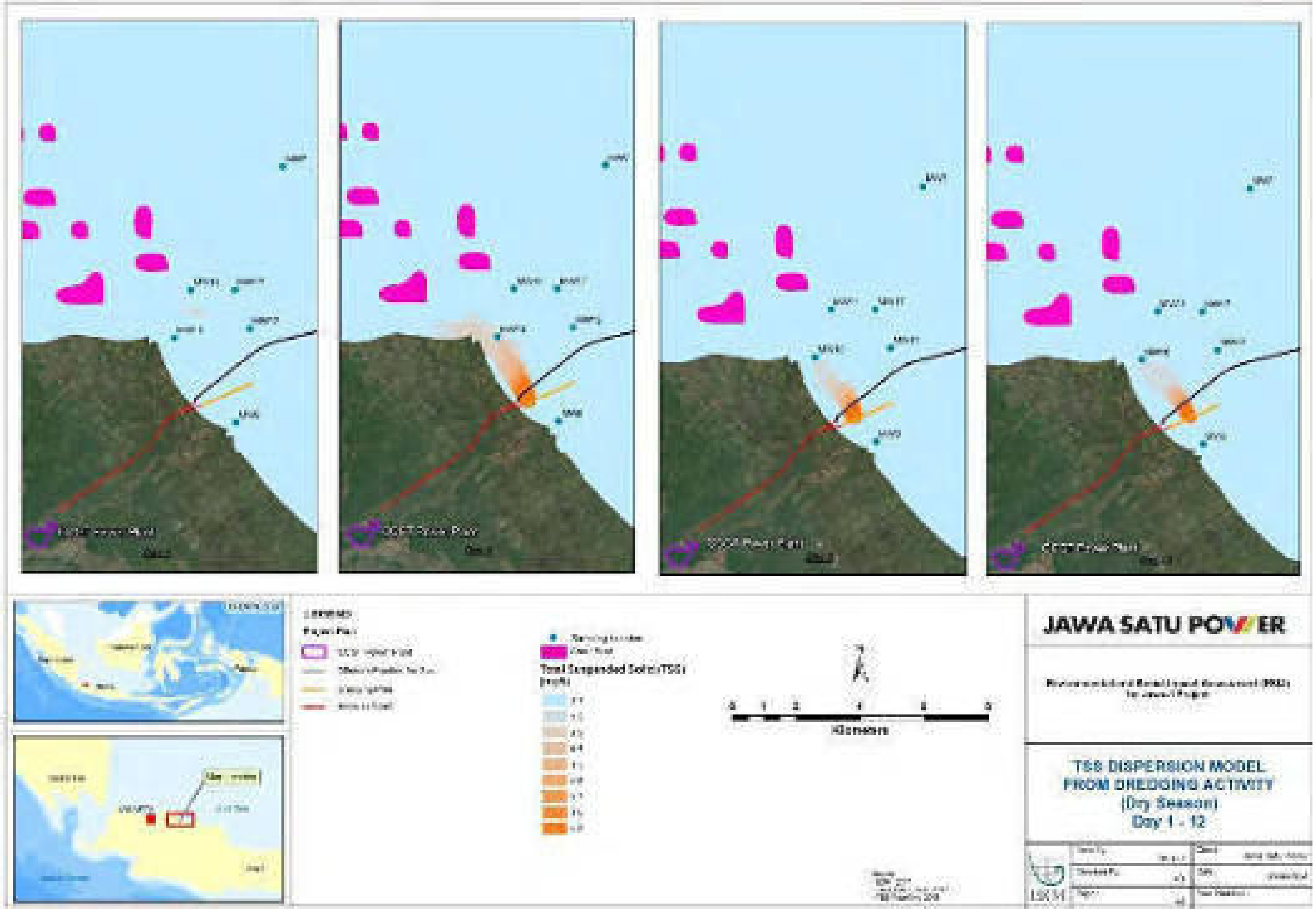


Figure 8-37 TSS Distribution at East (Dry) Season Day 16-28

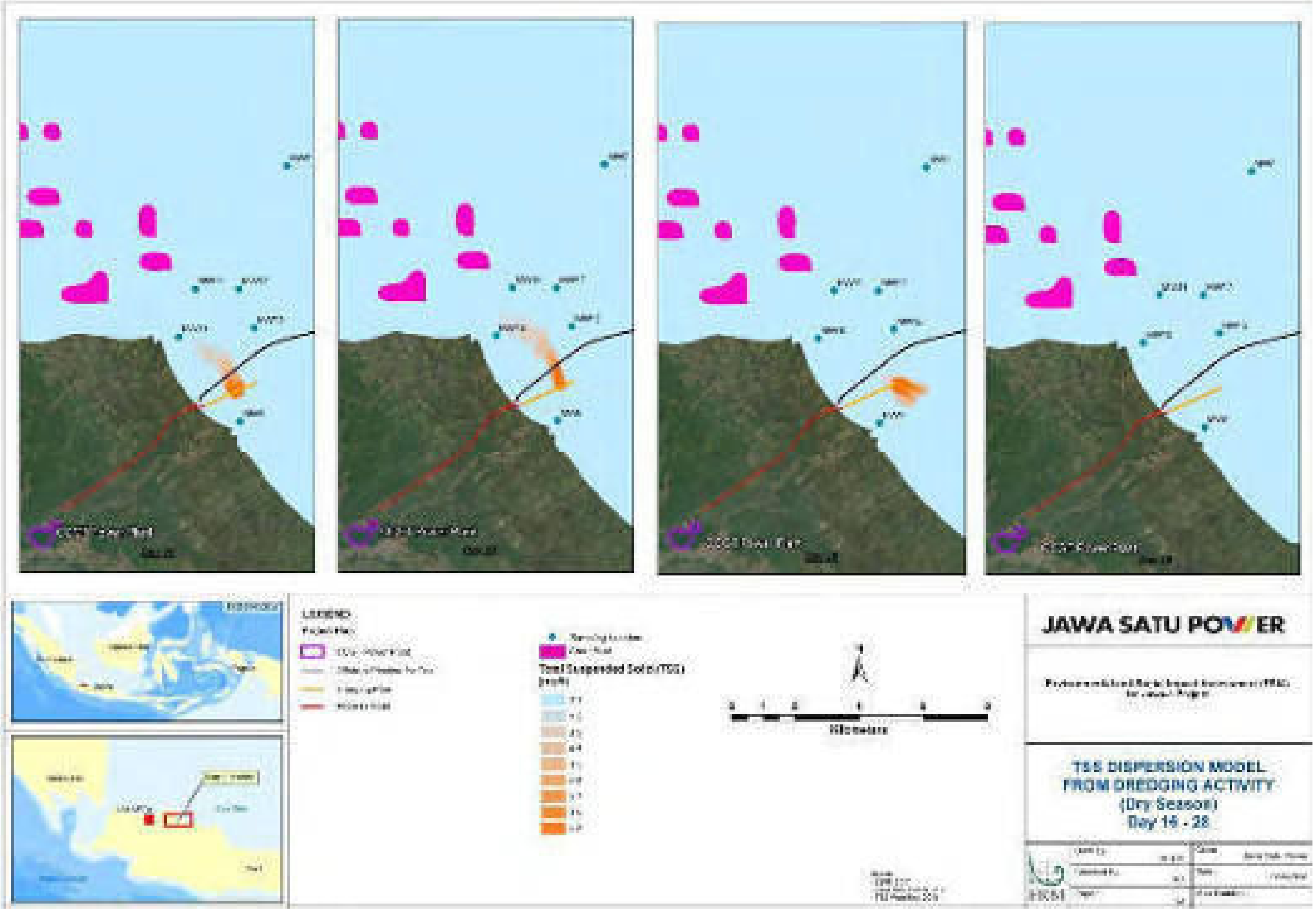


Table 8-110 Size and Radius of TSS Distribution

Duration	West Season (Km²)	East Season (Km²)
Day 1	1.15 to the northwest	1.11 to the northwest
Day 4	0.97 to the northwest	0.91 to the northwest
Day 12	0.74 to the northwest	0.698 to the northwest
Day 16	0.67 to the northwest	0.61 to the northwest
Day 20	0.489 to the northwest	0.43 to the northwest
Day 24	0.32 to the northwest	0.25 to the northwest
Day 26 (end of dredging)	0.18 to the northwest	0.11 south east
Day 28	0	0

The modelled results for thickness of sediment following deposition show that the affected area in either the west or the east seasons lies around the jetty location with an average thickness of 0.76 m (**Table 8-111**).

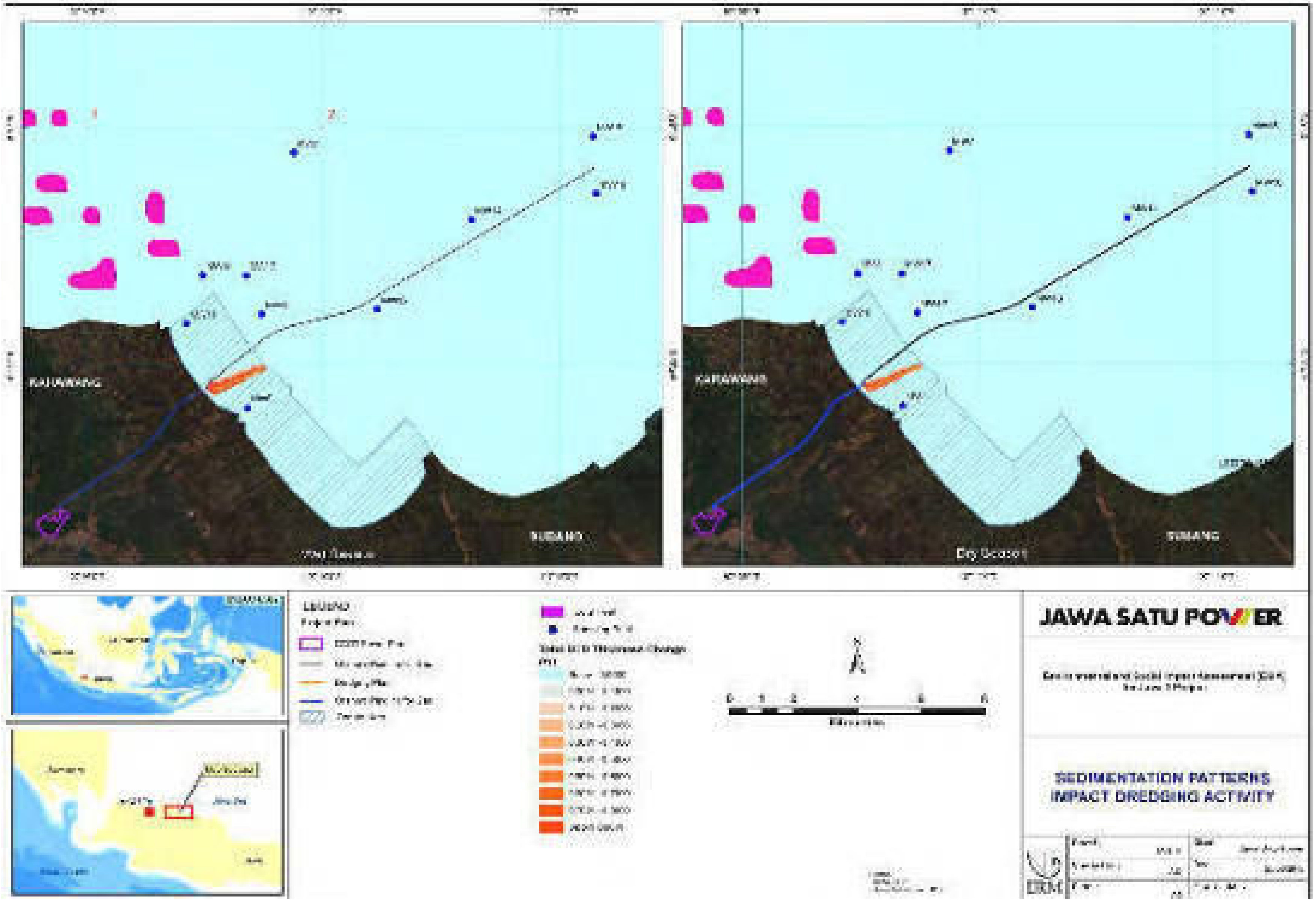
Table 8-111 Prediction Magnitude of Impact Increase of Sediment Settling from the Dredging Activity

Season	Thickness (m)	Area of Sediment Settling (km²)
Wet	0.798	0.77
Dry	0.721	0.63

Sediment-dwelling organisms living on the surface of the seabed are known as epifauna, where micro-organisms which lives mainly inside the sediment are collectively known as infauna. The mortality of benthic species from sediment settling varies on a number of factors including the depth of burial and ability of such species to successfully vertically migrate. The OSPAR Guidelines for the Management of Dredged Material state that for a retentive site, such as is proposed for the jetty and access channel, where the material deposited will remain within the vicinity of the site, the assessment should delineate the area that will be substantially altered by the presence of the deposited material and what the severity of these alterations might be. At the extreme, this may include an assumption that the immediate receiving area is entirely smothered.

For a conservative assessment therefore, it should therefore be assumed that mortality of the benthos occurs over the entire footprint of deposition. The modelled results for thickness of sediment deposition for the revised dredge plan of 45, shows that the affected area in either the wet or the dry seasons lies around the jetty location, with an average thickness of 0.76 m and a maximum area of 0.77 km² in the wet season. This is an increase in the area of deposition due to the method of movement of material nearshore to reduce the suspension as TSS, as previously described. Mapping of the deposition area of 0.77 km² along the length of the jetty in relation to the total area between the headlands of 20 km² (shown as shaded area in **Figure 8-38**), represents 3.85% of the total habitat.

Figure 8-38 Changes in Thickness of Sediment at the Dredging Location



Environmental baseline results from the sampling program shows that the area is fairly homogeneous around the project location Benthic communities in the Project area and particularly the nearshore zone are deemed to be able to tolerate high levels of sedimentation due to the high TSS levels measured at locations around the discharge areas of drainage channel and rivers and depositional environment.

Overall, the magnitude of loss and disturbance of low sensitivity soft sediment benthic infauna and epifauna communities as a result of jetty construction and access channel dredging will affect a relatively small proportion (3.85%) of the widely occurring habitats and communities along this coastline, but has the potential to significantly reduce environmental quality due to the proposed side-casting trenching method. Due to the short duration of activity and shallow depth of sediment deposition (<0.8m) at the maximum modelled level, recovery of the benthos in the affected area is expected to occur following the end of the dredging activity and return to background levels over a reasonable timescale. This impact as additional to the physical removal of the benthos and associated sediment is not considered significant as it minimises disturbance to the area of activities.

Considering the elevated levels of some metal parameters in sampled sediments that exceed minimum guideline standards but do not exceed maximum or PEL levels, it is considered advisable to retain the dredged material at the disturbed location close to the point of origin (retentive site).

An alternative is to remove the dredged material and select a re-use or alternative site disposal option (dispersive site). This would potentially incur impacts at the re-use of disposal location. As described under OSPAR all dredged materials have an impact potential (physical, biological) at the point of disposal. This impact includes covering of the seabed, local increases in suspended solids levels as well as potential impacts on habitats and marine fauna (benthos, fish). Disposal of sediments with low levels of contamination is not devoid of environmental risk and requires consideration of the fate and effects of dredged material and its constituents (OSPAR, 1998-20). Such an alternative will require detailed assessment, as well as a licence under Indonesian regulations. It is also required to include consideration of cost in relation to the benefit from the management alternative. Considering the assessment of the proposed dredging plan, it is considered that the impacts from the selected option are not significant (refer below).

All baseline sampling locations are unaffected by TSS from the dredging activity, with the exception of location MW10 where TSS is elevated by 3.2 mg/l. MW10 is in proximity to reported coral communities (although the quality of these are predominantly in poor condition as discussed previously) and this, combined with the exceedances in TSS in the baseline sampling is classed as **medium** sensitivity. The impact magnitude, recognising that the distribution of TSS from jetty dredging lasts for only 26 days, is considered to be **small** and therefore of **Minor** impact significance.

Table 8-112 Assessment of Impacts from Loss and Degradation of Marine Habitats during Jetty Installation and Dredging

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

Mitigation Measures

It is recommend that the following mitigation measures be applied in relation to marine habitat impacts during jetty installation and dredging:

- Project shall develop a dredging and disposal risk assessment and Dredging Management Plan in accordance with IMO and OSPAR guidelines.
- Additionally, the dredging footprint of the Project should be reduced as far as practicable in order to reduce the direct disturbance to the seabed and indirect effects from turbidity plumes. This includes:
- Dredging vessels will be equipped with the appropriate Global Positioning System (GPS) equipment or other navigational aids to ensure dredging will occur at the specified dredge footprint and disposal at the designated soil disposal site;
- EPCs' dredgers will maintain adequate clearance between vessel hull and the seabed at all states of the tide and reduce vessel speed to ensure that excessive turbidity is not generated by turbulence from vessel movement or propeller wash.

Monitoring Measures

The following monitoring measures are recommended:

- Records are to be kept and regularly reviewed (weekly) for implementation of the Dredging Management Plan.
- Direct measurement of the TSS periodically at baseline sampling station locations MW9, MW10, MW11 and MW12 to establish actual recorded levels verses modelled results.

Assessment of Residual Impact

In view of the current exceedances in baseline TSS measurements, the proximity of coral but recognising the short duration of disturbance; the residual impact to loss of habitat and seawater quality from jetty installation and dredging remains **Minor**.

8.13.3 Installation of Seawater Water Intake and Wastewater Discharge Pipelines

The seawater will be abstracted using one (1) offshore intake pipe connected to a submerged intake head located in a dredged pit located at -4.5 meters MSL. The offshore intake pipe is preliminary sized at 1.3 meter diameter. The approximate length of the intake pipe is 1,882 m.

The CCGT Power Plant process wastewater will be discharged using one (1) offshore discharge pipe connected to a submerged discharge diffuser located at -2.5m MSL. The offshore wastewater discharge pipe is preliminary sized at 0.9 meter diameter. The length of the discharge pipe is 932 m.

The seawater intake pipeline and wastewater discharge pipeline will be made of HDPE material. A common pre-trench of 2 km length will be dredged to install the seawater intake and discharge lines. It is envisaged to have about 1:00 am soil cover from top of the HDPE pipes all along the trench, except at the entrance of the pump station where the inlet is located at a water depth of about -7.00 m from MSL.

The equipment to be used for dredging activities consists of:

- Swamp back hoe until -1.00 m MSL; and
- Beyond -1.00 MSL, flat barge equipped with the long arm excavator or crawler cranes with clamp shell.

For a water depth of less than -3.00 MSL, the trench dimensions will be dictated by the width and the draft of the flat barge used to execute the work and therefore the bottom trench opening is assumed to be 18 m.

The trench dimensions beyond -3.00 MSL water depth will have an opening of 3.70 m and a top opening of 13.70 m and depth of 2.50 m to insert the intake line. The total volume of dredged materials is calculated at 57, 522 m^3, and dredged materials will be back filled to seabed level. The total volumes of dredged material from the installation of the outfall and intake pipelines are presented in ***Table 8-113*** and illustrated in ***Figure 8-39*** to ***Figure 8-40***.

Table 8-113 Installation Plan - Volumes by Section

Section	Dimensions	Volume of Dredge Material (m^3)	Method
LAT. +1.0 to 0.0	30 m^2 x 320 m	9,600 m^3	Back filling
LAT. 0.0 to -1	122 m^2 x 21 m	2,562 m^3	Back filling
LAT. -1.0 to -1.5	43 m^2 x 240 m	10,320 m^3	Back filling
LAT. -1.5 to -2.0	40 m^2 x 250 m	10,000 m^3	Back filling
LAT. -2.0 to -2.5	33 m^2 x 230 m	7,590 m^3	Back filling
LAT. -2.5 to -3.0	29 m^2 x 230 m	6,670 m^3	Back filling
LAT. -3.0 to -4.0	22 m^2 x 490 m	10,780 m^3	Back filling
Total		**57,522 m^3**	

Figure 8-39 Sequence of Intake and Discharge Pipeline Installations

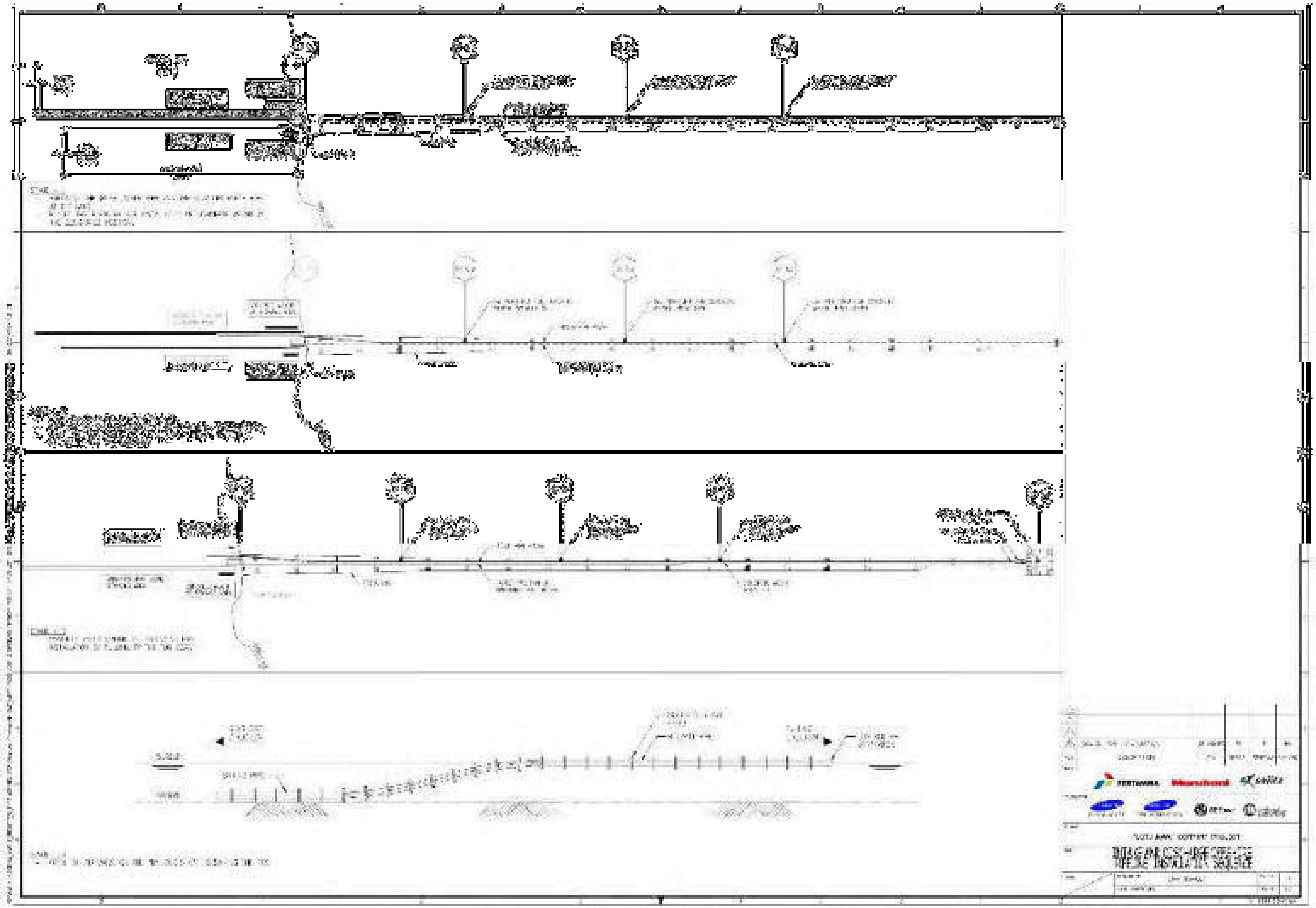
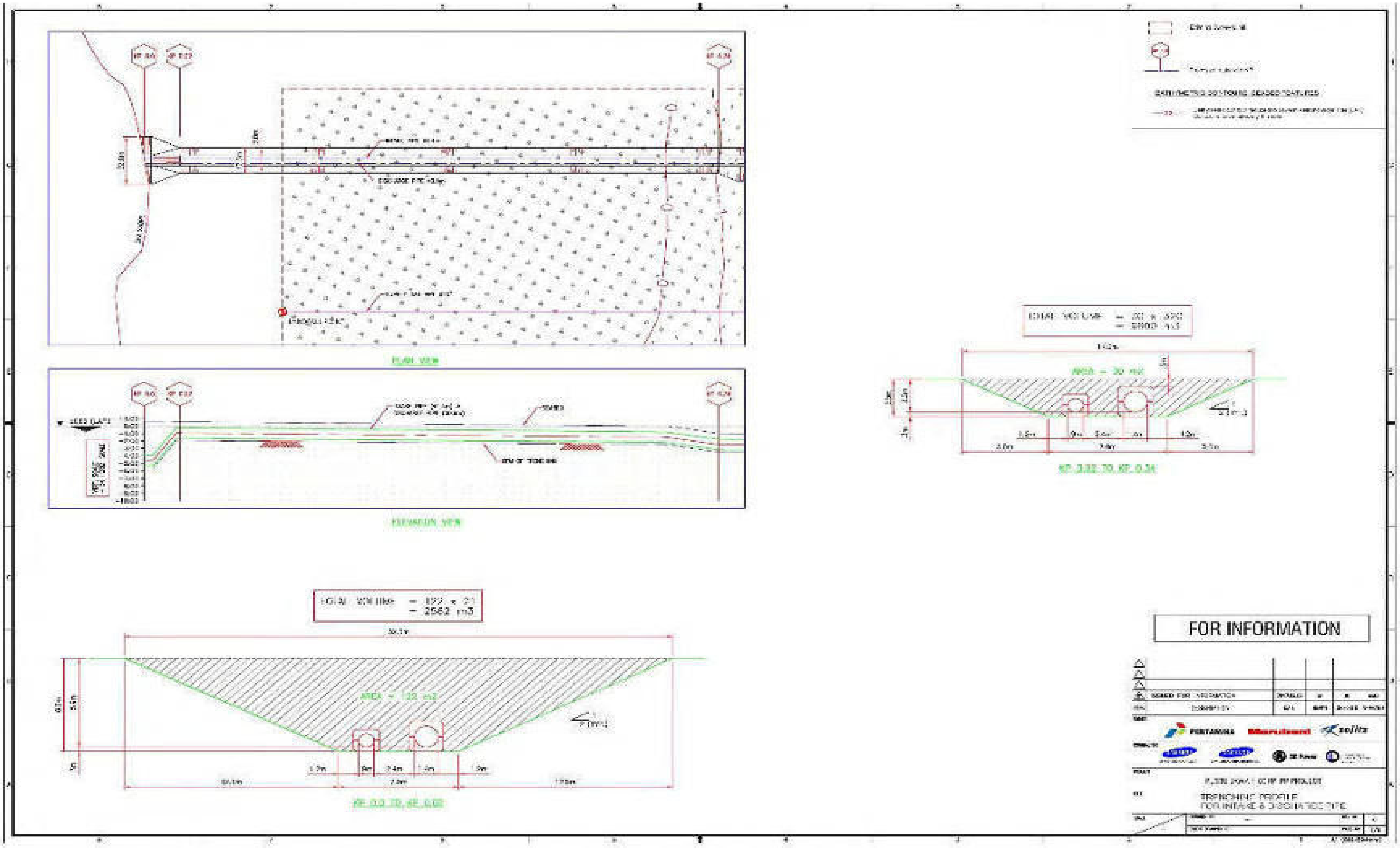
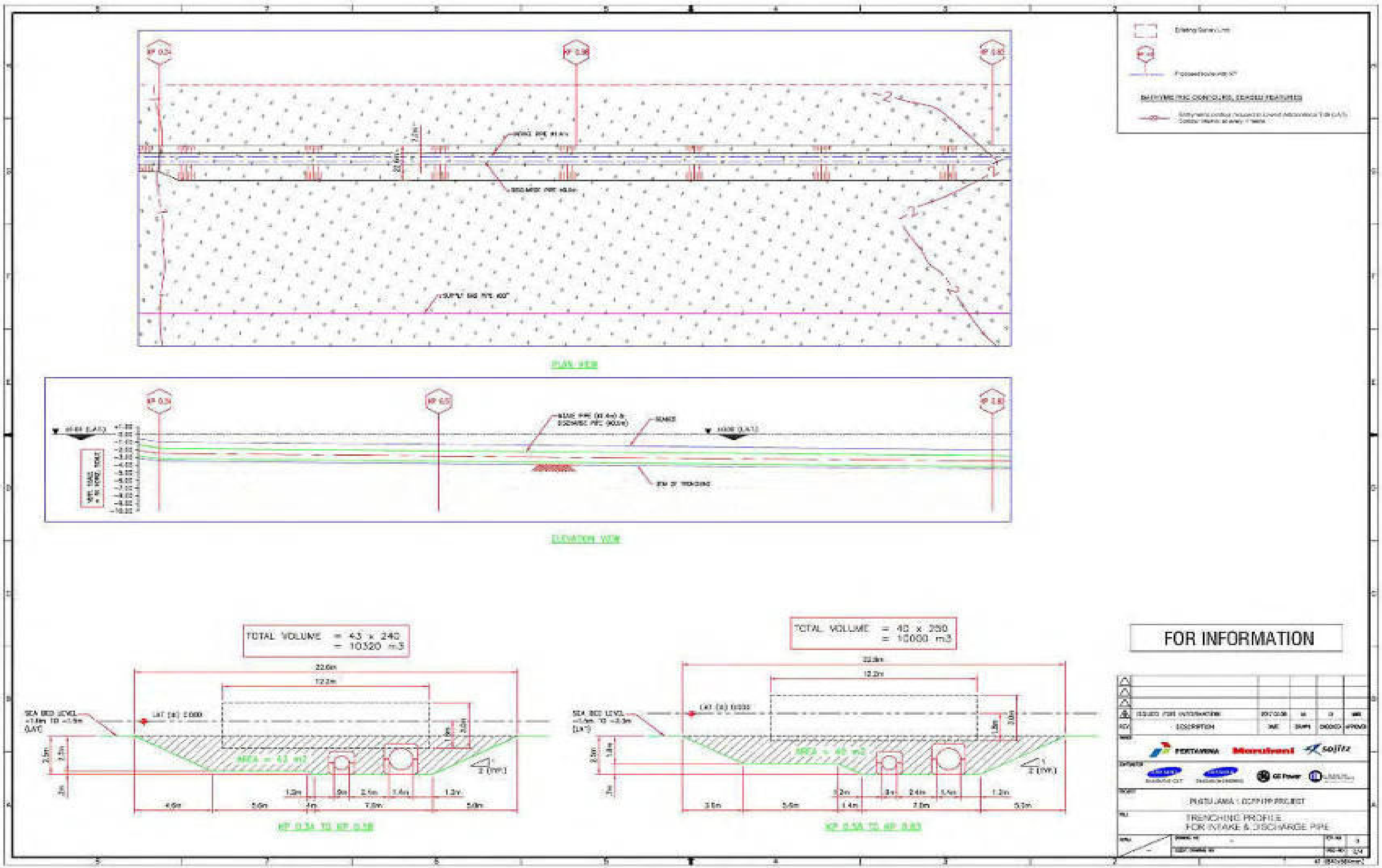
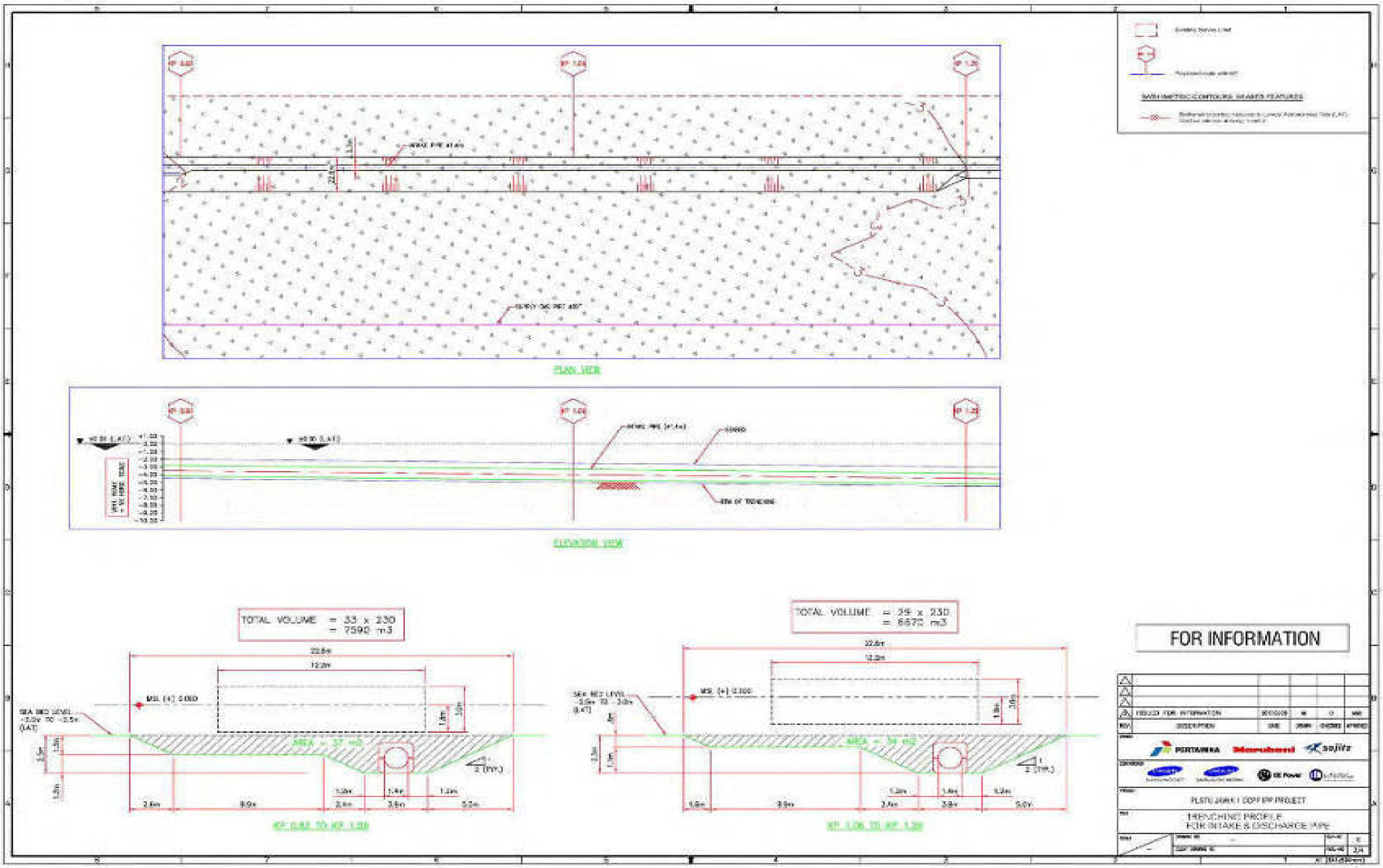
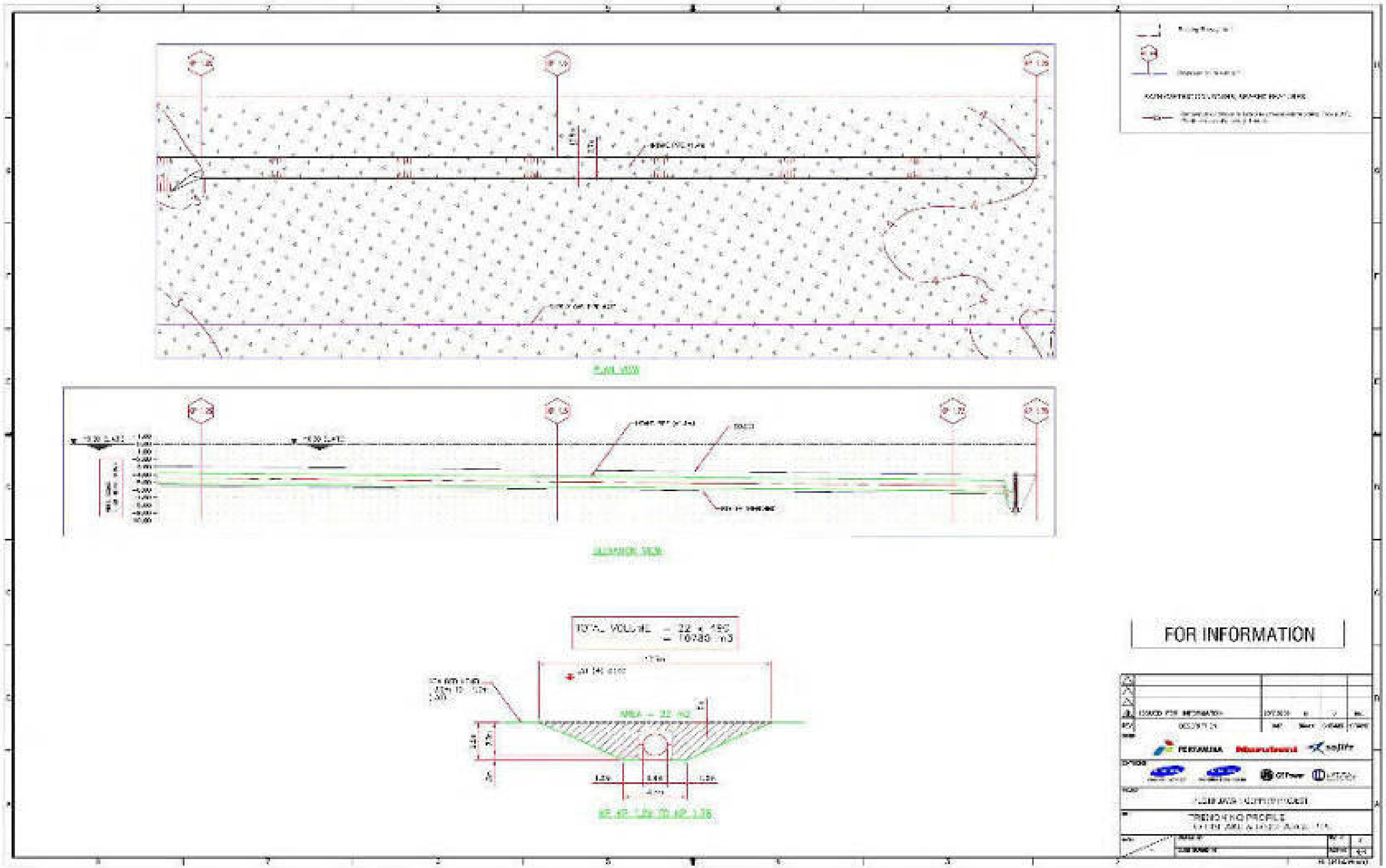


Figure 8-40 Trenching Profile of Intake and Discharge Pipeline Installations




PLAN VIEW
ELEVATION VIEW
TOTAL VOLUME = 43 x 240
= 10320 m3
TOTAL VOLUME = 40 x 250
= 10000 m3
22.0m
12.2m
AREA = 43 m2
AREA = 40 m2
KP 0.34 TO KP 0.58
KP 0.58 TO KP 0.83
FOR INFORMATION
PERTAMINA
Marubeni
Sojitz
TRENCHING PROFILE
FOR INTAKE & DISCHARGE PIPE


PLAN VIEW
ELEVATION VIEW
TOTAL VOLUME = 33 x 230
= 7590 m3
TOTAL VOLUME = 29 x 230
= 6670 m3
FOR INFORMATION
TRENCHING PROFILE
FOR INTAKE & DISCHARGE PIPE


FOR INFORMATION
PERTAMINA
Marubeni
sojitz

Impact Evaluation and Significance

Sediment dispersion modelling was conducted for both the wet (west) and dry (east) seasons to evaluate the magnitude and extent of the dredge plume (elevated TSS above background concentrations). In order to assess the magnitude of impact a simulation of the elevated TSS incorporated the processes of settling sediment (deposition, settling velocity, flocculation, erosion). The model assumptions were as follows:

1. Elevated TSS resulting from the intake and discharge pipeline installation, assumed the initial condition and boundary condition of TSS = 0;

2. Considering sediment characteristics the model was designed in one layer with six fraction compositions of sediments. Sediment fractions 1-3 represented 'fine sediment' and fractions 4-6 'hard sediment'. The critical shear stress of each fraction = 0.1 N / m^3;

3. Total dredging material of 57,522 m^3, with a dredging duration of 45 days, assuming 1,278.3/day m^3; and

4. The dredging location represented as points sources, with the total number of points being 45, or one point source a day.

Based on the model results, elevated TSS parameters from the dredging of intake-outfall pipe installation ranges from 1 to 9 mg/l. The direction of TSS movement as influenced by the hydrodynamic condition in the location of the study, is dominant to the northwest. The fulfilment of the Indonesian regulatory limit is influence by the ambient condition of the TSS concentration in the location of the project. As discussed previously there are a number of exceedances from the baseline sampling results at stations MW9 and MW10 which in a no project condition are above the limits of the Minister of Environment Decree No. 51 of 2004 attachment III for marine biota. The distribution of TSS lasts for 45 days and after the activity stops, by day 47 TSS is not recorded in the modelled area. The modelled magnitude of elevated TSS from the installation of the intake and discharge pipelines at the baseline sampling stations is presented in ***Table 8-114***.

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Table 8-114 Prediction Magnitude of Impact Average of TSS Parameters from the Intake and Discharge Pipeline Installation

Location	TSS Concentration (mg/l)			Standard Limit (mg/l)*	
	Baseline Setting	Magnitude of Impact (TSS Increase)	Resultant Environmental Condition	Mangrove	Coral Reef
MW7	<8	0.0	<8	80	20
MW9	647	0.0	647	80	20
MW10	142	3.4	145.4	80	20
MW11	11	6.7	17.7	80	20
MW12	12	0	12	80	20
MW13	50	0	50	80	20
MW17	11	0	11	80	20

** MoEF Decree No.51 year 2004 Annex III for Marine Biota*
Exceedances highlighted
*Locations refer to the sampling stations as illustrated in **Figure 8-34** to **Figure 8-37** and described in Annex B Environmental Baseline Surveys Results*

Based on the simulation of the impact of the dredging activity of 57,522 m^3 at the end of intake and discharge pipeline installation (day of 45), TSS distribution is dominant to the northwest and broader in the east (dry) season. However, in total average the TSS distribution is broader at the west (wet) season. The modelled areas of the impact distribution for the maximum TSS distribution of 9mg/l over the 45 day installation period is shown in ***Table*** 8-115.

Table 8-115 Area and Trajectory of Maximum Elevated TSS from the Intake and Discharge Pipeline Installation

Period	West Season (Km^2)	East Season (Km^2)
Day 1	1.77 north west	2.62 west
Day 5	2.12 north west	2.53 west
Day 10	1.78 north west	0.87 north
Day 15	1.65 north west	1.23 north west
Day 20	2.14 north west	1.78 north west
Day 30	1.74 north west	2.24 north west
Day 40	3.21 north west	0.68 north west
Day 45 (end)	0.59 north west	2.14 north west

The results of increased TSS dispersion from the intake and discharge pipelines installation are presented in ***Figure 8-41*** and ***Figure 8-42***.

Figure 8-41 Modelled TSS Elevations from Seawater Water Intake and Wastewater Pipeline Installation in West (Wet) Season

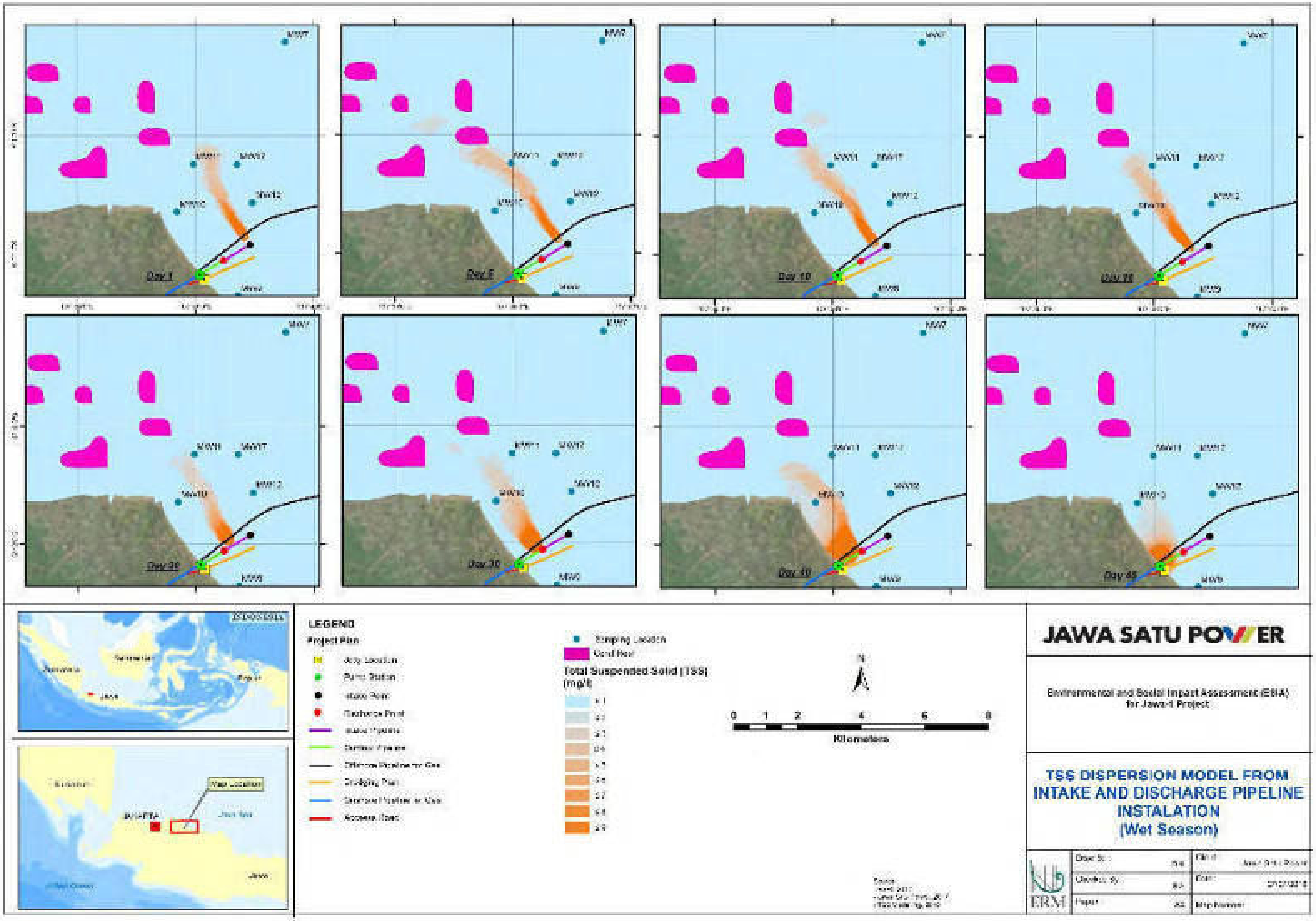
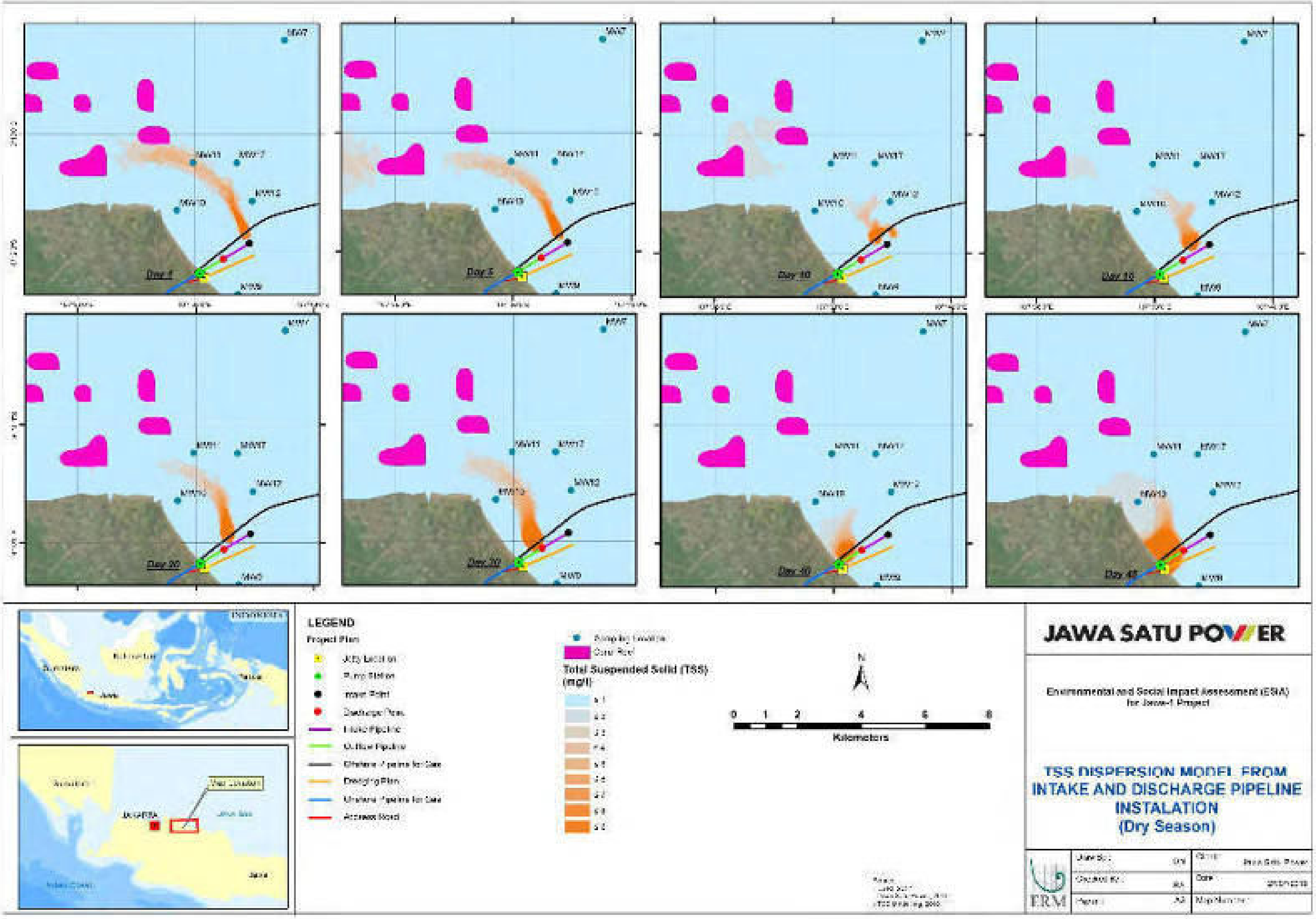


Figure 8-42 Modelled TSS Elevations from Seawater Water Intake and Wastewater Pipeline Installation in East (Dry) Season



The nature of the benthic has been discussed in the preceding sections. The loss of infauna and epifauna communities as a result of intake and discharge pipeline will affect a relatively small area of the widely occurring habitats and communities along this coastal area (total length of the dredging area 1.781 km and limited period of 45 days). As previously discussed, the recovery of the benthos in the affected area is expected to occur following the end of the dredging activity and return to background levels over a reasonable timescale. This impact as additional to the physical removal of the benthos and associated sediment is not considered significant as it minimises disturbance to the area of activities.

With the exception of baseline elevated TSS recorded at two baseline sampling stations (MW10 and MW11), the contribution of TSS from pipeline installation does not exceed the regulation limit of the Minister of Environment Decree No. 51 of 2004 attachment III for marine biota. The modelled TSS from pipeline installation does approach the nearest area of coral as shown in secondary data. The 2017 coral survey did not establish viable coral communities at this location given the high baseline TSS.

Considering the magnitude of elevated TSS, area impacted and duration, the distribution of TSS from intake and discharge pipeline installation impact magnitude is considered to be **small**. The sensitivity of the receptor is classed as **medium** given the natural exceedances against regulatory limits, resulting in an impact of **Minor** significance (***Table 8-116***).

Table 8-116 Assessment of Impacts from Loss and Degradation of Marine Habitats during Construction

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

Mitigation Measures, Management, and Monitoring

The mitigation and monitoring discussed for jetty installation should be implemented for the installation of the outfall and intake pipelines.

Assessment of Residual Impact

Given the medium sensitivity of the environment from the baseline exceedance of TSS standards, the residual impact remains **Minor**.

8.13.4 *Assessment of Impacts - Degradation of Marine Habitats and Ecological Communities from Invasive Marine Species (IMS)*

The FSRU will be mobilised to Indonesia from a fabrication yard in Korea. Additional support vessels may also be mobilised to the region from waters outside Indonesia. Invasive Marine Species could therefore be introduced through the discharge of ballast water or from vessel hull fouling.

Invasive species are any species that are non-native to a particular ecosystem and whose introduction and spread causes, or are likely to cause, socio-cultural, economic or environmental harm or harm to human health (*FAO, 2013*). Invasive species are naturalised species that reproduce often in large numbers and are spread over a large area, damaging native species (*FAO, 2005*).

The Global Invasive Species Database (GISD) (2017), returned no records for the marine area although there is potential for unreported invasive species to be present.

8.13.4.1 *Impact Evaluation and Significance*

Ballast water can contain thousands of aquatic microbes, plants and animals, which can be spread across the globe as the vessel releases ballast water. Unmanaged ballast water released in foreign ports could potentially introduce a range of invasive marine species. Invasions have already taken place around the world, in some instances with significant consequences for the local ecosystem.

The introduction or spreading of non-indigenous species through hull fouling of (typically slow-moving) vessels such as dredgers or Project equipment can occur, when marine plants and animals that attach and grow on the submerged parts of a vessel like the hull, propellers, anchors, niche areas and fishing gear and are transported to a receiving port and become established. Vessel biofouling is a major pathway for the introduction of exotic species around the world.

The introduction and spread of marine species through biofouling, or in a ship's ballast water, can harm fisheries, threaten healthy fish habitats and have adverse economic and health effects.

In view of the globally recorded negative effects of invasive species transfers, the International Maritime Organisation (IMO) considers these introductions to new environments via ships' ballast water, hull or other vectors. To reduce these risks, the IMO has instituted ballast water management regulations (1), including requirements for open ocean ballast water exchanges and associated ballast water management record books.

The implementation of open ocean ballast water exchanges has been shown to reduce plankton concentrations within ballast water holding tanks on container vessels by 90 percent (*Ruiz & Smith, 2005*).

The sensitivity of the project area to Invasive Marine Species is considered to be **Low**. The magnitude of effect due to Invasive Marine Species is likely to be **Medium**. The overall magnitude of this impact is therefore **Minor**.

Table 8-117 Assessment of Impacts from Invasive Marine Species

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

8.13.4.2 *Mitigation Measures*

It is recommended that the following mitigation measures be applied in relation to Invasive Marine Species during construction*:*

- The FSRU and any contracted vessels coming from outside of Java territorial waters will have vessel hull and niches confirmed to be free of IMS prior to mobilisation to the local waters of the Project area.

- All contracted vessels and the FSRU will maintain a current anti-fouling coating, as evidenced by a current Anti-fouling System Certificate under Annex 1 of the International Convention on the Control of Harmful Anti-Fouling Systems on Ships or other equivalent records.

- The FSRU and all contracted vessels will meet the requirements of the International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004, including:

  - Ballast water shall be managed in accordance with the provisions set out in the Convention; and
  - A Ballast Water Management Plan and a ballast water record book will be implemented and maintained on board. The FSRU and any vessels coming from outside of Jawa waters will have vessel hull and niches confirmed to be free of IMS prior to mobilisation to the local waters of the Project area.

8.13.4.3 *Monitoring Measures*

The following monitoring measures are recommended:

- Records are to be kept and regularly reviewed (3 monthly) for the completed Ballast Water Record Book.

8.13.4.4 Assessment of Residual Impact

The residual impact remains **Minor**.

8.13.5 Assessment of Impacts - Direct Mortality or Injury of Marine Fauna from Vessel Movements (Construction Vessel Presence)

A number of vessels will support the project during the construction phase, including those associated with the mobilisation and construction of the FSRU, construction and installation of the pipeline and general supply vessels. Specifically, vessels are likely to include a crane barge, support barge, tug and dive vessels. Vessels will also be temporarily present within the nearshore area during pipe laying, dredging and establishment of the FSRU mooring.

Project vessels could collide with marine fauna resulting in superficial injury, serious injury, affecting life functions (e.g. movement and reproduction) and in the most extreme cases, mortality.

8.13.5.1 Impact Evaluation and Significance

Marine fauna at most risk of vessel collision include marine turtle and marine mammal species of conservation significance. There are no confirmed records of marine turtles or mammals from surveys conducted within the Project site and there are no known important marine mammal or turtle habitats, such as turtle nesting beaches, associated with the coastline at the Project area. However, species of marine mammals are known to occur within Indonesia. Spinner dolphins (IUCN listed as Data Deficient) have been anecdotally recorded in the Project site, therefore individuals may occur within the Project site on occasion.

The sensitivity of marine mammal species to injury or mortality from vessel strike is considered to be **Medium** for the Data Deficient species.

Vessel speed has been demonstrated as a key factor in collisions with marine fauna such as marine mammals with faster vessels having a greater collision risk than slower vessels (*Laist et al. 2001*). Laist et al. (2001) suggest that the most severe and lethal injuries to cetaceans are caused by vessels travelling at 14 knots or faster.

Marine mammal collisions are uncommon and based on a NOAA database there are only two known instances of marine mammal collisions with vessels travelling at less than 6 knots (Jensen and Silber 2004).

Small cetaceans (dolphins) that may occur in the Project site are agile and highly mobile animals. Dolphins are commonly observed swimming around vessels and riding bow waves and are thus expected to have a greater awareness and ability to avoid the relatively slow moving Project vessels during construction activities. The lack of any recognised aggregation areas for marine mammals in the Project site reduces the likelihood of any vessel interactions with marine mammals.

The magnitude of effect due to marine fauna injury or mortality from vessel strike is likely to be **Small** as such an incident is either unlikely to occur or will be highly infrequent. Potential injury or mortality of an individual or small number of marine fauna during construction will not result in a substantial change in the population of the species present, or other species dependent on them. The overall magnitude of this impact is therefore **Minor**.

Table 8-118 Assessment of Impacts on Marine Fauna from Vessel Collision

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

8.13.5.2 *Mitigation Measures*

It is recommend that the following mitigation measures be applied in relation to vessel collision during construction:

- Vessels will operate in accordance with standard maritime practices, whereby vessel speeds will be adjusted depending on environmental conditions (e.g., visibility, metocean condition) as required by the captain of the vessel and to avoid any encountered hazards;
- Support vessels will not travel greater than six (6) knots within 300 m of a whale or 100 m from a dolphin, if sighted, (i.e. will maintain a caution zone of those distances). In addition, vessels will approach no closer than 100m from a whale or 50 m from a dolphin, if sighted. (Note this standard does not apply to support vessels engaged in limited/constrained manoeuvrability activities where vessel speed will already be low);
- Vessels will not directly approach a marine mammal from in front or behind their path of travel;
- Vessels will not exceed a speed limit of 5 knots within designated boating channels around the jetty or the FSRU; and
- Vessel bridge crew to maintain visual watch of any hazards (including marine mammals).

8.13.5.3 Monitoring Measures

The following monitoring measures are recommended:

- Records are to be kept and regularly reviewed (3 monthly) for the mortality or injury of marine fauna from vessel movements

8.13.5.4 Assessment of Residual Impact

In view of the implementation of mitigation measures, the residual impact is to remain **Minor** significance.

Operations Vessel Presence

Vessel collision impacts to marine fauna are described in the preceding Section under the construction phase and are not assessed further. Standard control measures for operational vessel movements will be the same.

8.13.6 Assessment of Impacts - Disturbance and Displacement of Marine Fauna by Underwater Noise during Construction

Disturbance and displacement of marine fauna by underwater noise could occur from pile driving activities, dredging and vessel activities during construction. Pile driving is required for the jetty construction as well as the FSRU mooring. The jetty construction is expected to require nine (9) months, with the foundations piled into the seabed. FSRU mooring is expected to require 32 days to install a total of 32 circular steel piles related to breasting and mooring dolphins (i.e. one (1) pile installed per day). All piling works will be completed using a hydraulic hammer as a quieter alternative to a diesel powered impact hammer.

Dredging activities will be required for the jetty construction to allow access to barges and other supply vessels. Dredging will be undertaken by swamp backhoe in shallow intertidal areas (<1 m depth) and by flat working barge equipped with long arm excavators or crawler cranes with clam shells in deeper water. Dredging will occur over approximately 9 months. Trenching along the seawater intake and waste water outflow pipelines and the pipeline route will also be undertaken using backhoe or clamshell methods for open trenching in shallow water up to 2 m depth and potential jetting or ploughing for post-trench activities in deep waters. Other vessel activities during construction, such as supply vessels, will also create underwater noise.

Construction activities at the proposed jetty and FSRU are therefore expected to generate underwater noise. This can affect marine biodiversity in three (3) main ways (*Richardson et al., 1995; Simmonds et al., 2004*):

- Injury or hearing impairment. Hearing loss may be temporary i.e. Temporary Threshold Shift (TTS), or permanent (Permanent Threshold Shift (PTS);

- Masking or interfering with other biologically important sounds (including vocal communication, echolocation, signals and sounds produced by predators or prey); and

- Disturbance leading to behavioural changes.

8.13.6.1 *Impact Evaluation and Significance*

As described in **Chapter 7**, deep water marine mammal species that have been recorded in the region are very unlikely to occur within the Project area. Interviews with local fishermen have indicated that dolphins, however, may sometimes occur in the area. The species are unknown but are most likely to be bottlenose dolphins. There is a small possibility that Indo-Pacific humpback and Irrawaddy dolphins could be present in nearshore waters. They are coastal species found broadly in Indonesia, but in fragmented and patchily distributed subpopulations, and have not been recorded in the region.

The severity of potential underwater noise impacts depends on the context of the surrounding environment and the sensitivity that the animal has to the sound. Three functional hearing categories have been assigned to whales and dolphins, based on whether they hear and communicate at low, mid or high frequencies (*Southall et al. 2007, Finneran 2015; 2016 and NMFS 2016a*). Large baleen whales (e.g. humpback whales) use low frequency sounds. Large toothed whales (e.g. sperm whales and some offshore dolphins) use mid-frequency sounds. Coastal dolphins (e.g. Irrawaddy dolphins) use high-frequency sounds. Based on this, NMFS (2016) have proposed impact criteria for TTS and PTS impacts in cetaceans (**Table 8-119**).

The context of sound exposure plays a critical and complex role in behavioural responses (*Gomez et al. 2016*). For example, different species (and different individuals or groups within a species) may respond differently to varying levels of sound depending on their behaviours and motivation at the time (e.g. foraging, socialising, reproduction) and other factors such as the type of sound, duration of exposure, and the suddenness of the onset of the received sound (*Gomez et al. 2016*). Cetaceans have been observed to exhibit varying behavioural responses to underwater sounds (ranging from, for example, momentary pauses in vocalisations and changes in body orientation, to changes in travel direction and behavioural avoidance) between SPLs of 120 and >180 dB re 1 µPa (*Southall et al. 2007; Gomez et al. 2016).* Higher received levels are not always associated with stronger behavioural responses (*Southall et al. 2007; Gomez et al. 2016*), but it is reasonable to assume that more significant behavioural responses such as avoidance are more likely to occur in response to higher sound levels. It is important to differentiate minor, biologically insignificant reactions from sustained, and/or biologically meaningful responses that may influence survival (*Southall et al. 2007*).

Currently, there are no specific received level thresholds for reliably assessing or regulating masking or stress responses. Impact assessment is focussed on responses that may lead to significant life stage impacts or displacement from an area, so a threshold for behavioural disturbance based on cetacean avoidance reactions to sound is more commonly adopted as a proxy for such effects (*Gomez et al. 2016*).

Table 8-119 Auditory Hearing Ranges and Underwater Noise Impact Criteria Proposed for Cetaceans

Receptor Group	Auditory Hearing Range	Impact Criteria	
		TTS * [3]	PTS * [3]
Low-frequency cetaceans	7 Hz – 35 kHz, most sensitive between 200 Hz and 19 kHz [1, 2, 3]	Impulsive: 213 dB (Pk), 168 dB (SEL_{cum}) Non-impulsive: 179 dB (SEL_{cum})	Impulsive: 219 dB (Pk), 183 dB (SEL_{cum}) Non-impulsive: 199 dB (SEL_{cum})
Mid-frequency cetaceans	150 Hz – 160 kHz, most sensitive between 8.8 kHz and 110 kHz [1, 2, 3]	Impulsive: 224 dB (Pk), 170 dB (SEL_{cum}) Non-impulsive: 178 dB (SEL_{cum})	Impulsive: 230 dB (Pk), 185 dB (SEL_{cum}) Non-impulsive: 198 dB (SEL_{cum})
High-frequency cetaceans	275 Hz – 160 kHz, most sensitive between 12 kHz and 140 kHz [1, 2, 3]	Impulsive: 196 dB (Pk), 140 dB (SEL_{cum}) Non-impulsive: 173 dB (SEL_{cum})	Impulsive: 202 dB (Pk), 155 dB (SEL_{cum}) Non-impulsive: 173 dB (SEL_{cum})
References: [1] Finneran (2015); [2] Finneran (2016); [3] NMFS (2016); [4] Southall *et al.* (2007)			
Notes: * Cumulative SEL thresholds are frequency-weighted according to the low, mid and high frequency functional hearing categories for cetaceans.			

Fish vary widely in their vocalisations and hearing abilities. Fish species with swim bladders connected to their inner-ear are considered to be most sensitive to sound pressure, while fish species without a swim bladder connection are less sensitive to sound pressure and may only be sensitive to the particle motion components of sound at very close ranges (*Popper & Fay 2011; Popper et al. 2014; Hawkins & Popper 2016; Carroll et al. 2017*).

Behavioural effects of noise on fish will vary depending on the particular circumstances of the fish, hearing sensitivity, the activities in which it is engaged, its motivation, and the context in which it is exposed to sounds (*Hawkins & Popper 2017*). Responses may include avoidance behaviours, startle reactions, increased swimming speed, change in orientation, change in position in the water column, changes to schooling behaviour (e.g. tightening of school structure), seeking refuge in reefs, and temporary avoidance of an area leading to temporary and localised changes in distribution (*Simmonds & MacLennan 2005; McCauley et al. 2003; Engås et al. 1996; Engås & Løkkeborg 2002; Slotte et al. 2004; Fewtrell & McCauley 2012; Popper et al. 2014; Carroll et al. 2017*).

Piling Noise

Literature indicates noise levels for a variety of pile and hammer types ranged from approximately 170 to 220 dB re 1 µPa (peak); 165 to 205 dB re 1 µPa (SPL); and 150 to 195 dB re 1 µPa2-s (SEL) (measured at 10 m from the source) (*Illinworth and Rodkin, 2007*). Hammering sounds from percussive pile driving have been reported with received levels to 135 dB re 1µPa at a range of one (1) km from the source, and an audible range extending to 10–15 km.

The highest sound intensity recorded for a pile driver (on record) is 257 dB re 1 µPa at 1 m (*Nedwell et al., 2009*). A 2002 study of pile-driving operations (to construct a new Australian Defence Force wharfing area in Twofold Bay, Eden, NSW) recorded an average level of 167 dB re 1 µPa (SPL) (at 300 m from the operation), falling to 145 dB and 136 dB re 1 µPa at 1.8 and 4.6 km respectively (*McCauley et al.,2002*). The average signal strength fell from 150 dB to 140 dB re 1 µPa between one (1) km and 3.1 km from the operation. Power spectra showed peaks mostly between 100 Hz and 1 kHz.

As well as the hammer types influence on noise levels, noise levels may also vary with rocky or soft substrate, where hammering through soft sediment may generate lower noise levels (*Luis et al., 2007*). Noise levels from percussive piling have their highest energy at lower frequencies from about 20 Hz to 1 kHz (*Greene, 1987*) but the range can extend much higher.

Based on the criteria recommended by NMFS (2016), pile driving may cause injury or hearing impairment (PTS/TTS) to dolphins from single hammer strike at close range (tens to hundreds of metres). Cumulative exposures may result in TTS to dolphins within a few kilometres if they remain within range for the duration of a pile driving activity, but they are likely to swim away and avoid the area before significant TTS occurs. Noise levels may remain above thresholds for behavioural disturbance for considerable distance (>five (5) km) (David, 2006), although significant avoidance responses can reasonably be expected to occur within one (1) or two (2) kilometres.

Popper *et al.* (2014) suggest that injury to fish may occur in response to pile driving sound levels greater than 207 dB re 1 µPa (peak), which would be limited to the immediate vicinity of the pile or may not be exceeded at all. TTS impacts may occur if fish remain in close proximity for an extended period of time, but again, it is likely that fish will swim away and avoid the area before significant TTS occurs. Fish that may normally be resident within adjacent mangrove habitat may abandon the mangroves immediately adjacent to the jetty during the pile driving period (approximately 64 days) but occupancy would be expected to return over days/weeks following construction activities and no long term population impacts are expected.

Dredging Noise

Literature is limited regarding noise levels generated from dredging activities and also depend on the type of dredger used. Most studies have been carried out on trailer suction hopper dredgers and indicate that the highest levels of sound are generated when the vessel is in transit. Jiménez Arranz et al. (2017) reviewed a number of dredging studies and indicate that backhoe dredging can produce noise levels of 164-179 dB re 1µPa@1m, reducing to 130-140 re 1µPa (rms) within approximately 100-200 m. Similarly, noise levels during a number of different grab dredging projects were found to fall to approximately 100-110 dB re 1µPa (rms) within approximately 150 m to 550 m.

To date, auditory injuries have not been observed or documented to occur in association with dredging. Lower levels of impact may take the form of recoverable damage to auditory tissues and hearing loss attributable to temporary threshold shifts (TTS) if animals are exposed for a long period of time and stay in the vicinity of the dredger. Behavioural responses from transient marine mammals and fish are more likely to occur, though such effects are likely to be limited mostly to within a few hundred metres from the dredging activity with underwater noise levels potential audible to over 1 km. Therefore, impacts from dredging are expected to be highly localised, temporary and of low magnitude.

Vessel Noise

Vessel movements during construction activities (i.e. construction, supply, etc.) will generate noise by cavitation caused by the rotation of propellers and by machinery operated on the decks and working areas. Marine operations conducted on the decks and working areas of the vessel introduce strong sounds of varying characteristics into the water column, largely at low frequencies.

Excessive continuous noise above a tolerable threshold for marine fauna may result in damage to the auditory system, behavioural change, avoidance, temporary shift in hearing thresholds and interference with acoustic signals (McCauley et al., 2003). The likely impacts associated with noise emissions from vessels are limited to localised disturbance of very low numbers of marine fauna that may be present in the vicinity of the works. Fish are known to quickly habituate to vessel noise (Smith *et al.*, 2004; Wysocki *et al*. 2006; Spiga *et al*., 2012; Nichols *et al*., 2015; Johansson *et al.*, 2016; Holmes *et al.*, 2017).

The overall significance of impacts associated with marine fauna during piling activities, dredging and vessel activities is discussed and presented in **Table 8-120.** The sensitivity of impacts associated with marine fauna during piling activities, dredging and vessel activities is considered to be **Medium**. The magnitude of effect associated with marine fauna during piling activities, dredging and vessel activities is likely to be **Medium** as without mitigation, injury/PTS/TTS impacts are possible adjacent to pile driving, in addition to behavioural impacts, although no long term population impacts expected.

The overall significance of this impact is therefore **Moderate** for this activity.

Table 8-120 Assessment of Impacts on Marine Fauna during Piling Activities, Dredging and Vessel Activities

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

8.13.6.2 *Mitigation Measures*

Given impacts are assessed of **Moderate** significance, the following additional mitigation measures, which are considered standard good practice controls are recommended:

- Acoustic decoupling (i.e. repositioning or placement on rubber fittings) of loud equipment during piling should be implemented.

- Pile driving management measures consistent with JNCC (2010) standard pile driving protocol:
  - Trained and dedicated Marine Mammal Observers (MMOs) and Passive Acoustic Monitoring (PAM) operatives during pile driving;
  - Mitigation zone (JNCC recommend a minimum mitigation zone of 500 m, to be determined on a case-by-case basis. The zone may be determined using numerical modelling of the pile driving characteristics proposed for the project, but in the absence of modelling, a conservative one (1) km mitigation zone will be implemented);
  - 30-minute pre-start observations;
  - Delay-start procedure (if marine mammal sighted within the mitigation zone);
  - Soft-start procedure (minimum 20 minutes); and
  - Shut-down procedures if marine mammal sighted within the mitigation zone during pile driving.

- Delay-start and shut-down procedures will also be implemented if a marine turtle is sighted within 500 m of the pile driving activity;

- Vessel and Dredger maintenance to be performed as adequate maintenance, including lubrication and repair of winches, generators, propulsion components and other potential sources is an effective measure for noise reduction; and

- Any incidents that occur during dredging that result in negative impacts on the marine species will be documented and reported to the authorities when required.

It is understood that marine piling work is based on 24 hour activity with a continuous operation until final penetration depth of the pile to avoid set-up, therefore night-time work will be required. In this case the following applies:

- Where piling/activity continues into a period of poor visibility/ night-time there is no need for additional mitigation.

- Where piling/activity is initiated during times of poor visibility (including night-time conditions, the activity will only be permitted if there have been no sightings of marine mammals within 2 hours prior to low visibility/darkness. Activities then to be kept continuous as much as is possible. Other standard mitigation is also required (with the exception of observation period).

8.13.6.3 Monitoring Measures

The following monitoring measures are recommended:

- Records shall be maintained of all marine species sightings in the area, including date and time, weather conditions, species identification, approximate distance from the pile, direction and heading in relation to the pile driving, and behavioural observations. When marine species are observed in the mitigation zone, additional information and corrective actions taken such as a shutdown of the pile driver, duration of the shutdown, behaviour of the animal, and time spent in the mitigation zone will be recorded.

8.13.6.4 Assessment of Residual Impact

The residual impact to Marine Fauna during piling activities, dredging and vessel activities is considered to become **Minor**, given the above additional measures.

8.13.7 Assessment of Impacts - Direct Mortality to Marine Fauna from Seawater Intake

The operational water supply of CCGT Power Plant will be primarily sourced from seawater. A seawater intake structure and pump station will be established in a fenced compound at the shoreline of the Java sea, close to the jetty and intake and discharge pipelines.

The base of the pump station will be 9.6m below the mean sea level (MSL). The seawater will be abstracted using one (1) offshore intake pipe connected to a submerged intake head located in a dredged pit located at -4.5 meters

MSL. The offshore intake pipe is preliminary sized at 1.3 meter diameter. The approximate length of the intake pipe is 2,000 m.

Seawater intake has the potential for impingement and subsequent entrainment of marine fauna, with can result in injury and mortality effects. Some of these organisms (or life stages of organisms), such as fish eggs, may be fully passive, lacking the ability to avoid intake flow regardless of velocity

8.13.7.1 Impact Evaluation and Significance

The significance of impacts associated with the seawater intake during operation activities is discussed and presented in **Table 8-121**.

There are no confirmed records of marine turtles or mammals from surveys conducted within the Project site and there are no known important marine mammal or turtle habitats, such as nesting beaches, associated with the coastline at the Project area. Spinner dolphins (IUCN listed as Data Deficient) have been anecdotally recorded in the Project site, therefore individuals may occur within the Project site on occasion.

As previously discussed, a range of infauna and epifauna were identified in the nearshore area. Crustaceans were very well represented within the surveyed mangrove area and other species are expected to occur widely in sediment throughout the region. The ecological quality status of benthic communities in the project area is classified as undisturbed to slightly disturbed.

Given that marine turtles or mammals are not expected to frequent the area and that no Critical Habitat is present within the Area of Influence, seawater intake is not expected to have an effect on mobile marine fauna. Impacts are likely to be limited to occasional and incidental intake of benthic invertebrates, although this is expected to have a negligible impact in the context of the wider soft sediment benthic communities surrounding the Project area.

The sensitivity of marine fauna to impingement and entrainment from the seawater intake is considered to be **Low.**

The intake design has not been finalized at the time of writing however the design will be based on MARPOL standards as such the magnitude of effect on marine fauna due to the seawater intake is therefore **Negligible** as the effect will not cause substantial change in the populations of marine fauna present in the area. The overall significance of this impact is therefore **Negligible**.

Similar to the CCGT intake, the FSRU intake system will be equipped with intake grid strainers on the hull that comply with MARPOL to mitigate entrainment.

Table 8-121 Assessment of Impacts from on Marine fauna from the Seawater Intake

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

8.13.7.2 Mitigation Measures

It is recommended that the following mitigation measures be applied in relation to the seawater intake:

- Installation of mesh screens or equivalent to limit ingress of marine organisms based on MARPOL standards.

8.13.7.3 Monitoring Measures

The following monitoring measures are recommended:

- Records are to be kept and regularly reviewed (3 monthly) regarding any mortality to marine fauna from the seawater intake.

8.13.7.4 Assessment of Residual Impact

In view of the implementation of mitigation measures, the residual impact remains **Negligible**.

8.13.8 Assessment of Impacts - Disturbance of Marine Fauna by Operational Underwater Noise Generated by FSRU Operations and LNG Tanker Offloading

Disturbance and displacement of marine fauna may occur from underwater noise produced by the operational FSRU and LNG tanker offloading activities. The estimated number of LNG tankers expected to offload LNG per will be based on PLNs energy requirements; the duration of the offloading process ranges from one (1) to two (2) days. During offloading, tankers may engage thrusters and will be assisted by tugs.

8.13.8.1 Impact Evaluation and Significance

During operations, the FSRU will be stationary and, therefore, noise sources will be limited to structure-borne noise from the gas fired turbine engine and machinery noise passing through the hull, noting that gas-fired engine turbines are less noisy than diesel-fired engine turbines.

As the FSRU will be stationary during operations no propeller cavitation noise will be expected, which accounts for a significant proportion of noise produced by vessels. Underwater noise generated by the FSRU will primarily consist of continuous broadband noise. Increased noise levels are expected during LNG offloading activities when tankers and tugs will engage thrusters to position alongside the FSRU, and machinery and pump noise may increase.

Operational noise from floating facilities have been measured in other locations around the world. Operational FPSO noise, which is comparable to the FSRU, has been reported to be in the order of 180 dB re 1µPa@1 m (SPL) (*Erbe et al. 2013*) and large vessel and tankers, such as the condensate tankers that will be involved in offtake activities, also produce noise in the order of 175 to 185 dB re 1µPa@1 m (SPL) (*Jiménez-Arranz et al. 2017*).

Modelling of both operational and unloading noise from an FPSO in the Barossa field (*ConocoPhillips 2017*) predicted that noise levels would fall below 160 dB re 1µPa within less than 100 m from the FPSO, and would fall to 120 dB re 1µPa within 1.4 km and within 11.4 km during normal operations and offloading activities respectively. However, while noise levels may be audible over these ranges, the lower noise levels in the order of 120 dB re 1µPa are likely to be only marginally above ambient background noise levels given existing distant vessel noise in the area. Other vessels operating in the area will also generate noise in the order of 165-185 dB re 1µPa at 1 m.

Despite the Project area considered to support low numbers of marine mammals, dolphins have previously been sighted and it is reasonable to assume there is some potential for dolphin species to be present in the vicinity of the FSRU on occasion. No aggregation, migration or important habitat for feeding or breeding is known to occur in the vicinity of the FRSU, and therefore, animals that occur in the area are expected to be transitory.

The noise levels generated during operations are not high enough to result in injury or hearing impairment. TTS would only occur if animals choose to remain in the immediate vicinity of the FSRU and tankers for an extended period, although such effects would be recoverable and habituation to the noise is likely. Behavioural responses from transient marine mammals and fish are more likely to occur.

Whales and dolphins have been observed to exhibit varying behavioural responses to underwater sounds (ranging from, for example, momentary pauses in vocalisations and changes in body orientation, to changes in travel direction and behavioural avoidance) between SPLs of 120 and >180 dB re 1 µPa (*Southall et al. 2007; Gomez et al. 2016*). Higher received levels are not always associated with stronger behavioural responses (*Southall et al. 2007; Gomez et al. 2016*), but it is reasonable to assume that more significant behavioural responses such as avoidance are more likely to occur in response to higher sound levels.

Impacts to marine fauna during operations are therefore expected to be limited to behavioural avoidance impacts which may be localised within a few hundred metres from the FSRU during normal operations, or could potentially extend to a few kilometres during peak unloading activities. It should be noted that dolphins are regularly observed swimming voluntarily in close proximity to vessels that generate comparable noise levels without apparent disturbance or disruption, and so this range of potential impact is considered to be conservative. Masking effects to dolphins are not expected except at close range, as the operational noise will be dominant at low frequencies, which would not significantly acoustically interfere with small cetaceans, which typically communicate and echolocate using much high frequencies.

Behavioural impacts to fish are likely to occur over shorter distances than for whales and dolphins. Behavioural response effects in fish will depend on the hearing sensitivity of the fish species that are present, but behavioural effects in response to continuous noise are likely to be limited to within tens or hundreds of metres, but are known to quickly habituate to such noise (*Smith et al., 2004; Wysocki et al. 2006; Spiga et al., 2012; Nichols et al., 2015; Johansson et al., 2016; Holmes et al., 2017*).

As the FSRU does not occur in any biologically important feeding, breeding or aggregation areas, only transient individuals will be exposed for relatively short periods of time. Therefore, while noise from the FSRU and LNG tankers may trigger a range of behavioural reactions, these responses are not expected to be biologically significant or result in population level effects.

The sensitivity of marine fauna to underwater noise from FSRU operations and LNG tanker offloading activities is considered to be **Medium**. The magnitude of effect associated with localised behavioural impacts to marine fauna and fish during operations is **Small**. The overall significance of this impact is therefore **Minor** for this activity.

Table 8-122 Assessment of Impacts on Marine Fauna during FSRU Operations and LNG Tanker Offloading Activities

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

8.13.8.2 Mitigation Measures

The following additional mitigation measure is recommended to minimise underwater noise during operations:

- The FSRU will be maintained in accordance with an inspection and maintenance schedule and procedure, which will reduce excessive noise levels that may otherwise be produced by defective machinery and equipment.

8.13.8.3 Assessment of Residual Impact

The residual impact to Marine Fauna during FSRU operations and LNG tanker offloading activities is considered to remain **Minor** with the above additional mitigation.

8.14 SUMMARY OF ENVIRONMENTAL IMPACTS

Summaries of the environmental impact assessment for construction and operations are provided in **Table 8-123** and **Table 8-124**.

Table 8-123 Summary of Environmental Impacts during Construction

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
Transportation/operation of vehicles (construction, materials/supplies and workforce)	Air Quality	Deterioration of air quality from exhaust emissions from vehicles	**Negligible**	• Old vehicles will be replaced with new, more fuel efficient alternatives. • Where feasible high use vehicles will be converted to cleaner fuels. • All vehicles, equipment and machinery will undergo a pre-use inspection prior to use and periodic maintenance inspections.	**Negligible**
Transportation/operation of vehicles (construction, materials/supplies and workforce)	GHG	Increased GHG Emissions at National Level	**Major**	• Optimisation of construction schedule and placement of laydown areas/temporary camp sites to reduce overall traffic movements/distance travelled, thus reducing GHG emissions from transport.	**Major**
Transportation/operation of vehicles (construction, materials/supplies and workforce)	GHG	Increased GHG Emissions at Global Level	**Moderate**		**Moderate**
Transportation/ operation of vehicles (construction, materials/supplies and workforce)	Terrestrial Biodiversity	Disturbance and displacement of fauna and flora due to the use and movement of heavy machinery and vehicles	**Negligible**	• Use of the access road should be restricted to construction vehicles only. Checkpoints should be used to manage access and inspect vehicles for vegetation (including firewood) taken from the Project Area. • All vehicles are to maintain a speed of a maximum of 40km/hr within work sites to reduce the risk of fauna strike. • All land rehabilitation will be undertaken using native indigenous species. The area of landscaping within the Project area shall re-establish habitat values including re-establishing mangrove habitats along the foreshore area and coastal vegetation along the access road, CCGT plant and facilities. • A community program is to be established with adjacent landowners to replant mangrove forest along foreshore areas and re-establish coastal vegetation on non-utilised	**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				public land and private land (With consent of the land-owner) within the Javan Coastal Zone EBA between the Muara Gembang – Tanjung Sedary KBA and the Muara Gimanuk KBA. This program will re-establish habitat within the EBA suitable for the endemic bird trigger species.	
Workforce presence	Terrestrial Biodiversity	Direct mortality to fauna and flora from hunting and poaching from the workforce and local residents	**Minor**	• Hunting and poaching will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation. • The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to hunting and poaching, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations.	**Negligible**
General Land Clearance – all sites	GHG and Climate Change	Increased GHG emissions (National Level)	**Major**	• Actual land clearing/disturbance will be minimised to the greatest extent possible. Net GHG emissions could also be reduced by revegetation in many areas that will be cleared only for temporary activities such as laydown areas and temporary camps for construction.	**Major**
General Land Clearance – all sites	GHG and Climate Change	Increased GHG emissions (Global Level)	**Moderate**		**Moderate**
General construction activities - all sites	Terrestrial Biodiversity	Disturbance and Displacement of Fauna	**Negligable**	• The planned vegetation clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing; • Clearing of habitat within Natural Habitat areas (mangrove forests) along the coastal zone will be avoided and minimised where possible. No clearing of mangroves is to occur outside of the Project area.	**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				• All land rehabilitation will be undertaken using native indigenous species. • A community program is to be established with adjacent landowners to replant mangrove forest along foreshore areas and re-establish coastal vegetation on non-utilised public land and private land (With consent of the land-owner) within the Javan Coastal Zone EBA between the Muara Gembang – Tanjung Sedary KBA and the Muara Gimanuk KBA. • A Fauna Shepherding Protocol is be used in the Javan Coastal EBA to ensure that any endemic bird species have vacated the area prior to any clearance work.	
General construction activities - all sites	Landscape & Visual	Visual impact of activities and sites	**Negligible**	No additional mitigation needed	**Negligible**
General construction activities - all sites	Air Quality	Dust generation - Deterioration of air quality	**Major**	• Develop and Implement a Dust Management Plan (DMP). The DMP will contain the measures outlined in this document and a plan for implementation. • Regular site inspections will be performed to monitor compliance with the DMP. All inspection results will be recorded and corrective actions taken where mitigation and management measures are not being implemented effectively. • Daily onsite and offsite inspections will be undertaken to visually assess the dust emissions from earthwork and construction activities, and from vehicles exiting the construction sites. Results from the inspection will be recorded and appropriate measures will be taken to reduce emissions where necessary. • All dust and air quality complaints will be recorded, the cause identified and the appropriate measures taken to reduce emissions in a timely manner. • The frequency of site inspections will be increased when activities with a high potential to produce dust are being carried out and during prolonged dry and windy conditions. • Use of site watering to suppress wind and physical disturbance dust generation.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				• Only cutting, grinding, or sawing equipment fitted with suitable dust suppression techniques such as water sprays will be used. • All chutes, conveyors and skips will be covered at all times. • Drop heights from conveyors, loading shovels and hoppers will be minimised. • Ensure an adequate water supply on site for effective dust suppression and mitigation.	

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
General construction activities – CCGT Power Plant	Air Quality	Dust generation - Deterioration of air quality	**Major**	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top cover in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape. • Real time PM_{10} monitoring will be undertaken at two fenceline locations. Monitoring will commence 3-months prior to the earthwork phase commencing. • Wind breaks will be erected around the construction site at least the height of any stockpile on site. • Use of site watering to suppress wind and physical disturbance dust generation. • The construction site will be planned so that machinery and dust causing activities are located away from air sensitive receptors as far as possible. • All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required. • Deliveries of ready-made cement and other fine powders will be delivered in enclosed tankers and stored with suitable emission controls to prevent escape of material and overfilling during delivery. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
General construction activities – Onshore Pipeline	Air Quality	Dust generation - Deterioration of air quality	**Major**	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top cover in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable. • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
General construction activities - Substation	Air Quality	Dust generation - Deterioration of air quality	**Major**	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top cover in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape. • All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable. • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.	**Minor**
General construction activities - Transmission Line Towers	Air Quality	Dust generation - Deterioration of air quality	**Minor**	• All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Implement a wheel washing system.	**Minor**
CCGT Power Plant high noise generating construction activities e.g. bulk earthworks, piling	Most affected receptors, nearby community	Temporary and short-term noise disturbance impacts and amenity issues	**Major**	• CCGT construction work and activities should be carried out during the IFC daytime hours (i.e. 7am7AM to 10pm10PM). Where possible the CCGT construction works and activities should conclude at 6PM daily, to further minimise impacts and provide respite outsiders standard business hours. • Any work that is performed outside these hours (i.e. during the night time period, 10pmPM to 7am7AM) should be	**Moderate**
	Other affected receptors, broader community		**Moderate**		**Moderate**
CCGT Power Plant general construction	Most affected receptors, nearby community	Temporary and medium-term noise	**Moderate**		**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
activities e.g. site preparation and building construction	Other affected receptors, broader community	disturbance impacts and amenity issues	**Moderate**	suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (i.e. 45 dBA), at all potentially affected sensitive receptors. Where this is not possible it may be necessary to undertake the night works with agreement from nearby and potentially affected neighbours. • Where works near R2, or any unforeseen activities in close proximity to other receptors, are to occur and these works are anticipated to generate high noise levels of >70 dBA, potential respite periods (e.g. three hours of work, followed by one hour of respite) should be implemented. Respite should be implemented if it is the preference of the affected receptors and if it is feasible and reasonable, and practicable, to implement during the works. In some circumstances respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure. • Where unforeseen works will occur in close proximity to a receptor and these works are anticipated to generate high levels of noise (e.g. >75 dBA), potential respite periods (e.g. three hours of work, followed by one hour of respite) should be considered. Respite should be implemented if they are the preference of the affected receptors and if they are feasible and reasonable, and practicable, to implement during the works. In some circumstances respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure. • During the construction design, appropriate plant, equipment and/or machinery should be selected for each task and efficient work practices adopted to minimise the total construction period and the number of noise sources on the site. The quietest item of plant available should be selected where options that suit the design permit.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				• During the works, unnecessary noise due to idling diesel engines and fast engine speeds should be avoided when lower speeds are sufficient. • During the works, drivers should be instructed to travel directly to site and avoid any extended periods of engine idling at or near residential areas. • During any night works, any activity that has the potential to generate impulsive noise should be completely avoided. These types of events are particularly annoying, especially at night and have the limited potential to generate sleep disturbance or awakening impacts. • During the works, ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the site. • During the works, ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse. • Regular monitoring of construction (including piling, see other mitigation below also) noise levels will be conducted and an evaluation of compliance provided for. All site noise levels will be measured in the absence of any influential sources not associated with the project. If the measured project noise levels are below the predicted values and comply with the criteria presented in this report, no further mitigation or management measures may be required. If the measured project levels are above the predicted noise levels and/or criteria presented in this report, further mitigation and/or management measures will be considered and implemented, where feasible, reasonable and practical to do so. **Piling**: • CCGT piling and activities should be carried out during the IFC daytime hours (i.e. 7AM to 10PM). Where possible the	

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				CCGT construction works and activities should conclude at 6PM daily, to further minimise impacts and provide respite outsiders standard business hours. • Any work that is performed outside these hours (i.e. during the night time period, 10PM to 7AM) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (i.e. 45 dBA), at all potentially affected sensitive receptors. Where this is not possible it may be necessary to undertake the night works with agreement from nearby and potentially affected neighbours. • CCGT piling should be conducted as per the method summarised in Section 3.1 and reproduced in Annex C of the acoustics assessment report. • All noise reducing mitigation that is presented Annex C of the acoustics assessment report should occur i.e. pre-drilling to ten metres depth, at all piling locations; use of pile caps and cushions, the latter consisting of five layers of high strength multiflex board; and installation of the EGI fence adjacent to the village area. The height and specification should be determined after EPC test piling and noise monitoring. • The work sequence that is presented Annex C the acoustics assessment should be strictly adhered to and no more than 12 piling rig units should work concurrently unless an alternative work sequence and piling rig layout design/plan is identified that will reduce noise levels, or minimise impacts to those presented in this report.	

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				• Where any unforeseen piling works will occur in close proximity to a receptor and these works are anticipated to generate high noise levels >70 dBA, potential respite periods (e.g. three hours of work, followed by one hour of respite) should be implemented. Respite should be implemented if it is the preference of the affected receptors and if it is feasible and reasonable, and practicable, to implement during the works. In some circumstances respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure.	
Road traffic on access roads general construction traffic	Most affected receptors, nearby community only.	Temporary and medium-term noise disturbance impacts and amenity issues.	**Major**	• Construction road traffic associated with CCGT works should be limited to the IFC daytime hours (i.e. 7AM to 10PM). Any traffic that is required outside these hours (i.e. during the night time period, 10PM to 7AM) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (45 dBA), at all potentially affected sensitive receptors. • During the works, unnecessary noise due to idling diesel engines and fast engine speeds should be avoided when lower speeds are sufficient. • During the works, drivers should be instructed to travel directly to site and avoid any extended periods of engine idling at or near residential areas. • During any night works, any activity that has the potential to generate impulsive noise should be completely avoided. These types of events are particularly annoying, especially at night and have the limited potential to generate sleep disturbance or awakening impacts. • During the works, ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the site. • During the works, ensure that all plant, equipment and vehicles movements are optimised in a forward direction to	**Moderate**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				avoid triggering motion alarms that are typically required when these items are used in reverse. • Implementation of a community grievance mechanism and community consultation should occur.	
ORF general construction activities	Most affected receptors, nearby community only	Temporary and short-term noise disturbance impacts and amenity issues: **noise and vibration**	**Minor**	• Nil	**Minor**
Transmission Line general construction activities	Most affected receptors, nearby community only.	Temporary and short-term noise disturbance impacts and amenity issues: **noise and vibration**	**Minor**	• Nil	**Minor**
Gas delivery pipeline general construction activities	Most affected receptors, nearby community only.	Temporary and short-term noise disturbance impacts and amenity issues: **noise and vibration**	**Negligible**	• Nil	**Negligible**
Cibatu Baru II/Sukatani substation construction activities	Most affected receptors, nearby community only.	Temporary and short-term noise disturbance impacts and amenity issues: **noise and vibration**	**Minor**	• Nil	**Minor**
CCGT Power Plant construction activities	Most affected receptors, nearby community only.	Temporary and short-term disturbance impacts and amenity issues **vibration**	**Minor**	• Nil, however the mitigation specified for noise is also anticipated to assist with vibration.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
Onshore Receiving Facility (ORF), Transmission Line, Gas delivery pipeline, Cibatu Baru II/Sukatani substation construction activities	Most affected receptors, nearby community only.	Temporary and short-term disturbance impacts and amenity issues: **noise and vibration**	**Negligible**	• Nil	**Negligible**
Seawater Water Intake and Cooling Water Outfall Discharge Pipeline construction activities	Most affected receptors, nearby community only.	Temporary and short-term disturbance impacts and amenity issues: **noise and vibration**	**Minor**	• Nil	**Minor**
Jetty construction activities	Most affected receptors, nearby community only.	Temporary and short-term disturbance impacts and amenity issues: **noise and vibration**	**Minor**	• Nil: Noise modelling of Jetty piling works has identified that unmitigated emissions comply with the most stringent night time project-specific criteria (45 dBA) at the closest and/or potentially most affected receptor (N14) situated within the potential area of influence of these activities, as documented in Section 6.1 of the **Annex E** acoustics assessment report. On this basis, the noise reducing mitigation and management measures that are applicable to CCGT piling works, do not apply to Jetty piling, which can be undertaken a) at any time of day i.e. during the daytime or the night time and b) without implementing the noise reducing measures reproduced in Annex C of the **Annex E** acoustics assessment report.	**Minor**
High noise generating construction activities – CCGT Power Plant e.g. bulk earthworks	Noise	Temporary and short-term noise disturbance impacts and amenity issues (most affected receptors, nearby community).	**Major**	• CCGT construction work and activities should be carried out during the IFC daytime hours (i.e. 7am to 10pm). Any work that is performed outside these hours (i.e. during the night time period, 10pm to 7am) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (45 dBA), at all potentially affected sensitive receptors. Where this is not possible it may be necessary to undertake the night works	**Moderate**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
	Noise	Temporary and short-term noise disturbance impacts and amenity issues (other affected receptors, broader community).	**Moderate**	with agreement from nearby and potentially affected neighbours. • Where unforeseen works will occur in close proximity to a receptor and these works are anticipated to generate high levels of noise (e.g. >75 dBA), potential respite periods (e.g. three hours of work, followed by one hour of respite) should be considered. Respite should be implemented if they are the preference of the affected receptors and if they are feasible and reasonable, and practicable, to implement during the works. In some circumstances respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure. • Construction road traffic should be limited to the IFC daytime hours (i.e. 7am to 10pm). Any traffic that is required outside these hours (i.e. during the night time period, 10pm to 7am) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (45 dBA), at all potentially affected sensitive receptors. • During the construction design, choose appropriate machines for each task and adopt efficient work practices to minimise the total construction period and the number of noise sources on the site. Select the quietest item of plant available where options that suit the design permit. • During the works, avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient. • During the works, instruct drivers to travel directly to site and avoid any extended periods of engine idling at or near residential areas, especially at night. • During any night works, any activity that has the potential to generate impulsive noise should be avoided. These types of events are particularly annoying, especially at night and have the limited potential to generate sleep disturbance or awakening impacts.	**Moderate**
General construction activities – CCGT Power Plant e.g. site preparation and building construction	Noise	Temporary and medium-term noise disturbance impacts and amenity issues (most affected receptors, nearby community).	**Moderate**		**Minor**
	Noise	Temporary and medium-term noise disturbance impacts and amenity issues (other affected receptors, broader community).	**Moderate**		**Minor**
General construction road traffic on access roads	Noise and Vibration	Temporary and medium-term noise disturbance impacts and amenity issues.	**Moderate**		**Moderate**
General construction activities – CCGT Power Plant	Vibration	Temporary and short-term disturbance impacts and amenity issues (most affected	**Minor**		**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
		receptors, nearby community).		• During the works, ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the Site. • During the works, ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse. • Implementation of a community grievance mechanism and community consultation should occur. • Regular monitoring of noise levels in these construction areas is conducted. Where required additional noise mitigation measures are put in place to ensure levels remain below the accepted standards. All site noise levels should be measured in the absence of any influential sources not associated with the project. • If the measured project noise levels are below the predicted values and noise/vibration levels comply with the criteria presented in this report, no further mitigation or management measures may be required. • If the measured project levels are above the predicted noise levels and/or criteria presented in this report, further mitigation and/or management measures should be considered.	
General construction activities – Onshore Receiving Facility (ORF), transmission line, Cibatu Baru II/Sukatani substation	Noise	Temporary and short-term noise disturbance impacts and amenity issues	**Minor**		**Minor**
	Vibration	Temporary and short-term disturbance impacts and amenity issues	**Negligible**		**Negligible**
General construction activities – gas delivery pipeline	Noise	Temporary and short-term noise disturbance impacts and amenity issues	**Negligible**		**Negligible**
General construction activities - Seawater Water Intake and Cooling Water Outfall Discharge Pipeline	Noise and Vibration	Temporary and short-term disturbance impacts and amenity issues	**Minor**		**Minor**
General construction activities - jetty	Noise and Vibration	Temporary and short-term disturbance impacts and amenity issues	**Minor**		**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
Earthworks, including vegetation clearance, excavation, grading and levelling	Soil	Exposure of soil causing erosion and loss of top soil.	**Moderate**	• Delineation of clearance boundaries to limit the areas to be cleared. • Scheduling clearance activities to avoid extreme weather events such as heavy rainfall, extreme dry and high winds. • Revegetation areas with temporary land use, conducting progressive rehabilitation. • Demarcate routes for movement of heavy vehicles to minimise disturbance of exposed soils and compaction of sub-surface layers. • Reuse topsoil within rehabilitation activities. • Control erosion through diversion drains, sediment fences, and sediment retention basins.	**Minor**
Earthworks, including vegetation clearance, excavation, grading and levelling	Soil	Exposure of soil causing erosion and loss of top soil.	**Moderate**	• Stockpiles to be separated into topsoil and sub-soil and be located at least 10 m from any surface water source and groundwater well or 50 m from Cilamaya canal; and • Stockpiles are to be located in areas surrounded by natural wind barriers to minimise the potential for wind erosion.	**Minor**
Earthworks, including vegetation clearance, excavation, grading and levelling	Groundwater	Acid sulphate Soil impacts to groundwater, vegetation, surface water quality and aquatic biota from soil clearing at the Access Road and Jetty coastal areas	**Moderate**	For earthworks and excavations in the waterlogged coastal soils where there is the potential for ASS, the following measures are recommended: • Prior to proceeding with any soil disturbance activities, conduct onsite ASS tests at coastal excavation locations; • Where ASS is confirmed to be present implement control measures, such as: – Schedule excavation such that the potential effects on any area disturbed at any one time are limited and managed; – Stockpiling of ASS is only permitted as a short-term activity where removal from site is not possible (e.g. weather) and must be placed on impermeable area with runoff protection, 50 m away from surface water; – Minimise the time that excavations are left open and the presence of temporary spoil piles to reduce the amount of time that ASS is exposed to the air. – No dumping of exposed ASS is permitted onto the surrounding land or into surface waters;	**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				– Use of marine, estuarine, brackish or fresh waters is not permitted as a means of diluting and/or neutralising ASS or associated contaminated waters. – Given the fine sediment and waterlogged nature of the potential area of ASS, covering excavated spoil with clean material is not recommended as the material may liquidise, flow and contaminate the surrounding area. • Evaluate treatment and disposal options based on volume of ASS material, considering: – Removal, treatment and disposal offsite; – Neutralisation of ASS materials (e.g. lime application); or – Strategic reburial in anoxic environment. • Monitoring samples of soil and surface water following completion of earthworks/excavation in ASS affected area. The above mitigation measures should be detailed in an ASS Management Plan that details the steps, measures and strategies that will be used to manage potential impacts of the excavation works that have the potential to disturb ASS materials at the site to reduce the magnitude of the potential impact.	
Earthworks, including vegetation clearance, excavation, grading and levelling	Surface Water Quality	Deterioration of surface water quality.	**Moderate**	Sponsor shall also inform the EPCs to develop Construction Environment Management Plan and Run-off and Sediment Control Plans prior to the commencement of construction activities to include the following: • Major earthworks activities during construction shall be scheduled during dry season as much as possible. • Topsoil removed during clearing shall be stored in specified areas. Stockpiled earthworks, during and after clearing will be placed as bunds at strategic locations in order to reduce sediment loadings to the storm run-off. • Stockpiles to be separated into topsoil and sub-soil and be located at least 10 m from any surface water source and groundwater well or 50 m from Cilamaya canal; • Open stockpiles of construction materials (e.g. aggregates, sand and fill material) in places which are identified to have a possibility of significant run-off will have measures in place to prevent the washing away of construction materials, soil, silt or debris into any drainage system.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				• Earthworks to form the final surfaces will be followed up with surface protection and drainage works to prevent erosion caused by rainstorms. Soil erosion caused by wind and rainstorms shall also be reduced by minimising the land clearance area during construction activities, where possible, providing surface protection such as sheet cover. • Temporary traffic areas and access roads, if any, formed during construction will be protected by coarse stone ballast or equivalent. These measures shall prevent soil erosion caused by rainstorms.	
Earthworks, including vegetation clearance, excavation, grading and levelling	Terrestrial Biodiversity	Loss of habitat and degradation of habitat due to the construction activities	**Minor**	• No clearing of mangroves is to occur outside of the Project area; • Clearing vegetation outside of designated areas will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation. • The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to unauthorised clearing of vegetation, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations. • The planned vegetation clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing. • All land rehabilitation will be undertaken using native indigenous species. The area of landscaping within the Project area shall re-establish habitat values including re-establishing mangrove habitats along the foreshore area and coastal vegetation along the access road, CCGT plant and facilities.	**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				• A community program is to be established with adjacent landowners to replant mangrove forest along foreshore areas and re-establish coastal vegetation on non-utilised public land and private land (With consent of the land-owner) within the Javan Coastal Zone EBA between the Muara Gembang – Tanjung Sedary KBA and the Muara Gimanuk KBA. • Planting of native indigenous flora, including mangroves along the shoreline adjacent to the road and jetty construction sites is to occur to reduce impacts to connectivity along the shoreline. • Appropriate rehabilitation of disturbed areas using native vegetation is to occur to facilitate movement of fauna species, especially within the EBA. It is estimated that approximately 10ha of land adjacent to project components is available for site revegetation.	
Earthworks, including vegetation clearance, excavation, grading and levelling	Terrestrial Biodiversity	Emissions (dust, noise, vibration) and discharges (run-off, effluent) disturbance and degradation of habitats	**Minor**	• Measures to control dust are to be utilised to limit generation of dust and hence deposition onto vegetation surrounding construction areas. • All machinery to be used in areas of Natural Habitat and Critical Habitat are to exert a low pressure on the ground surface so as to minimise soil compaction. • All machinery and hand held equipment used must comply with required air and noise emission standards. • Sediment and erosion control measures are to be used in all areas of construction to minimise soil contaminated runoff entering waterways. These measures are to be outlined in a Sediment and Erosion Control Plan. • All disturbed soil surfaces are to be rehabilitated and native flora species are to be planted within areas under the projects control. These species are to be suitable habitat for bird species listed in the Javan Coastal Zone EBA.	**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
Earthworks, including vegetation clearance, excavation, grading and levelling	Surface Water Quality	Reduction of surface water quality	**Minor**	• Stockpiles to be separated into topsoil and sub-soil and be located at least 10 m from any surface water source and groundwater well or 50 m from Cilamaya canal; • Construction of drainage ditches and retention ponds to collect water run-off to reduce flows. • Develop a Construction Sediment and Erosion Management Plan including erosion control measures such as limitation of gradients on earthworks, installation of sediment traps along water drainages including silt fences, and vegetation traps, sediment barriers and geotextile curtains. • Prompt temporary or permanent stabilisation and reinstatement of earthwork areas will be conducted to reduce the amount of exposure time and manage potential for wind/water erosion impacts leading to loss of sediment and potential entry into water courses.	**Minor**
Earthworks, including vegetation clearance, excavation, grading and levelling - Critical and Natural habitat	Terrestrial Biodiversity	Emissions (dust, noise, vibration) and discharges (run-off, effluent) disturbance and degradation of habitats	**Moderate**	• Habitat biodiversity offsets are unnecessary to achieve a no-net-loss of biodiversity values. Specific measures however to manage Critical habitat species will be required to be outlined within a Biodiversity Action Plan.	**Moderate**
Earthworks, including vegetation clearance, excavation, grading and levelling - Critical and Natural habitat	Terrestrial Biodiversity	Emissions (dust, noise, vibration) and discharges (run-off, effluent) disturbance and degradation of habitats	**Negligible**	• All machinery to be used in areas of Natural Habitat and Critical Habitat are to exert a low pressure on the ground surface so as to minimise soil compaction. • All machinery and hand held equipment used must comply with required air and noise emission standards. • Sediment and erosion control measures are to be used in all areas of construction to minimise soil contaminated runoff entering waterways. These measures are to be outlined in a Sediment and Erosion Control Plan. • Hours of operation of the construction site are to be limited to the hours of 7.00am to 10.00pm Monday to Sunday. • All light sources are to be directed away from areas of Natural Habitat and Critical Habitat, where feasible.	**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
Earthworks, including vegetation clearance, excavation, grading and levelling - Critical and Natural habitat	Terrestrial Biodiversity	Introduction of invasive species through increased movement of people, vehicles, machinery, vegetation and soil.	**Minor**	• The use of fencing and hoarding during construction in the Javan Coastal EBA is to be kept to a minimum around Project construction sites; • Development of an Invasive Species Management Plan to include: • The provenance of any fill material brought onto the site is to be checked regarding invasive species contamination. • Vehicle wash down procedures are to be used to reduce the transmission of invasive species into and from the project site(s). • Control measures are to be utilised in areas of Natural Habitat and Critical Habitat • All disturbed soil surfaces are to be rehabilitated and native flora species are to be planted within areas under the projects control. These species are to be suitable habitat for bird species listed in the Javan Coastal Zone EBA.	**Negligible**
Fencing	Terrestrial Biodiversity	Fragmentation of habitat, or permanent /temporary severance of wildlife corridors between isolated habitats of importance for biodiversity.	**Negligible**	• The use of fencing and hoarding during construction in the Javan Coastal EBA is to be kept to a minimum around project construction sites. • Appropriate rehabilitation of disturbed areas is to occur to facilitate movement of fauna species during operation, especially within the EBA.	**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
Jetty Construction, Dredging and Pipeline Trenching	Marine Biodiversity	Direct loss and Degradation of Marine Habitats and Water Quality	**Minor**	• Project shall develop a dredging and disposal risk assessment and Dredging Management Plan in accordance with IMO and OSPAR guidelines. • The dredging footprint of the Project to be reduced as far as practicable in order to reduce the direct disturbance to the seabed and indirect effects from turbidity plumes. This includes: • Dredging vessels will be equipped with the appropriate Global Positioning System (GPS) equipment or other navigational aids to ensure dredging will occur at the specified dredge footprint and disposal at the designated soil disposal site; • EPCs' dredgers will maintain adequate clearance between vessel hull and the seabed at all states of the tide and reduce vessel speed to ensure that excessive turbidity is not generated by turbulence from vessel movement or propeller wash. • Records are to be kept and regularly reviewed (weekly) for implementation of the Dredging Management Plan. • Direct measurement of the TSS periodically at baseline sampling station locations MW9, MW10, MW11 and MW12 to establish actual recorded levels verses modelled.	Minor

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
Vessel presence and movements	Marine Biodiversity	Direct mortality or injury of marine fauna from vessel movements	**Minor**	• Vessels will operate in accordance with standard maritime practices, whereby vessel speeds will be adjusted depending on environmental conditions (e.g., visibility, metocean condition) as required by the captain of the vessel and to avoid any encountered hazards. • Support vessels will not travel greater than 6 knots within 300m of a whale or 100m from a dolphin, if sighted, (i.e. will maintain a caution zone of those distances). • Vessels will approach no closer than 100m from a whale or 50m from a dolphin, if sighted (Note this standard does not apply to support vessels engaged in limited/constrained manoeuvrability activities where vessel speed will already be low). • Vessels will not directly approach a marine mammal from in front or behind their path of travel. • Vessels will not exceed a speed limit of 5 knots within designated boating channels around the jetty or the FSRU. • Vessel bridge crew to maintain visual watch of any hazards (including marine mammals). • Records are to be kept and regularly reviewed (3 monthly) for the mortality or injury of marine fauna from vessel movements	**Minor**
Dredging, FSRU mooring/jetty pile driving, construction	Marine Biodiversity	Disturbance and displacement of marine fauna by underwater noise during construction	**Moderate**	• Acoustic decoupling (i.e. repositioning or placement on rubber fittings) of loud equipment during piling should be implemented. • Pile driving management measures consistent with JNCC (2010) standard pile driving protocol: – Trained and dedicated MMOs and PAM operatives during pile driving. – Mitigation zone (JNCC recommend a minimum mitigation zone of 500 m, to be determined on a case-by-case basis. The zone may be determined using numerical modelling of the pile driving characteristics proposed for the project, but in the absence of modelling, a conservative 1 km mitigation zone will be implemented). – 30-minute pre-start observations.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				– Delay-start procedure (if marine mammal sighted within the mitigation zone). – Soft-start procedure (minimum 20 minutes). – Shut-down procedures if marine mammal sighted within the mitigation zone during pile driving. • Delay-start and shut-down procedures will also be implemented if a marine turtle is sighted within 500 m of the pile driving activity. • Where piling/activity continues into a period of poor visibility/ night-time there is no need for additional mitigation. • Where piling/activity is initiated during times of poor visibility (including night-time conditions, the activity will only be permitted if there have been no sightings of marine mammals within 2 hours prior to low visibility/darkness. Activities then to be kept continuous as much as is possible. Other standard mitigation is also required (with the exception of observation period). • Vessel and Dredger maintenance to be performed as adequate maintenance, including lubrication and repair of winches, generators, propulsion components and other potential sources is an effective measure for noise reduction. • Records shall be maintained of all marine species sightings in the area. • When marine species are observed in the mitigation zone, additional information and corrective actions taken such as a shutdown of the pile driver, duration of the shutdown, behaviour of the animal, and time spent in the mitigation zone will be recorded. • Any incidents that occur during dredging that result in negative impacts on the marine species will be documented and reported to the authorities when required. • Only hydraulic hammer for pile driving is used, not diesel based for the FSRU piles. • Records shall be maintained of all marine species sightings in the area, including date and time, weather conditions, species identification, approximate distance from the pile,	

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				direction and heading in relation to the pile driving, and behavioural observations. When marine species are observed in the mitigation zone, additional information and corrective actions taken such as a shutdown of the pile driver, duration of the shutdown, behaviour of the animal, and time spent in the mitigation zone will be recorded. •	
FSRU and vessel mobilisation	Marine Biodiversity	Introduction of invasive species from FSRU/vessels brought from outside Indonesian waters (ballast water/hull fouling)	**Minor**	• The FSRU and any contracted vessels coming from outside of Java territorial waters will have vessel hull and niches confirmed to be free of IMS prior to mobilisation to the local waters of the Project area. • All contracted vessels and the FSRU will maintain a current anti-fouling coating, as evidenced by a current Anti-fouling System Certificate under *Annex 1 of the International Convention on the Control of Harmful Anti-Fouling Systems on Ships* or other equivalent records. • The FSRU and all contracted vessels will meet the requirements of the International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004, including: - Ballast water shall be managed in accordance with the provisions set out in the Convention; and - A Ballast Water Management Plan and a ballast water record book will be implemented and maintained on board.	**Minor**
Hydrotest of offshore pipeline	Marine Water Quality	Reduction of marine water quality	**Minor**	• Chemicals used in hydrotesting will be selected with consideration for their potential ecotoxicity and will use the lowest toxicity practicable for preserving pipeline integrity.	**Minor**
Hydrotest of onshore equipment	Surface Water Quality	Deterioration of surface water quality.	**Moderate**	• For the selection of chemicals for hydrotest water, the Project will select biocides / chemical additives that present a low risk of contamination, in terms of dose concentration, toxicity, biodegradability, bioavailability, and bioaccumulation potential.	**Minor**
Waste management	Environmental Quality	Generation, handling, treatment and disposal of solid	**Moderate**	• Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
		and liquid hazardous and non-hazardous wastes		attracting pests and vermin and to minimise odour nuisance). • Store wastes in closed containers away from direct sunlight, wind and rain and systematically to allow inspection between containers to monitor leaks or spills. • Ensure that liquid waste storage areas have impermeable floors and containment, of capacity to accommodate 110% of the volume of the largest waste container. • All wastes will be disposed of by authorised third- party disposal contractors. • Concrete waste of inert nature will be stored in a laydown area near the concrete batching plant and will be reused where possible. • Any bitumen waste will be stored separately in a lined area to be disposed of by licensed contractors.	
Waste management	Infrastructure	Pressure on existing waste management infrastructure	**Moderate**	WMP required detailing: • Waste inventory that details all wastes anticipated by the construction works, the frequency at which they will occur and the timing in the Project programme, is needed. • Waste disposal sites in the area that are licensed to accept the types of waste the construction phase will create, following the 3Rs ethos (i.e. reduce, reuse and recycle). • Waste storage and segregation. • Waste transfer and transport. • Training to workers. • Waste auditing.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
Wastewater discharge and runoff	Surface Water Quality	Deterioration of surface water quality.	**Moderate**	• Portable or permanent sanitation facilities serving all workers should be provided at all construction sites e.g. one (1) toilet for every 25 workers up to the first 100, and one for every 50 thereafter) will be provided for the construction workforce. Septic tanks shall be provided to treat the sanitary discharge. • Wastewater collected from canteen kitchens, including that from basins, sinks and floor drains, should be discharged into sanitary sewers via grease traps. The sanitary sewer should then be treated prior to discharge or reuse as greywater. • Surface run-off from bunded areas should pass through oil/water separators prior to discharge to the stormwater system.	**Minor**
Wastewater discharge and runoff	Surface Water Quality	Deterioration of surface water quality.	**Moderate**	• All surface run-off from the construction areas potential sources of contamination will be minimised and reduced (e.g. by minimising the area of impermeable surfaces) and the peak discharge rate will be reduced (e.g. by using retention ponds and silt screen). • Appropriate surface drainage surrounding the construction areas will be designed and provided where necessary. This includes diversion channels to intercept storm water running-off the cleared areas and prior to large scale land clearance and removal of topsoil, where appropriate. These channels will be protected against erosion such as sandbag, rock armouring or lining as required. • Stormwater management structures such as stormwater ponds will be designed to collect the silt-laden surface runoff and allow the removal of silt by natural settlement, which in turn should reduce sediment loading prior to discharge into receiving environment. • All drainage facilities and sediment control structures will be inspected on a regular basis and maintained to confirm proper and efficient operation at all times and particularly during rainstorms. Deposited silt and grit will be removed regularly. The stormwater drainage system will be periodically inspected for blockage sand cleaned at least once before the monsoon season each year.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact (Post-mitigation)
				• Measures will be taken to reduce the ingress of drainage into excavations. If trenches have to be excavated during the wet season or rainy conditions, they will be excavated and backfilled in short sections wherever practicable. Water will pumped out from trenches or foundation excavations will be discharged into storm drains via silt removal facilities. • Personnel will be trained to visually inspect discharged water quality for oil and grease traces (that will be visible on the surface) periodically and take appropriate corrective actions. • A dike wall shall also be constructed around high potential spillage area such as fuel tank. For spillage in other location is considered to be minor so that oil pan and containment devices are necessary to response. Additionally, containment devices are to be provided for storage areas of oil, fuel and chemicals to control contaminated surface runoff. • Control and monitoring systems will be used to alert the crew to leaks or any other potential risks.	

Table 8-124 Summary of Environmental Impacts during Operation

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
Workforce presence	Terrestrial Biodiversity	Direct mortality to fauna and flora from hunting and poaching from the workforce and local residents	**Negligible**	• Fauna Shepherding Protocol is be used in the Javan Coastal EBA to ensure that any endemic bird species have vacated the area prior to any clearance work.	**Negligible**
CCGT Power Plant	Air Quality	Combustion of natural gas and deterioration of air quality (on Ecology)	**Negligible**	• Stack height increase from 60m to 65m; or • NO_x emission concentration guaranteed reduction from 51mg/Nm^3 to 40mg/Nm^3. • Continuous stack emission monitoring (CEM) will be installed and operated throughout the operational lifetime of the Project to ensure that the NO_x emission concentration from the CCGT does not exceed 51mg/Nm^3 or the reduced guaranteed value of 40mg/Nm^3, whichever is confirmed by the Project; • Annual stack emission testing of NO_x emissions will be undertaken to counter check the performance of the emission monitoring system; • Installation of two continuous ambient NO_2 air quality and meteorological monitoring systems. One monitoring system will be positioned in the area where the maximum short-term ground level concentrations have been predicted based on detailed dispersion modelling. The second monitoring system will be located in an area representative of the true background so a differentiation can be made between background and potential impacts to air quality from the Project. The effectiveness of the monitoring program will be reviewed regularly.	**Negligible**
CCGT Power Plant	Air Quality	Combustion of natural gas and deterioration of air quality (on Human Health)	**Minor**		**Negligible**
CCGT Power Plant	Air Quality	Deposition of salt (Sodium Chloride (NaCl)) on the surrounding agriculture from the operations of	**Negligible**	• No additional mitigation needed.	**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
		two (2) wet cooling tower systems			
CCGT Power Plant	GHG and Climate Change	Increased GHG Emissions (National Level)	**Major**	• Cold venting of gas directly to atmosphere will be avoided where possible. If significant quantities are emitted, the project should consider flaring, as this converts the CH_4 to CO_2 and thereby reduces the net GHG emissions in terms of CO_2-e emissions	**Major**
CCGT Power Plant	GHG and Climate Change	Increased GHG Emissions (Global Level)	**Moderate**		**Moderate**
CCGT Power Plant	Terrestrial Biodiversity	Degradation of habitat from air emissions and runoff	**Minor**	• Mitigation measures are to be outlined within the Biodiversity Action Plan for the Project area.	**Minor**
Presence of CCGT, transmission lines, substation and roads	Landscape and Visual	Visual impact of activities and sites	**Minor**	• Planting may be designed to either screen or significantly reduce the visual dominance through filtering. • For viewing locations where a high or un-acceptable level of visual impact may occur, landscape mitigation and screening would reduce these impacts.	**Minor**
CCGT Power Plant	Noise & Vibration	Disturbance impacts and amenity issues.	**Minor**		**Minor**
500 kV Transmission Line Operations	Noise	Disturbance impacts and amenity issues.	**Minor**		**Minor**
Cibatu Baru II/Sukatani Substation Operations	Noise	Disturbance impacts and amenity issues.	**Minor**		**Minor**
500 kV Transmission Line Operations	Vibration	Disturbance impacts and amenity issues.	**Negligible**		**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
Access Roads Operations - Road traffic, light and heavy vehicles	Noise & Vibration	Disturbance impacts and amenity issues.	**Negligible**	• No additional noise mitigation of plant and equipment is required, however it is recommended that the noise reducing mitigation already incorporated into the CCGT project design is implemented. • All CCGT noise walls and barriers should be constructed from suitably dense material i.e. concrete or masonry, as per the layout and heights specified in the design and without any gaps or cracks that could reduce the acoustic performance of the barrier. • For the substation, noise generating equipment should be selected to achieve the emissions assessed in this report. Where they cannot be achieved boundary noise barriers or transformer bay walls should be implemented to reduce emissions to compliant values. • JSP should also remain aware of the potential for nuisance, or an unacceptable level of amenity, to occur due to operational noise and vibration and continue to plan for and then manage the project design accordingly. • Operational Noise Monitoring required: – All site noise levels should be measured in the absence of any influential sources not associated with the project. – If the measured project noise levels are below the predicted values and noise/vibration levels comply with the criteria presented in this report, no further mitigation or management measures may be required. – If the measured project levels are above the predicted noise levels and/or criteria presented in this report, further mitigation and/or management measures should be considered.	**Negligible**
Onshore Receiving Facility (ORF), Gas Delivery Pipelines	Noise & Vibration	Disturbance impacts and amenity issues.	**Negligible**	No additional mitigation needed.	**Negligible**
Seawater Water Intake and Cooling Water Outfall	Noise & Vibration	Disturbance impacts and amenity issues.	**Negligible**	No additional mitigation needed.	**Negligible**
Floating Storage and Regasification Unit (FSRU) – Operations	Noise & Vibration	Disturbance impacts and amenity issues.	**Negligible**	No additional mitigation needed.	**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
500 kV Transmission Line	Terrestrial Biodiversity	Direct mortality of avifauna along the transmission line due to strike during operation	**Negligible**	Biodiversity Action Plan for the Project area to include: • Bird deflectors on the length of the power line. The deflectors will increase line visibility by thickening the appearance of the line for easier detection by avifauna. • Use moveable markers of contrasting colours (e.g. black and white) that protrude above and below the line, and be placed 5-10 m apart. • Removing the thin neutral or earth (shield) wire above the high voltage transmission lines where feasible, and where this is not possible, marking the line to make it more visible. • Minimising the vertical spread of power lines. Having lines in a horizontal plane reduces collision risk. • Habitat manipulation to influence flight activity and bird behaviour, e.g. tree lines under the high voltage lines to increase visibility. • Insulating cables close to poles, at least 70 cm on both sides and around perching areas, and up to at least 140cm. • Hanging insulators under cross arms and poles, provided the distance between a likely perch (mainly the crossarm) and the energised parts (conductors) is at least 70 cm.	**Negligible**
Vessel presence and movements	Marine Biodiversity	Direct mortality or injury of marine fauna from vessel movements	**Minor**	• Vessels will operate in accordance with standard maritime practices, whereby vessel speeds will be adjusted depending on environmental conditions (e.g., visibility, metocean condition) as required by the captain of the vessel and to avoid any encountered hazards. • Support vessels will not travel greater than 6 knots within 300m of a whale or 100m from a dolphin, if sighted, (i.e. will maintain a caution zone of those distances). • Vessels will approach no closer than 100m from a whale or 50m from a dolphin, if sighted. (Note this standard does not apply to support vessels engaged in limited/constrained manoeuvrability activities where vessel speed will already be low). Vessels will not directly approach a marine mammal from in front or behind their path of travel. • Vessel bridge crew to maintain visual watch of any hazards (including marine mammals).	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
FSRU Operations and LNG Tanker Offloading	Marine Biodiversity	Disturbance and displacement of marine fauna may occur from underwater noise	**Minor**	• The FSRU will be maintained in accordance with an inspection and maintenance schedule and procedure, which will reduce excessive noise levels that may otherwise be produced by defective machinery and equipment.	**Minor**
Seawater intake	Marine Biodiversity	Impingement and subsequent entrainment of marine fauna, with can result in injury and mortality effects.	**Negligible**	• Installation of mesh screens or equivalent to limit ingress of marine organisms.	**Negligible**
Waste management	Environmental Quality	Generation, handling, treatment and disposal of solid and liquid hazardous and non-hazardous wastes	**Moderate**	• An induction regime for Project staff highlighting the waste management system and how wastes are to be managed on site. • Provide bins for the segregation and proper storage wastes to minimise the potential releases to the environment or contamination of other materials. • Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimise odour nuisance). • Hazardous waste store should be segregated to avoid the co-storage of incompatible waste types. • Store wastes in closed containers away from direct sunlight, wind and rain and systematically to allow inspection between containers to monitor leaks or spills. • Ensure that storage areas have impermeable floors and secondary containment, of a capacity to accommodate 110% of the volume of the largest waste container. • Hazardous wastes will be disposed of by authorised third-party disposal contractors.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
Waste management	Infrastructure	Pressure on existing waste management infrastructure	**Moderate**	• WMP required detailing: • An inventory of the wastes anticipated by the Project. • Identification of the disposal routes the Project plans to use for its waste in the operation phase. • A programme of audit for the waste infrastructure and waste hauliers the Project intends to use. • Site rules for waste management including segregation, storage and packaging requirements for each waste type. • Mapping of waste facilities on site including distribution of waste receptacles at strategic locations aboard the FSRU, along the pipe line route, at the CCGT power station and the substation.	**Minor**
Wastewater discharge and runoff	Surface Water Quality	Deterioration of surface water quality.	**Moderate**	• All drainage facilities and sediment control structures will be inspected on a regular basis and maintained to confirm proper and efficient operation at all times and particularly during rainstorms. • Deposited silt and grit will be removed regularly. The stormwater drainage system will be periodically inspected for blockage sand cleaned at least once before the monsoon season each year. • Measures will be taken to reduce the ingress of drainage into excavations. If trenches have to be excavated during the wet season or rainy conditions, they will be excavated and backfilled in short sections wherever practicable. Water will pumped out from trenches or foundation excavations will be discharged into storm drains via silt removal facilities. • Personnel will be trained to visually inspect discharged water quality for oil and grease traces (that will be visible on the surface) periodically and take appropriate corrective actions. • Control and monitoring systems will be used to alert the crew to leaks or any other potential risks.	**Minor**
Wastewater and process cooling water discharges from the CCGT pipeline	Marine Water Quality	Reduction of marine water quality	**Minor**	• Wastewater and cooling water discharge will be conducted below the water surface, to increase dispersion. • Pipeline outlet structure to include a diffuser. • Monitoring of receiving water quality will be undertaken at the discharge location within three (3) months of operations commencing, and annually thereafter.	**Negligible**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
Waste water and process cooling water discharges from the FSRU and Vessels	Marine Water Quality	Reduction of marine water quality	**Minor**	• Monitoring of receiving water quality will be undertaken at the discharge location within 3 months of operations commencing, and annually thereafter. • Any potential exceedances in discharge standards will be addressed through corrective actions, which may include additional treatment or dilutions prior to discharge.	**Minor**
Jetty Presence	Marine Water Quality	Disturbance to coastal processes, sedimentation and reduction of water quality	**Negligible**	• EPC required to conduct sedimentation study to measure the sedimentation rate. • Monitoring plan which includes periodic monitoring for sediment accretion or erosion in the area of the jetty.	**Negligible**

9 SOCIAL AND COMMUNITY HEALTH IMPACT ASSESSMENT

This chapter identifies and discusses the predicted positive and significant negative social and community health impacts associated with construction and operation of the Project. The Project receptors are defined as villagers located within the AoI that may be impacted or influenced by the Project as a result of their proximity to the Project site and/or associated facilities.

Based on the analysis of the Area of Influence (AoI), the Project will impact total of 39 villages in three (3) regencies, Karawang, Bekasi, and Subang in the West Java Province, Indonesia.

9.1 SOCIAL AND HEALTH IMPACT ASSESSMENT DEFINITIONS

The impacts are assessed based on the data in **Chapter 7** and the impact assessment methodology explained in **Chapter 3**. When undertaking assessments of this nature, several important criteria must be considered such as magnitude; vulnerability and stakeholder perceptions:

- Determining the magnitude of change in social and community health, assets and conditions as a result of the Project and the vulnerability of social receptors involves ascertaining their ability to adapt to socio-economic, cultural or bio-physical changes whilst maintaining their overall livelihood, health status and quality of life; and
- Determining the magnitude of change in social and community health, assets and conditions as a result of the Project.

9.1.1 *Determining Magnitude*

The magnitude of social and community health impacts is understood as a reflection of the 'size' or degree of change caused by social and community health impacts. As discussed in **Chapter 3**, magnitude is a function of one or more of the following characteristics:

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

Table 9-1 provides the definitions for social and community health impact characteristics that culminate in a rating for magnitude.

Table 9-1 Designation of Social Magnitude

Designating Magnitude	Description
Negligible	Change remains within the range commonly experienced within the household or community.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of households and is of a short duration.
Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may be regional in scale.
Large	Change dominates 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, no magnitude is assigned, unless there is ample data to support a more robust characterisation. It is usually sufficient to indicate that the Project will result in a positive impact, without characterising the exact degree of positive change likely to occur.

9.1.2 *Determining Vulnerability*

In the social and community health context, vulnerability is the accepted term for describing the sensitivity of the social receptor that will experience the impact. A vulnerable individual (or group) is one that could experience adverse impacts more severely than others, based on his/her status (for example poverty status, access to basic goods and services). Vulnerability is a pre-existing status that is independent of the Project.

It is important to understand the vulnerability context as it will affect the ability of the social receptor to adapt to any changes brought about by the Project (directly or indirectly). A higher level of vulnerability can result in increased susceptibility to negative impacts or a limited ability to take advantage of positive impacts.

A Project may also exacerbate existing vulnerabilities if the status of individuals and communities and their coping mechanisms are not adequately understood or considered. In order to identify vulnerable receptors, it is necessary to identify receptors that may experience these circumstances (**Table 9-2**).

Table 9-2 Levels of Vulnerability

Ranking	Definition
Low	Minimal vulnerability; consequently with a high ability to adapt to changes brought by the Project and opportunities associated with it.
Medium	Some, but few areas of vulnerability; still retaining an ability to at least in part adapt to change brought by the Project and opportunities associated with it.
High	Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project and opportunities associated with it.

Vulnerable and Sensitive Receptors

In the case of this Project the ESIA team identified a number of potentially vulnerable and sensitive receptors. Vulnerable groups may include:

- Those residing below the World Bank identified poverty line;

- Female headed households with no additional income streams; and
- The elderly, young and ill.

Sensitive groups may include:

- Land owners and users in close proximity to Project construction activities;
- Fishermen along the coastline in the vicinity of the FSRU and subsea pipeline locations;
- Those residing along the fence line of the power plant or utilising facilities along the fence line such as the school and mosque; and
- Other road users along the Project transportation routes.

The Project is located in close proximity to a number of communities, in particular the power plant, the transmission line and the substation as illustrated in **Figure 9-1**, **Figure 9-2** and **Figure 9-3**. The substation has sensitive receptors within 150 m of its location (largely housing), the transmission line has a variety of structures in close proximity including houses, paddy fields, community infrastructure within the right of way ( ). In addition, the power plant borders a school, mosque and community housing. These sensitive receptors and the potential project impacts are further discussed in the subsequent sections of this chapter. The environmental impacts on these receptors from noise, vibration, dust and air and marine discharges have previously been discussed in *Chapter 8* of this ESIA.

Figure 9-1 Transmission Line Sensitive Receptors

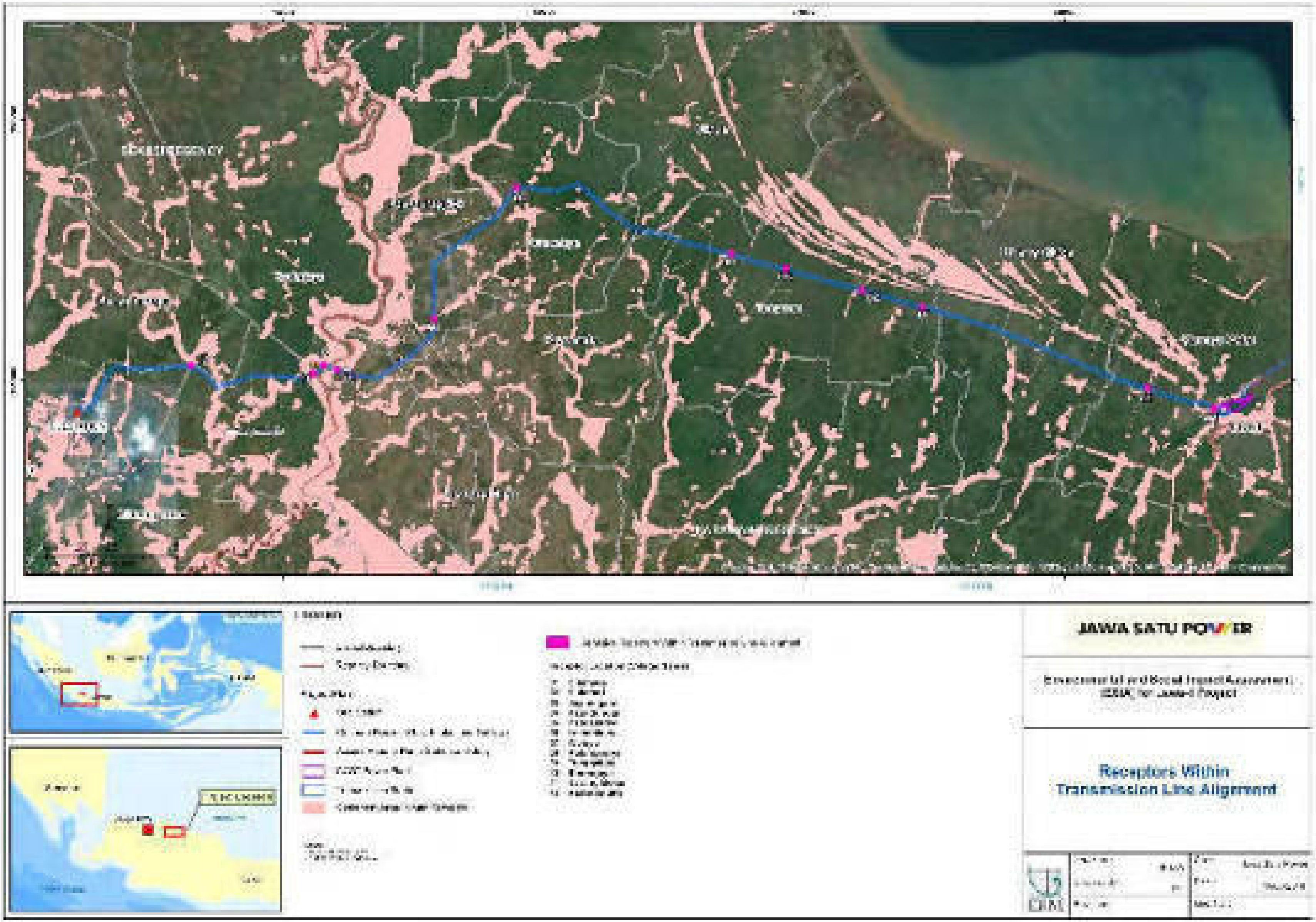
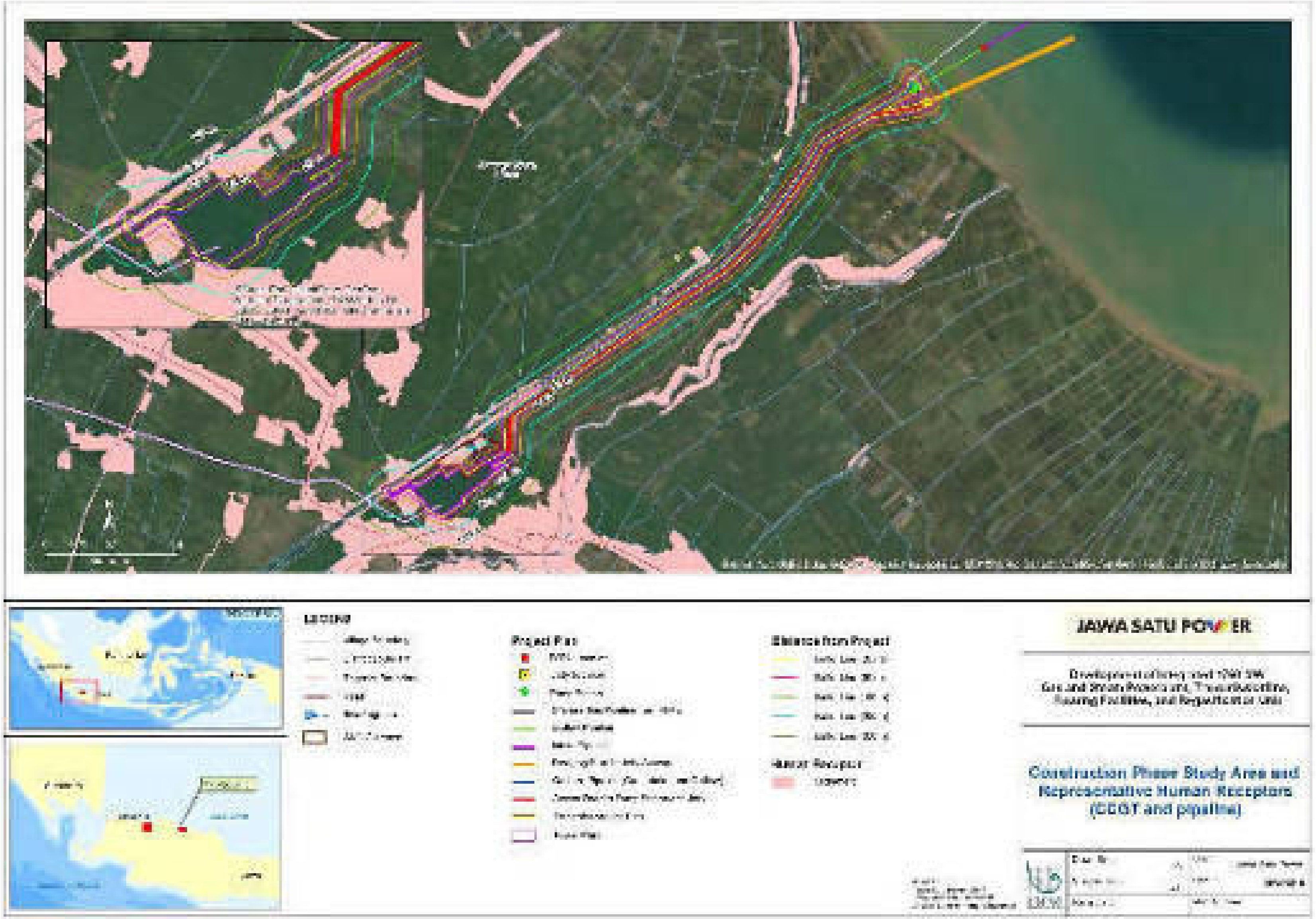


Figure 9-2 Substation Sensitive Receptors

Figure 9-3 Power Plant and Pipeline ROW Sensitive Receptors



9.1.3 *Integrating Stakeholder Perceptions into the Assessment Process*

It is common that Project affected people have perceptions that Project impacts are more significant than will actually be the case. This is referred to as perceived impacts (as opposed to actual impacts).

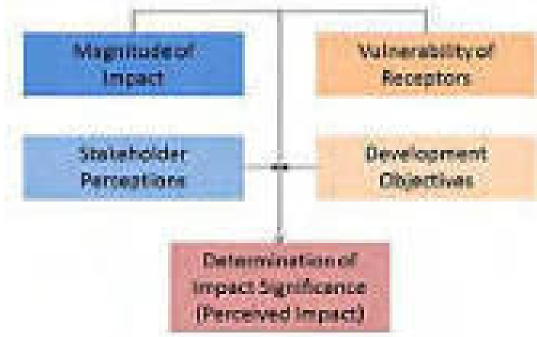
A common example of this is the perception that Project health and safety impacts are more significant than the reality; this is largely due to a limited understanding of the Project description and the Best Available Technology (BAT) that can be applied.

Regardless as to whether an impact is considered as negligible by the Project or ESIA team, if it has been identified as significant by a stakeholder and therefore must be factored into the evaluation process. This may result in the development of focused mitigation and management measures that specifically address these perceptions (such as technical health and safety briefings with the communities).

It should be noted that perceived impacts are no less important than actual impacts with respect to addressing community acceptance for a Project, and that failure to adequately assess such impacts and develop supporting mitigation may result in Project delays as in the case of actual impacts.

Figure 9-4 illustrates how the assessment of impacts considers stakeholder perceptions and vulnerability as well as similar criteria to the environmental assessment (e.g. magnitude and development objectives).

Figure 9-4 Building in Perceptions, Stakeholders and Planning



9.1.4 *Evaluating Significance for Social and Health Impacts*

The significance of social and community health impacts is evaluated taking into account the magnitude of the impact and the vulnerability of affected receptors. In rating significance the matrix in **Table 9-3** is used to assign social and community health impact significance for both negative and positive impacts, and includes the definitions of magnitude and vulnerability designations.

Whilst the default is to not rate the significance of positive impacts as it is not possible to gather exact data to accurately measure the positive impact, it is important to describe how the impact may differentially benefit vulnerable groups.

Table 9-3 Significance Rankings for Social and Community Health Impacts

		VULNERABILITY		
		Low Minimal areas of vulnerabilities; consequently with a high ability to adapt to changes brought by the Project	**Medium** Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the Project	**High** Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project
MAGNITUDE	**Negligible** Change remains within the range commonly experienced within the household or community.	**Negligible**	**Negligible**	**Negligible**
	Small 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.	**Negligible**	**Minor**	**Moderate**
	Medium Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.	**Minor**	**Moderate**	**Major**
	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.	**Moderate**	**Major**	**Major**

9.1.5 *Interpretation of Social Impact Significance*

Table 9-4 shows how the different designations of significance may be interpreted. These are described to reflect the Project context and setting, specifically reflected in planning and stakeholder views as appropriate.

Table 9-4 Description of Social and Health Impact Assessment Significance Rankings

Significance	Negative Social Impacts	Negative Health Impacts
Negligible	Inconvenience caused, but with no consequences to livelihoods, culture or quality of life.	Receptors may experience annoyance, minor irritation, or stress associated with change; minimal impact to perceived quality of life. Does not require treatment. No long-term consequences for the health of individuals and the community.
Minor	Impacts are short term and temporary and do not result in long term reductions in livelihood or quality of life.	Temporary reduction to health status of certain individuals that can be easily treated and does not result in long term consequences for community health. Impacts may lead to greater health inequalities in Project area.
Moderate	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 of diseases or injuries as well as exposure to Project operational risks to the local community. May result in long term but reversible community health impacts.
Major	Diverse primary and secondary impacts that will be impossible to reverse or compensate for, possibly leading to long-term impoverishment, or societal breakdown.	Loss of life, severe injuries or chronic illness requiring hospitalisation. Exposure to and incidence of diseases not commonly seen previously in the area. Likely to have long-term consequences for community health.

Note: *Positive impacts are not ranked for significance, as discussed above.

9.2 FINDINGS OF THE SOCIAL AND HEALTH IMPACT ASSESSMENT

Key socio-economic impacts were identified during the scoping phase and through engagement with relevant stakeholders i.e. local government authorities and potentially impacted villagers. Different potential impacts have been identified and assessed as a result of the proposed construction and operation activities i.e. the CCGT Power Plant and the transmission line and substation, as well as the FSRU and its associated facilities. The resulting potential community impacts also vary in significance at different phases of the Project i.e. construction and operation.

The key social impacts and/ or opportunities identified and assessed include:

- Local employment and business opportunities;
- Disturbance to/ loss of income from agricultural activities;
- Disturbance to/ loss of income from marine fishing activities;

- Disturbance to/loss of income from fresh water fish cultivation;
- Community health, safety, and security; and
- Disturbance to social structure.

The impact assessment results will be grouped into three main categories namely:

- Social impacts resulting from the land acquisition;
- Social impacts during the construction activities; and
- Social impacts during the operations.

It is noted that some impacts (or opportunities), such as local employment and business opportunities, community health, and community safety, are triggered across a number of the proposed Project activities and throughout each of the Project phases.

As such, discussion on these impacts may be repetitive however, deemed important to show the detailed analysis of the impact at each of the facilities and Project phase. A summary table is provided at the end of each chapter to condense the impacts evaluated.

9.3 SOCIAL IMPACT RESULTING FROM THE PROJECT'S LAND ACQUISITION

In total, the Project will acquire 762,671 m^2 from private land owners; as such economic displacement will take place (mainly paddy fields and fish ponds) however no physical displacement will occur. In addition, an estimated 180,000 m^2 will be leased and 1,742,298 m^2 used for the transmission line right of way. In total of 132 land owners will have their land acquired, with 724 land owners receiving compensation for land within the transmission line right of way. Of the 132 land owners 20 households were assessed as vulnerable due to either age category (elderly) or status as female-headed household. .

The ADB considers resettlement impacts as significant if 200 or more persons lose 10% or more of their productive or income-generating assets. (No physical land displacement is planned). Based on the findings presented in the Resettlement Plan (**Annex I**) the Involuntary Resettlement Category is B given less than 200 people will be significantly impacted.

A vulnerability profile of the impacted land owners and users was evaluated based on the following criterion:

- Households with an income below the poverty line: according to the National Statistical Bureau for West Java Province the West Java Province Poverty Line in 2017 was IDR 354,866 per month per capita. Based on this standard, there are no vulnerable people affected by the land acquisition;

- *The landless or those without legal title to land*: All of the land users interviewed during the field survey confirmed to have plot of land at least for the current house they are living in. Some are having plots of land outside the Project location. Typically, the land users also cultivate other land beside the plots acquired by the project. As such, no vulnerable people were identified under this category;

- *The elderly (older than 65 years old, unproductive group) as the head of household*: There are 18 landowners in this group, aged between 65 and 86r;

- *Female-headed households*: two identified female headed household are impacted.; and

- *Indigenous people and ethnic minorities*: No indigenous people/ethnic minorities are impacted by the Project's land needs.

Based on these categories, the total number of the vulnerable people affected by the land acquisition is 71 people (20 households). As such, the Project will support these households by establishing sustainable effective livelihood restoration activities as set out in the Resettlement Plan. These households will be offered support in the form of Project employment during construction upon, procurement of goods and services from female headed households during construction, implementation of a scholarship program/vocation training activities and support in terms of small scale agriculture. The activities will be implemented over a period of three years during construction and will be monitored and reported on bi annually to ensure program sustainability and restoration of livelihoods.

The Project has been undertaking extensive consultations in relation to the land acquisition process and compensation since May 2017; records are presented in **Annex I**.

The following sections provide an overview of the land acquisition at each Project location.

9.3.1 Loss of Income from Fresh Water Fisheries Activities

Discussion of Impacts

The estimation of the total land to be acquired by the Project for access road, jetty, onshore pipeline is approximately 200,000 m^2. Approximately 95% or equal to 190,000 m^2 is utilised by the community for fresh water fish cultivation. The land areas to be acquired in this area are illustrated in **Figure 9-5.**

Ten land owners have land ownership evidence in this area; among the 10 individuals 2 couples (husband and wife), hence the total number of land owners in the coastal area is 8 households. The number of land users is 4 households. The Project is applying a willing buyer willing seller principle to acquire the land led by Pertamina; based on the NJOP and market price and fair negotiations.

The coastal area displays accumulation of sediment carried to the area in suspension by the river discharge. This is deposited in a low energy environment, resulting in the gradual accumulation of sediment layers, shallowing of the coastal waters and build up of land. It is estimated from historical maps that this pattern of deposition has resulted in a seaward shift of the coastline of approximately 300 m over 15 years.

This natural process was confirmed during the ESIA surveys with the fish pond cultivators who stated that the area originally underwater has emerged due to natural sea sedimentation. According to a statement letter from the MoEF due to this process the land is now categorised as protected forest belonging to the MoEF[1].

However, the local community has been utilising this land for many years (in the form of fish ponds) and as such the ownership of the land around the area varies i.e. a number of people have ownership certificates, deed of sale and purchase, or a land use permit from the village authorities. The Project is currently undertaking the land owner identification and inventory process (as of June 2018).

The fish pond cultivators in the area confirmed that it typically takes three years to cultivate the land into a fish pond requiring regular maintenance i.e. once every five or six (6) months. Typical fish cultivated in the area include milkfish and tilapia as well as wild shrimps from the sea that enter the ponds during the high tide.

Note a part of this area is also classified as Protected Forest however, some households are claiming ownership. The Project is obtaining an IPPKH (the right to borrow and use Forest Area) from the MOEF anticipated to be secured before September 2018. Genuine land owners and users have been identified (through land ownership certification evidence); as such will be appropriately compensated.

However, given the presence of these fish pond areas, some form of impact to the land owners'/users' income is likely. This is resulting from a loss of shrimp or fish for daily consumption or income and lost income/incurred expenses during the establishment of a new fish pond. The Project has developed a Resettlement Plan (RP) that sets out how the Project will assess and compensate the land owners and users at replacement value including lost assets and provide moving and rehabilitation assistance..

The amount of compensation paid will consider the following aspects:

[1] The Ciasem-Pamanukan Protected Forest Area is based on the Decree of the Minister of Environment and Forestry Number SK.3287 / MenLHK-PKTL / KUH / PLA.2 / 7/2016

- Size of the fish pond;
- Market value of assets on the land such as fish, shrimps and huts;
- Cost spent to establish a new fishpond; and
- Lost income whilst establishing a new fishpond with the same quality.

Impact Evaluation and Significance

The number of the land owners to be impacted by the land acquisition is 8 households and as such the magnitude of the impact is Small.
All of the land owners and users in the coastal area have alternative income streams other than from fish farming. Field survey confirmed that all land owners generate more than IDR 4,000,000 per month, higher than minimum wage in Karawang (IDR 3,605,272).

The Project is proposing to compensate the impacted people (both land owners and land users) based on current market price negotiations along with consideration of lost earnings; further the same quality of the land is abundantly available nearby the current location.

Nevertheless, it is predicted that the cultivators will need some time to re-establish their fish pond in a new location (or seek an alternative income stream) thus a temporary loss of income is anticipated. Most of the land owners will lose less than 50% of their total land, however income for the land owners in the coastal area is considered high compared to the minimum regional wage. Furthermore, all of the land owners have alternative income aside from their fishpond/ farming activities. Considering these issues, the sensitivity is assessed as being **Medium.**

Therefore, the Project land acquisition impact to loss of income from fresh water fisheries activities is assessed as **Minor** and is presented in **Table 9-5**.

Table 9-5 Loss of Income from Fresh Water Fisheries Activities

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

Proposed Mitigation Measures

To mitigate the negative impacts, the Project is expected to implement the following measures:

- Implement the RP in a timely manner to ensure that the livelihood of the affected people is not impacted (this includes addressing grievances effectively);

- Undertaking consultation with the land owners and users about the Project schedule to allow them to preparing the necessary activities to sell their fish or shrimp and identify a new land area to re-establish their fish pond (or seek alternative employment opportunities);

- Support the fishpond owners/ cultivators to re-establish new fish ponds (e.g. provision of construction equipment) to shorten the period of transition from the current to the new location to reduce temporary loss of income;

- Prioritisation for Project employment opportunities and/ or provision of goods and services;

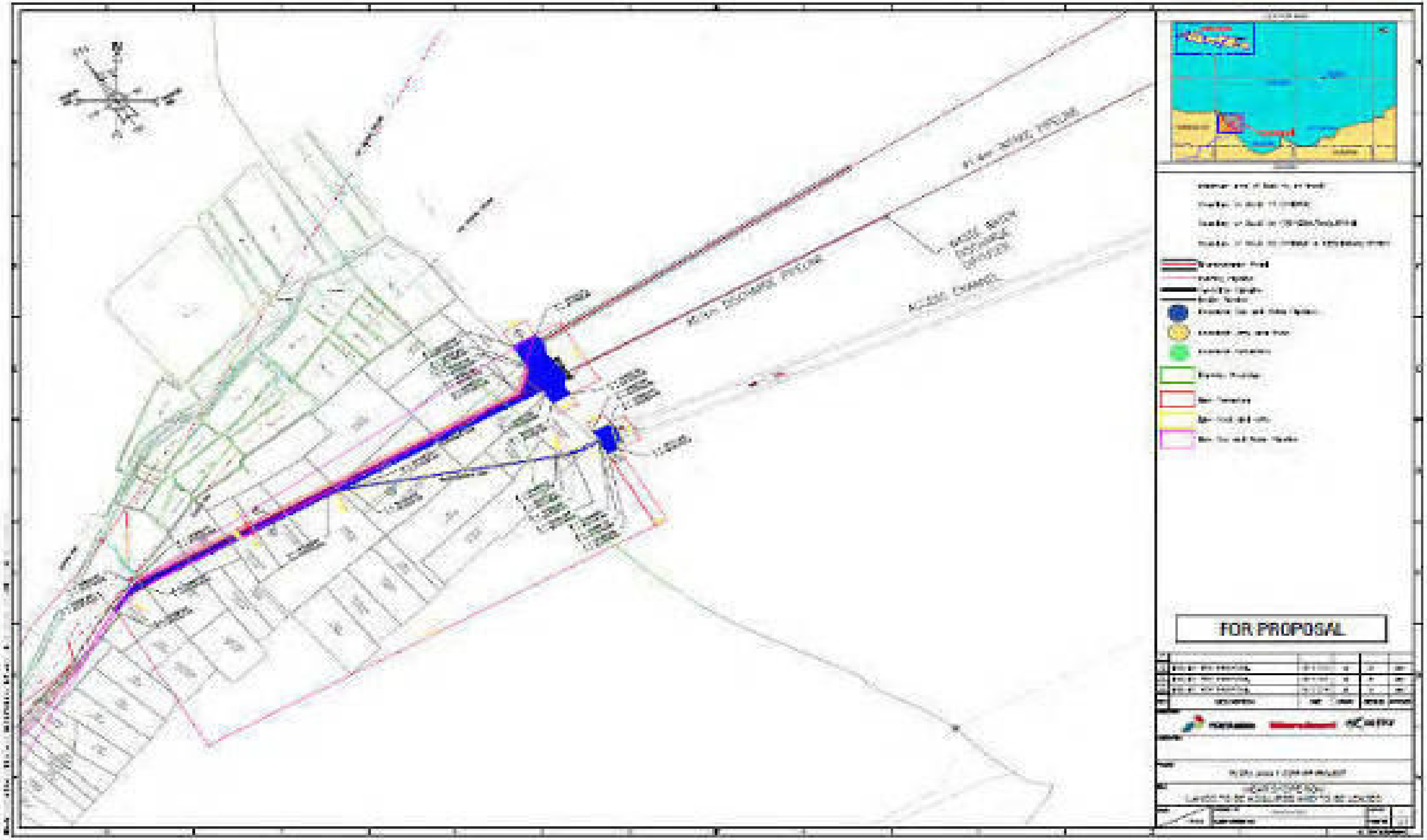
- Implement the targeted LRP for those deemed eligible;

- Prioritisation for participation in the Project's CSR program.

Residual Impact Significance

As a result of implementation of the proposed additional measures, the residual negative impact to fresh water fishing activities will be **Negligible**. This is assuming the RP, consultation and additional mitigations above are implemented effectively.

Figure 9-5 Location of Coastal Areas to be Acquired



9.3.2 *Loss of Income of the Land Owners from Agricultural Activities*

Discussion of Impacts

The Project is acquiring land approximately 762,671 m^2 in the Karawang and Bekasi Regencies for the power plant, pipeline right of way, access road, transmission line and sub-station.

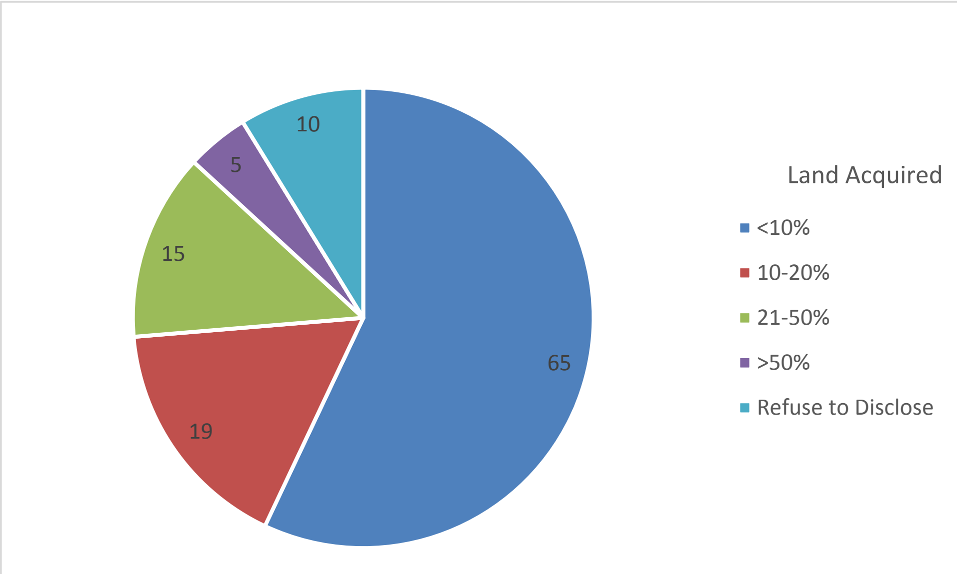
The land acquisition has been undertaken on a willing buyer willing seller principle through a negotiated settlement process; in cases where the owner does not agree to sell their land, the Project has adjusted the design. For example, the transmission line has been rerouted at approximately 45 locations; this is to either address land owners refusing to sell or to avoid the right of way being in close proximity to sensitive receptors. The offered price is based on the market value gathered from discussions with the respective village heads.

The negotiated price offered in the transaction process was confirmed to be significantly above the tax object sale value (*Nilai Jual Objek Pajak*) of the land and typically twice times of the current market price in the area. A comprehensive overview of the land acquired, NJOP, market values and agreed final price are presented in the RP (**Annex I**).

One (1) Ha of land produces approximately 6.1 ton of paddy in Karawang and 5.3 ton in Bekasi Regency per one harvest season (six (6) months). Farmers typically spend IDR 8,142,857 for production costs per 1 Ha. The crops (largely paddy) are sold at an average price of IDR 4,500/ kg.

The majority (60.33%) of the land owners associated with the transmission line and substation sold less than 10% of their total agricultural land to the Project and less than 10% of the land owners sold more than 50% of their agricultural land to the Project as presented in **Figure 9-6.** Hence, there is a potential for lost income of the land owners from agricultural activities due to the land acquisition.

Figure 9-6 Percentage of Total Land Acquired (Transmission Line and Substation)



Impact Evaluation and Significance

Of the 124 landowners for the tower footings and substation 104 disclosed their land ownership details:

- 65 owners lost less than 10% of their productive assets;
- 19 owners lost 10-20% of their productive assets;
- 15 owners lost 21-50% of their productive assets;
- 5 owners lost >50% of their productive assets; and
- 10 owners refused to disclose the total land owned.

As such, a total of 39 land owners will lose more than 10% of their productive asset. However further analysis of the socio-economic profile of these people confirms 24 of these land owners generate income through other activities. One land owner confirmed they were not interested in additional income and another 14 land owners indicated farming was their main source of income with 5 also having other income streams and/or family members who contribute to the household's income. As such only nine (9) land owners depend solely on farming to generate their income.

Given the majority of land owners still own a significant amount of remaining lands and that only a few land users were impacted (and confirmed they can easily find additional land to work on), the magnitude is assessed as **Small** however the sensitivity is considered **Medium** given their high reliance on agriculture as the primary income.

The Project's RP has a policy to compensate the land owners based on the current market price and also allowing the owners/users to harvest their crops prior to the construction. Notice is being communicated to the land owners as to when the Project will acquire their lands and as such a cut-off date for harvesting.

Furthermore, the Project's intent is to allow the land owners to continue paddy cultivation underneath the tower footing once construction has been completed. This is currently being discussed with PLN who will be the final approver of this approach.

The ESIA survey and consultations confirmed that the offered compensation value was higher than the current market price (and NJOP) and sufficient to purchase bigger plots of paddy field in the area. Some of the land owners have already used the compensation money to buy or rent bigger plots and are expected to generate higher income from those plots. A detailed analysis of the impacted land owners is presented in the RP (**Annex I**).

Given the above, the impact of the land acquisition as a result of lost income from agricultural activities is determined as **Minor** as presented in **Table 9-6.**

Table 9-6 Loss of Income of the Land Owner from Agricultural Activities

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

9.3.3 Loss of Income of the Land Users from Agriculture Activities

Discussion of Impacts

Although the majority of plots along the transmission line route are cultivated by the land owners a number of plots are utilised by sharecroppers or land users in particular at the sub station (more so along the pipeline right of way and access road). The land survey confirmed that 23 land users are cultivating plots of the land acquired in the transmission line and substation area, and 4 in the coastal area. They typically cultivate a minimum of 0.5 Ha of land in one plot.

Based on the ESIA socio-economic survey, the average income of the land users is IDR 1,800,000/ month (the monthly minimum wage is ~IDR 3,500,000). As such the land acquisition is potentially impacting the land users particularly those who rely solely on their income from cultivating the acquired land such as land users of the substation land in Bekasi Regency.

The Project does not intend to compensate land users unless crops/fishpons are damaged however is planning to allow the users to harvest their crops prior to the construction period. If the land users are not able to harvest their crop the Project will compensate for their lost income as set out in the Entitlements Matrix in **Annex I**. Notice is being communicated to the land owners as to when the Project will acquire the land and as such a cut-off date for harvesting will be communicated. Furthermore, they will be supported with livelihood strategies; such as prioritisation related to Project employment and participation in the Project's CSR program.

Impact Evaluation and Significance

The number of the agricultural land users to be impacted by the land acquisition process along the transmission line and substation is estimated at 28 people. Considering these facts, the magnitude of impact to land users' loss of income from agricultural activities is assessed as being Small. Furthermore, 29% of the land users who work as a farmers have an alternative source of income other than cultivating the acquired land.

In addition, agricultural lands in the Karawang and Bekasi area are available abundantly if the land users seek to cultivate other plots. Even though the Project has communicated the cut-off date for harvesting, a temporary loss of income may occur during the transition period, when the user is identifying a new plot of land to cultivate (or alternative employment).

As such, the severity of the impact is assessed as being **Medium**. Therefore, the impact of land acquisition related to lost income of the land users from agricultural activities is determined as **Minor** as presented in **Table 9-7**.

Table 9-7 Loss of Income of the Land User from Agricultural Activities

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

Proposed Mitigation Measures

To mitigate the potential negative impacts, the Project is expected to implement the following measures:

- Implement the RP in a timely manner to ensure that the livelihood of the affected people is not impacted (this includes addressing grievances affectively and implementing a livelihoods strategy);

- Undertaking consultation with the land owners and users about the Project schedule to allow them to prepare the necessary activities to harvest their crops and identify a new land area to purchase and/ or cultivate (or seek alternative employment opportunities);

- Prioritisation for Project employment opportunities and/ or provision of goods and services;

- Prioritisation for participation in the Project's community development program; and

- Prioritise the severely affected land users in the livelihood restoration program and monitor the livelihood condition of the affected people to ensure their quality of life is the same of better than previously.

Residual Impact Significance

Given the sensitivities associated with land acquisition and the long term nature of its potential impacts the residual remains **Minor.** This is assuming the RP, livelihoods strategy and effective timely consultation is undertaken and the additional mitigations above are implemented effectively.

9.3.4 Summary of Land Acquisition Impacts

Table 9-8 below provides a summary of the impact assessment for the land acquisition

Table 9-8 Summary of Land Acquisition Impacts

Receptor	Potential Impact	Impact Evaluation	Mitigation	Residual Impact
Land Acquisition – land owners & cultivators along the access road, jetty, onshore pipeline	Lost income from fresh water fisheries activities (shrimp or fish)	**Minor**	• Implement the RP to ensure livelihoods are not impacted; • Undertaking consultation with the land owners and users; • Support the fishpond owners/ cultivators to re-establish new fish; and • Prioritisation for Project opportunities.	**Negligible**
Land Acquisition – land owners & users along the access road, onshore pipeline, transmission line right of way and substation	Lost income from paddy fields	**Minor**		**Minor**

9.4 SOCIAL IMPACTS DURING CONSTRUCTION

This chapter discusses the potential social and community health impacts predicted as a result of the three key Project activities during construction:

- FSRU and Offshore Pipelines;
- CCGT Power Plant, Onshore Pipelines and Coastal Infrastructure; and
- Transmission Line and Substation.

Discussion of impacts to fishing grounds and fish stock are presented in *Chapter 8* of this ESIA-Marine impacts.

9.4.1 Loss of Income of Marine Fishermen Communities

Discussion of Impacts

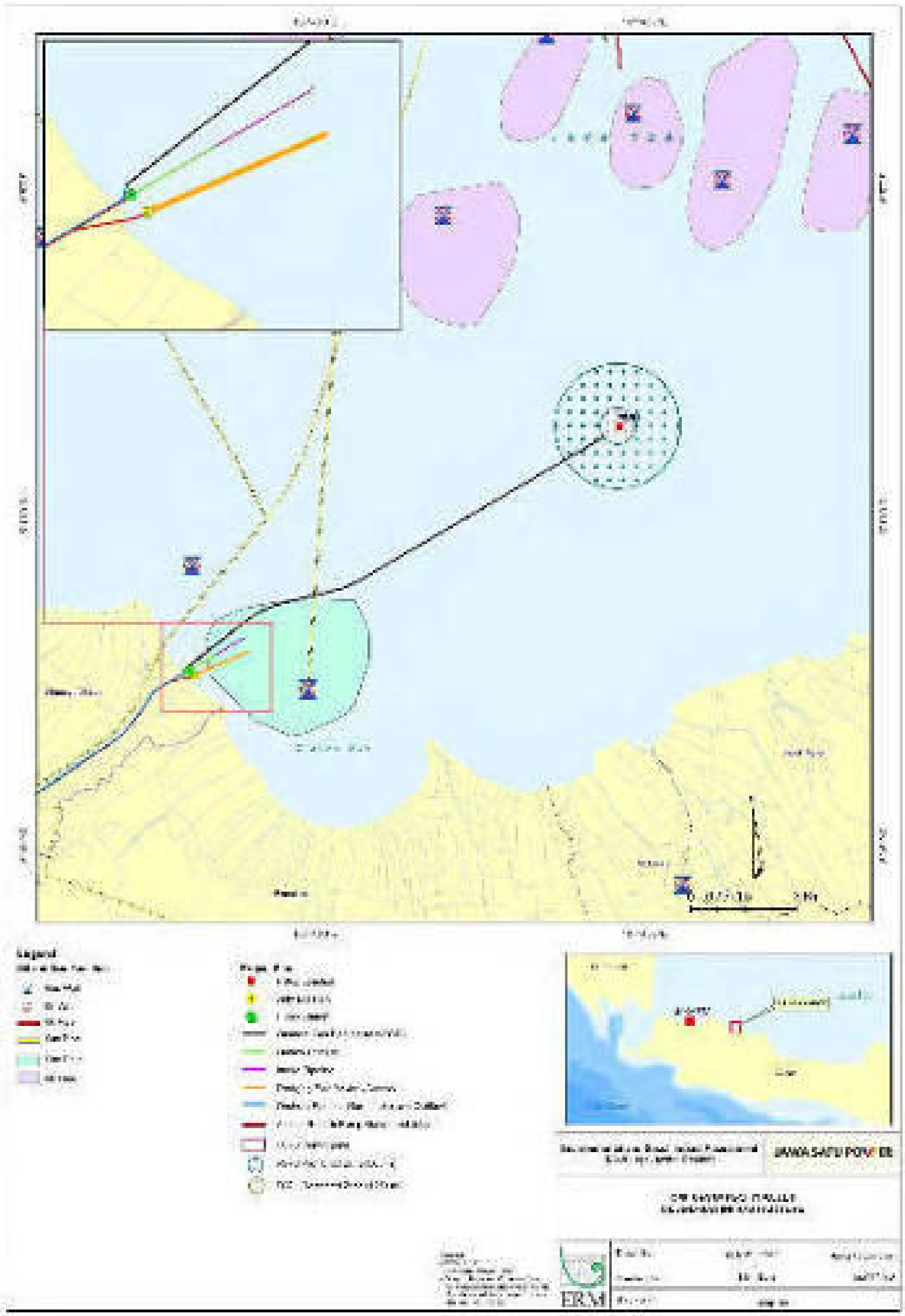
The FSRU will be located in Ciasem-Pamanukan Bay within the Subang Regency; it will be permanently moored offshore at a distance of roughly 9 km perpendicular from the Regency coastline and will receive LNG deliveries. The construction of the FSRU will be outside of Indonesia in a shipyard; after which the vessel will be transported to the location where it will be installed with mooring poles and the offshore unloading platform decks. Mobilisation of the equipment and construction materials will be transported via a range of vessels to the FRSU, most likely from Tanjung Priok Port or the jetty.

The FSRU will be permanently moored with a 500 m prohibited zone and 1,250 m restricted zone in accordance with the Indonesian Government regulations (**Figure 9-7**). As such ships/ vessels can only pass outside the prohibited/restricted zones including fishing vessels. As such, a disturbance to local fishing activities further than 9 km offshore may occur due to the longer distances to travel increasing operational costs (mainly fuel and reducing time at sea resulting in a potentially decreased fish catch.

A subsea gas pipeline will be required to deliver gas to shore from the FSRU. As the FSRU location is within the fishing Zone II area (roughly seven (7) km to 22 km coastal area from the sea level at the lowest tide), the pipeline will traverse through both Zone II and Zone I (roughly four (4) km to seven (7) km of coastal area from the sea level at lowest tide). The pipeline will have a 500 m exclusion zone to prohibit anchoring of vessels above the right of way and fishing activities that may damage the pipeline; this will be enforced via communications with the marine authorities and discussed with the local fishing groups.

In order to lay and bury the pipeline, there will be dredging of seabed materials which potentially may damage fish nets and other fishing equipment whilst causing a disturbance to the fishing ground especially shrimp ponds which are typically located up to 3.2 km from the shoreline.

Figure 9-7 Location of FSRU Exclusions Zones and offshore Project Facilities



However, during the surveys from mid-2017 to early 2018 only a few permanent fishing devices were observed nearshore. These are likely to grow in numbers with Project activities being more visible due to the attraction of compensation.

Based on discussions with the fishing communities in Blanakan and Muara villages, many still use traditional methods to locate fish grounds (especially shrimp). Given the potential for noise and vibration activities during the construction period, albeit temporary, they expressed some concerns around how these activities may impact their fishing activities.

Removal of 0.33 hectares of mangroves within the Project area is not considered to significantly impact local fishing grounds. Whilst the area of mangroves along the Java Sea has reduced significantly, the proportional loss of mangroves along the shoreline is considered to be minor. Some minor reduction in fish and shrimp breeding grounds will occur in the short term, however biodiversity offsets will be utilised in the medium to long term to offset this impact, improving the management of adjacent mangrove areas and hence fish/shrimp breeding grounds.

The mooring of the FSRU is estimated to take three to four (4) days after which the 500 m exclusion zone will be in place throughout the duration of the operations. The laying of the subsea pipeline is estimated to be completed within three (3) months (April to July 2020).

Impact Evaluation and Significance

The magnitude of the impact of an increase in marine traffic and the decrease in water quality for the local fishing activities are assessed as **Small** due to the impact duration being only three months in total to lay the offshore pipeline and the fact that restricted areas will be minimal during this time. This is supported by the assessment findings of the marine water quality and biodiversity set out in *Sections 8.12* and *8.13*.

Meanwhile, the sensitivity of receptors is assessed as being **High** as fishing is the main source of income for the majority of people particularly in Blanakan Village (there were no alternative sources of income identified during the ESIA survey). It was noted in 2017 farming conditions were poor hence there was a high reliance on fishing for their daily income.

This is further compounded by the existing concerns/perceptions on the impacts to fishing by the fishermen (as captured in the AMDAL public consultations and ESIA community consultations).

The Project impact significance to fishing income is assessed as **Moderate** as presented in **Table 9-9**.

Table 9-9 Disturbance to Marine Fishing Income

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

Proposed Mitigation Measures

To mitigate the impact, the Project is expected to implement the following measures:

- Conduct regular socialisation and consultation activities with the relevant stakeholders such as the head of Blankan and Muara villages, the district as well as the impacted fishermen in an open, timely and transparent manner. This will be particularly important prior to the clearing of the mangrove areas where shrimp breeding occurs and also offshore activities that will require restrictions;

- A fish catch survey is planned between August 2018 and April 2019. The survey will involve the following tasks:
  - Confirmation of all fishing villages potentially impacted by the project;
  - Observation of fishing activities, including landing data;
  - Baseline data/photolog of types of fishing gear and types of fish/ marine species;
  - Stakeholder mapping of relevant fishing stakeholders;
  - Baseline data of the fishing communities' income;
  - Mapping of fishing grounds and main fishing routes from villages to fishing grounds and landing areas to capture farms / fish farms.
  - Local fish market baseline data; and
- Based on the survey findings additional measures will be added to the Project's LRP to address potential loss in income of fisherfolk;

- Ensure the Project's grievance mechanism is well socialised and that any grievances submitted are addressed in a fair and timely manner;

- Ensure the RP set out the process for entitlements for damage or removal of or to fishing nets/equipment. Any compensation agreed will be on a case by case basis through discussion with all parties involved;

- Develop a relevant community development program for the impacted fishermen, coordinating with relevant authorities, and fishing communities. The program will be identified through further identification of the fishermen's needs;

- Restrict access to project controlled areas (jetty, access roads, mangroves and fish ponds) to prohibit fishing activities. The Sponsor will work closely with local fishermen and authorities in this regard.
- All terrestrial and marine construction areas proposed to be cleared will be clearly marked in the field in order for local people to avoid these areas.
- Prioritise employment for interested local fishermen; and
- As set out in **Chapter 8** (EIA), all activities undertaken offshore will be undertaken using BAT[1] with the aim of reducing environmental impacts where possible.

Residual Impacts

As a result of implementation of the proposed additional measures, the residual negative impact of the Project construction to fishing activities will be **Minor**.

9.4.2 Employment and Business Opportunities

Discussion of Impacts

Based on the estimation of workforce requirements from the Sponsors and EPC estimation up to 500 workers are required for the mooring of the FSRU, offshore infrastructure, jetty and access road construction. Of this total around 150 will be unskilled and used to support the onshore construction activities.

The majority of the unskilled roles are assumed to be prioritised for the local directly impacted villages around the Project facilities (in this case Muara, Blanakan and Cilamaya) with jobs likely to include manual laborers, drivers, security, catering and cleaning positions. The Sponsors will instruct the EPC (Meindo) to optimise local employment where feasible as part of their local content policy.

Based on current estimates from Samsung, the Power Plant EPC, approximately 3,500 workers will be required during the peak construction activities; around 50-60% will be local and 5% female. These numbers include the site manager, construction superintendent and supervisor, electrical and instrument installation, health and safety officer, heavy machine operator, welder, piping installation, crane operator, road construction, security and civil works.

Roughly 600 workers will be required during the construction of the sub station and transmission line; of that roughly 80% will be local. The Project has described the minimum requirement for the workers as secondary / junior high school graduates with a relevant certification. The construction of the

[1] Best Available Technology refers to technology for limiting pollutant discharges with regard to an abatement strategy.

CCGT Power Plant will take up to 36 months to complete and the transmission line roughly 22 months from the laying of the foundation, construction, tower erection and stringing.

Based on the baseline information (Karawang Regency Statistic in Figures, 2016), there are 82,118 people in Karawang Regency and 122,444 in Bekasi that are classified as unemployed and of a working age. At the village level of Cilamaya there are reportedly 2,528 people categorised as of working age but not employed and seeking job opportunities. This indicates a large segment of locals that are willing and potentially expect to have access to Project employment opportunities.

The baseline data presented in **Chapter 7** indicates not only a large pool of unemployed workers or casual/seasonal workers but also a high desire amongst the directly impacted communities to be employed by the Project. This was also reflected very strongly in the consultation activities undertaken as part of the AMDAL and ESIA processes.

In addition to employment opportunities, to support the construction activities (e.g. to provide materials, equipment, supplies as well as services such as cleaning and catering and other construction activities) a number of goods and services will be required. The Project will require accommodation for non-local (skilled) workers amongst the villages close by to the construction activities. This is likely to be within the community in rented houses. As such, in addition to rent, cleaning and catering needs will also need to be met locally.

This large demand for employment and goods and services over the construction period will create additional markets for existing small and medium local business e.g. kiosks supplying daily needs or restaurants near the Project location. It is assumed that the Project would optimise the procurement of local goods and services where feasible.

Impact Evaluation and Significance

Given the Project's commitment to optimise local employment and procurement, also the high community expectation to be employed and to provide good and services, it is therefore very likely that the Project will have a positive impact in terms of employment and business opportunities; albeit small in scale and temporary.

Proposed Mitigation Measures

Local people have a high expectation to be employed by the Project; hence it is likely that during the Project construction there will be competition among the locals as well as people from the neighbouring villages and districts.

To optimise the Project benefits to local community through employment and business opportunities, the Project will implement the following additional mitigation measures:

- To have clear stipulation of using local labour in the EPC contract to instruct the EPC to prioritise qualified local people in accordance with the needs of the Project;
- To ensure the EPC liaises closely with the local village leaders and local government authorities to agree on the appropriate procedures for recruitment and hiring (to avoid agents and set out a fair and transparent process);
- To clearly follow Indonesian regulations related to the hiring of labour 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.
- Provide and communicate clear and factual information about the Project's needs related to employment and business opportunities to ensure the community understand the opportunities and the scale and to prioritise locals where feasible; and
- To widely socialise the grievance mechanism (set out in the SEP) to track and monitor concerns associated with Project employment / workforce recruitment. Where complaints are submitted the Project will undertake an immediate investigation to close the matter out fairly.

9.4.3 Opportunities for Female Participation

Discussion of Impacts

Overall, in the Project area the male population is higher than the female population however, the gender ratio is relatively balanced. In terms of land owners, 47 were female. A total of five (5) female land users were also identified. However only two of these individuals were the heads of the household but both earned a monthly income above the poverty line.

Most females are engaged in daily household activities, handicrafts, trading or farming. It was also communicated during consultations that opportunities for females is expected and welcome in the community.

Given the Project will hire roughly 4,800 workers during construction and that approximately 50% will be local it is expected that some benefits from this will be received by local females either through direct employment, procurement of goods and services or indirectly through a member of their family being employed by the Project.

Impact Evaluation and Significance

The Project recognises the opportunity to support the development of opportunities for females in the local area. The Project has also committed to employing a minimum of 5% of females or approximately 240 females. This target will increase during operations to 10% or approximately 13 workers.

In addition, the Project has committed to providing assistance to vulnerable women affected by land acquisition (should any become known throughout the process). It will also utilise women's groups to supply procurement requirements where feasible.

Furthermore during implementation of the Project's CSR activities the Project is aiming for a 40% of participants to be female.

Proposed Mitigation Measures

In addition to establishing targets for JSP and its EPCs there are a number of additional measure that will be adopted by the Project including:

- Engaging with female representatives in the villages to discuss the recruitment processes and criteria in order to ensure females are aware of these opportunities it will be important the project; and

- Developing CSR activities focused on supporting the development of local females e.g. in improvement of agricultural practices and improving health and sanitation awareness.

9.4.4 Managing Community Expectations

Discussion of Impacts

During the consultations undertaken for the AMDAL and ESIA the expectation of employment as raised on many occasions by males, females and youth in the impacted villages visited. This need is supported by the fact that many of the households' income in the Project area are below the monthly minimum wage.

This is also likely creating high community expectation for the Project local employment to improve their economic condition. Furthermore the lack of economic opportunities other than fishing and agriculture also hinder the ability for the villagers (especially in Karawang) to gain employment outside these sector.

To handle this issue, the EPCs will coordinate with the Sponsors on the approach taken to recruitment and local employment. The job opportunities will be communicated with village heads and an announcement placed on the village announcement boards. All candidates from the directly affected villages will be eligible for selection by the EPC based on their needs and skills.

Impact Evaluation and Significance

Given the existing skill sets within the community and the Project's requirements for workers some of these expectations will be met (especially around the power plant that requires a significant number of unskilled workers).

However the number of realistic job positions along the transmission line and substation will not be as significant and therefore individuals seeking employment indicates expectations require management.

Furthermore the requirements during operations even at the power plant will reduce significantly therefore the mature and duration of employment will need to be careful communicated. Should they not be managed the community may become discontent with the Project, social jealousies may arise between those who have been employed and those who have not which could lead to community protests, delays and escalating Project costs.

This likely impact may not only take place during the construction but also potentially occur during the operation stage. There will be a significant decrease in the number of job opportunities during this stage. In addition, at the end of construction worker contracts, due to the limited employment opportunities elsewhere, as is typical on Projects of this nature in Indonesia, the hope is that once employed by the Project the worker will be retained through the whole Project lifecycle.

As a result of the above, managing expectations early and clearly will be important when mitigating community impacts. The availability of local jobs for the CCGT is relatively high given the existing employment market and as such the magnitude is considered **Medium** and the sensitivity is clearly **High**.

The Project is committing to optimising local employment where feasible; however, there is still the potential for community dissatisfaction. For this reason, the impact is assessed as **Major** as set out in **Table 9-10**.

Table 9-10 Community Expectations for Local Employment

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

Proposed Mitigation Measures

It is assumed that a range of management measures will be in place. In addition, the Project is expected to implement the following additional mitigation measures:

Provide and communicate clear and factual information about the Project's needs related to employment and business opportunities to ensure the community understand the opportunities and the scale and to prioritise locals where feasible:

- To avoid over committing or promising employment and clearly setting out employment needs to address grievances or community complaints;
- To have clear stipulation of using local labour in the EPC (Samsung) contracts to instruct the EPC to prioritise qualified local people as construction workers in accordance with the needs of the Project;
- To adhere to all Indonesian laws and international treaties related to recruitment and treatment of workers to ensure fair terms and conditions and rights;
- To ensure the EPC liaise closely with the local village leaders and local government authorities to agree on the appropriate procedures for recruitment and hiring (to avoid agents and set out a fair and transparent process);
- Work closely with the local government agencies to synchronise the Project's needs and the local's capacity to offer opportunities to females also;
- To widely socialise the grievance mechanism (set out in the SEP) to track and monitor concerns associated with Project employment / workforce recruitment. Where complaints are submitted the Project will undertake an immediate investigation to close the matter out fairly; and
- Implement a community development program to increase the skills of local workers and the capacity of local businesses to meet the needs and requirements of the Project for the longer term.

Residual Impact Significance

As a result of implementation of proposed additional measures, the residual Project impact related to managing community expectations associated with Project employment will be **Minor**.

This impact is variable and requires careful monitoring to test (and adapt) the level of engagement and provision of Project information is sufficient.

9.4.5 Disturbance to Fresh Water Fisheries Activities

Discussion of Impacts

A jetty will be built to support mobilisation of heavy equipment and materials during construction and also be used during emergencies during operations. The jetty will be constructed at Muara Village located 7.6 km miles from the north coast of Ciasem Bay, Subang Regency. The jetty will occupy an area of 500 m^2.

The onshore pipeline is approximately seven (7) km length will be installed underground. Backhoes will be used to trench the area where proposed pipeline is buried. The proposed onshore pipelines will include three main pipelines i.e. the seawater supply pipe, the waste water discharge pipe and the 20-inch gas supply pipeline.

The construction of the jetty, onshore pipeline, and access road to CCGT is estimated to complete within 12 months. These facilities are located adjacent of the fish pond areas in Muara and Cilamaya Villages. The construction activities will involve land clearing and earth works, trenching and dredging. In additional to the land acquisition impacts discussed earlier it is predicted that during the construction activities the level of noise, dust, and vibration will increase significantly. Given the location is nearby active fish ponds the disturbance to fishing activities in the fish pond area is anticipated.

Impact Evaluation and Significance

The location of the active fish ponds will be in close proximity to the access road and shoreline construction activities. As such the dust from the construction vehicles and activities may cause damage to the nearby ponds affecting the yield of fish or shrimp.

Given the fact that fresh water fish cultivation is one of the main sources of income in Muara Village the increased noise, dust, and vibration during the construction may also pose a perceived impact to the reduced productivity of the fish pond, therefore the magnitude and sensitivity of this issue is Medium. This may be further heightened by the desire for compensation given the land acquisition process will have previously acquired several ponds along the right of way and access road.

Therefore the significance of impact to fresh water fisheries activities is assessed as **Moderate (Table 9-11).**

Table 9-11 Disturbance to Fresh Water Fisheries Activities during the Construction

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

A discussion of salt water impacts i.e. marine fishing is presented in *Section 9.4.1*.

Proposed Mitigation Measures

To mitigate the negative impacts, the Project is suggested to implement the following measures:

- Apply noise, dust, and vibration barriers to reduce the level of disturbance to fresh water fisheries activities;
- Establish a grievance mechanism which is accessible for all community groups to report concerns associated with disturbance to fresh water fisheries activities. Immediate action should be taken in a case that the livelihood of the fish pond owners/ cultivators is impacted by the Project;
- Conduct regular socialisation and consultation activities with the relevant stakeholders such as the head of Blanakan and Muara villages, in an open, timely and transparent manner;
- Ensure the RP set out the process for entitlements for damage of fish ponds. Any compensation agreed will be on a case by case basis through discussion with all parties involved; and
- Prioritise employment for interested local fish pond owners.

Residual Impact Significance

As a result of implementation of the proposed additional measures, the residual Project negative impact to fresh water fisheries activities during the construction will be **Minor** significance.

9.4.6 Disturbance to Agriculture Activities

Discussion of Impacts

Based on the spatial analysis and field observations the access road, pipeline, and maintenance road facilities in Cilamaya and Muara village will be built along agricultural areas. The access road will be constructed seven (7) km length and six (6) m in width with a one (1) m slope on both sides. As such there is a potential of higher water flow to the paddy field along the construction site especially during the rainy season hence potential disturbance to agricultural activities due to flood is also anticipated.

It should be noted that flooding is common in the rainy season in some surrounding areas. Based on engineering modelling the Project will not have further impact on the level of local flooding (**Annex L**).

In additional to the land acquisition impacts discussed earlier it is predicted that during the construction activities the level of noise, dust, and vibration will increase significantly as well as the risk of flooding. Given the location is nearby paddy fields the potential to disturb farming activities exists.

The transmission line will be approximately 52 km in length routed from the proposed CCGT Power Plant to Cibatu Baru II/Sukatani EHV substation. The right of way has been routed as much as possible away from residential areas; passing largely over paddy fields. The route passes through the Bekasi and Karawang Regencies impacting land owners and users in 37 villages, temporarily. The line will comprise 118 transmission towers with a transmission corridor/ right of way of around 17 m each side of the transmission lines (total of 34 m).

All land required to construct the tower footings has been acquired by the Project based on a willing buyer and willing seller principle as discussed in the previous chapter (a remaining 20% payment will be made following the transfer of the land deeds by the land agency, expected to be complete by May 2018). Land owners underneath the right of way will also be compensated based on the government regulations for easement compensation (the identification of these land owners is still underway).

Similar to the pipeline right of way and access road, during the construction land owners and users of the fields just outside the right of way may be impacted due to the mobilisation of equipment and materials as well as the construction activities.

Based on the site observations access will be through paddy fields. The EPC will plan to liaise with the local owner of the land required for access and laydown areas. Compensation will be agreed on a one to one basis depending on the size of land required, loss of potential income and the duration (noting the use of the land is only temporary).

Based on discussion with the EPC access to the right of way (to bring in equipment) is likely to be using manual labor (rather than constructing a road and using vehicles). This will reduce the level of impact on the existing paddy lands.

Impact Evaluation and Significance

The construction activities, to develop the access roads in particular, may cause damage to the nearby paddy fields may affecting the crop yield or be perceived to damage the paddy field or its irrigation. Given the reliance on paddy as one of the main sources of income the sensitivity to the fields being damaged is **High**, however the magnitude is considered **Low** as the impact is likely to only be those field directly adjacent to the construction activities (**Table 9-12**).

Similar to the impacts to fish ponds the issue may be further heightened by the desire for compensation given the land acquisition process will have previously acquired several areas of paddy field ponds located along the right of way of access road.

Given the above the significance of impact to agriculture activities along the due to construction activities are assessed as **Moderate**.

Table 9-12 ***Disturbance to Agriculture Activities***

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

Proposed Mitigation Measures

To mitigate the negative impacts, the Project is suggested to implement the following measures:

- Apply appropriate flood barriers, box culverts etc. to manage flooding as well as dust mitigations/suppression techniques;
- Socialise the grievance mechanism which is accessible for all community groups to report concerns associated with damage to paddy fields;
- Conduct regular socialisation and consultation activities with the relevant stakeholders along the road and right of way in an open, timely and transparent manner;
- Ensure the RP set out the process for entitlements for damage to paddy. Any compensation agreed will be on a case by case basis through discussion with all parties involved; and
- Prioritise employment for interested local farmers.

Residual Impact Significance

As a result of implementation of the proposed additional measures, the residual Project negative impact agricultural activities during the construction of the jetty, access road, and maintenance road will be **Minor** significance.

9.4.7 Ecosystem Services Impacts

Discussion of Impacts

The priority ecosystem services identified as relevant to communities includes:

- Food such as wild-caught fish, shellfish and aquaculture; and

- Freshwater.

Local people, particularly along the coast (Muara and Blanakan) as well as in Cilamaya, are reliant on their fishponds for household consumption and local fishing activities for income. As such, the construction activities and the requirement of land for the right of way and access road may have an impact on some of these households as well as restrictions to fishing around the FSRU.

In terms of access to freshwater, most households still utilise wells (household and communal). Most of the households use bottled (gallon) water for drinking and the well water for cooking and bathing. However, the Project (and its EPCs) have confirmed it will not have an adverse impact on groundwater due to its construction or operation activities. As such the impact as a result of the power plant construction and operation on community health impact on those residing in Cilamaya is considered Negligible.

Impact Evaluation and Significance

The RP results (**Annex I**) indicate the compensation is more than sufficient for the impacted land owners to purchase new lands and construct ponds. In addition land users have confirmed they can easily source additional lands to work on. Further replaceability of these activities is not an issue, as such the impact on food resources is not considered significant. The community do not rely solely on fish and have a variety of others foods to choose from along with other fishing/aquaculture options as well as their close proximity to the town of Cilamaya that offers an abundancy of foods. As such, the magnitude of this impact is considered small as is the sensitivity resulting in a **Negligible** impact (**Table 9-13**).

Similar to food, access to freshwater is abundant with numerous options. The Project is not anticipated to impact the groundwater through compaction activities at the power plant site and as such is not considered to impact the communities access. However a hydrogeological assessment is to be conducted. Should an impact to groundwater be identified (e.g. contamination or lowering of level)appropriate mitigation will be put in place and monitoring will be undertaken throughout the compaction activity Furthermore, all effluent will be monitored before discharge and treated to ensure wastewater is below the established threshold. Given this, the impact is also considered **Negligible (Table 9-13)**.

Table 9-13 Disturbance to Ecosystem Services

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

9.4.8 Reduced/Loss of Community Access

Discussion of Impacts

Based on the spatial analysis and field observations the access road, pipeline, and maintenance road facilities in Cilamaya and Muara village will be built along agricultural areas. It is anticipated that the community, particularly farmers who cultivate land along the main facilities, may have to reroute, resulting in a longer journey time to and from their fields, village office, market, and other public facilities. At this stage it is unclear how the construction activities access will be managed however it is assumed that access will be restricted to workers only to manage health and safety risks.

Furthermore, it is not the intention of the EPC to restrict road use of the private SKG Cilamaya road (around the Power plant perimeter) during construction, as such communities residing close to the power plant site will still be able to use this road. It should be noted that during specific construction periods there will large traffic volumes delivering materials to and from the site that may result in congestion.

Impact Evaluation and Significance

The EPC has confirmed that it will enable access for local communities during the construction activities across the access road construction via flagmen as such it is anticipated that although the sensitivity to this issue is Medium, the magnitude is small and therefore the impact is **Minor**.

Table 9-14 Impact as a Result of Lost/Reduced Access

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

Proposed Mitigation Measures

To mitigate the negative impacts, the Project is suggested to implement the following measures:

- Socialise the grievance mechanism which is accessible for all community groups to report concerns associated with loss in access;
- Conduct regular socialisation and consultation activities with the relevant stakeholders along the road and right of way in an open, timely and transparent manner; and
- Discuss with EPC and village head options to allow safe access through the construction works e.g. pedestrian bridge, flag men and safe pathways etc.

Residual Impact Significance

As a result of implementation of the proposed additional measures, the residual Project negative impact on loss of access is predicted as **Negligible**.

9.4.9 Impacts due to a Non-local Workforce Presence

Discussion of Impacts

Across the various Project activities non local workers who will be employed where skilled positions cannot be filled by locals; this will particularly be the case for the power plant where non locals will be housed in worker accommodation in the community and surrounding areas in rental properties. The specific locations and capacities are still being decided by the EPCs and will only be confirmed once their sub contractors are selected prior to construction activities commencing.

The workers will therefore inject cash into the local economy through rental payments and daily needs. However, the presence of non-locals in a community such as Cilamaya can result in a number of adverse issues including:

- Local community discontent due to non locals benefiting from employment opportunities;
- Community conflict between non locals due to ethnicities/religions;
- Increased pressure on existing community infrastructure and services (e.g. waste disposal, electricity, water, sanitation and health care);
- Increased demand for good leads to increased prices in goods and services;
- Increased anti-social behaviours (including excessive alcohol use and use of sex workers); and
- Introduction and / or increases prevalence of communicable diseases such as sexually transmitted infections (STIs).

Of particular concern is the potential for an increase in the commercial sex trade as is often associated with large scale developments, particularly when a large (often mainly male) workforce is required for short to medium period of time. If appropriate precautions are not taken, this can increase the rate of STIs (e.g. HIV / AIDS and Hepatitis A) in the Project area and unwanted pregnancies.

The ESIA field survey and secondary research confirmed that prostitution exists within the Project area. Based on the data from the HIV / AIDS Prevention Commission of Indonesia, there were 25 hotspot locations for prostitution in the Regency of Karawang in 2016 with the risk ratio of being infected with HIV/ AIDS through commercial sex trade at 59%[1]. It was also reported that there was generally a limited awareness and understanding in the community related to STIs. The village of Blanakan is also a well-known area for prostitution; 10 km from the Power Plant area.

Health facilities in the areas are available to address day to day health issues. However, their capacity (e.g. availability of diagnostic equipment, availability of medicine) to respond to an increase in STI transmission is limited.

Impact Evaluation and Significance

The impacts associated with the presence of a non local workforce such as community health, community conflict and increase in anti-social behaviours have been considered in this assessment. Given the large number of non-locals that will be present in the area for up to 36 months, the close proximity of their living arrangements and the presence of commercial sex workers in close proximity the impact is considered **High**.

[1] https://karawangplus.com/gila-karawang-punya-25-tempat-prostitusi/

Table 9-15 Impacts as a Result of Non-Local Workers

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

Proposed Mitigation Measures

The Project will implement the following additional mitigation measures to manage potential negative impacts associated with the presence of non-local workers:

- Maximise the use of local workers where feasible and provide training and capacity building;
- Compulsory medical examinations for Project workers, including contractors to ensure they are fit for working and to monitor the prevalence of communicable diseases detected through annual medical check-up;
- Establishment of an onsite health clinic with qualified doctor responsible for the treatment of worker (and sub contractor) issues;
- Training for all workers on the expected workforce behaviours, sexually transmitted infections and cultural awareness;
- Establish a project policy on worker behaviours and widely socialise to workforce and local village leaders;
- Conduct inductions and training refreshers on the Project's Code of Conduct regarding do's and don'ts in relation with interaction with locals;
- Establishment of a zero tolerance approach should workers conduct any activities that are against Project policy;
- Implementation of a strict worker management plan;
- Conduct regular consultations (formal and informal) with the villages leaders to obtain feedback on worker interactions and potential concerns or grievances; and
- Establish a grievance mechanism accessible for all community groups (and workers) to report concerns associated with non local workers.

In addition to managing impact to the local community from workers it is importance the Project manage impacts to workers. The IFC and European

Bank for Reconstruction and Development (EBRD) have developed a comprehensive guidance note on worker's accommodation standards. This guidance note should be shared with the EPCs and their subcontractors to ensure adherence. It will be important for each sub contractor to develop their own worker accommodation plan that demonstrates compliance and provide regular inspection reports to the EPCs/Sponsors on workforce accommodation conditions for all workers (management and labourer).

At a minimum the EPCs should ensure:

- All accommodation identified for use by construction workers comply with Indonesian and ILO standards i.e. safe structures, clean, and sanitary conditions, and easy access with separate arrangements for females and males;
- Where large number of workers are involved transportation to and from the site is provided to manage congestion impacts;
- Are impacts to the environment well managed i.e. proper disposal of wastes and effluents;
- All workers have access to clean water for consumption and washing;
- Appropriate H&S measures are in place such as access to a first aid kit, fire extinguishers and alarms and security; and
- All workers have access to a grievance mechanism.

Residual Impact Significance

As a result of implementation of proposed additional measures, the residual impact on the community associated with non-local presence to community health is considered **Minor.**

9.4.10 Community Impacts due to Migration Influx

Discussion of Impacts

The Project will employ a range of people during the construction phase; as stated previously over 4,000 workers will be employed during the construction and onshore facilities around the coastal area. Given the large number of workers and the potential for indirect employment or goods and services opportunities there is the potential for an influx of people seeking opportunities. These opportunity seekers may be local who have left and are now returning to seek employment, families of workers employed by the Project or business entrepreneurs. These scenarios may all be likely given the Project's location to Jakarta and its ease of access.

The influx of opportunity seekers to a Project area has with it associated benefits and also adverse impacts including:

- Local community discontent due to non-locals benefiting from business opportunities;
- Community conflict between non locals due to ethnicities/religions;
- Increased pressure on existing community infrastructure and services (e.g. waste disposal, electricity, water, sanitation and health care);
- Increased demand for good leads to increased prices in goods and services;
- Increased anti-social behaviours (including excessive alcohol use, drug misuse, use of sex workers and crime);
- Introduction and / or increases prevalence of communicable diseases in the Project area or to the local community; and
- Increase demand for housing and daily goods benefiting local land lords and hospitality/retail owners.

Impact Evaluation and Significance

The impacts associated with influx such as community health, community conflict and increase in anti-social behaviours are currently have been considered in this assessment.

The local community has a high expectation for employment and as such would have a low tolerance to non locals being offered opportunities over locals therefore the sensitivity is **Medium** as they still have opportunities for other income streams in the area.

However the magnitude is **Small** due to small number of non-local opportunities associated with the Project and the close proximity of Jakarta that offers numerous job and business opportunities.

Considering the above the impact significance as a result of influx is assessed as being **Minor.**

Table 9-16 Impacts as a Result of Influx

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

Proposed Mitigation Measures

The Project will implement the following additional mitigation measures to manage potential negative impacts associated with influx:

- Establish recruitment and employment plan that clearly sets out workforce requirements and local content. This plan will be consulted with local government and disseminated widely with the aim of discouraging influx. The plan will also include a demobilisation plan for non-locals after the construction period;

- Establish a grievance mechanism and accessible for all community groups to report concerns associated with potential influx. Where complaints are submitted the Project will undertake an immediate investigation; and

- The Project to liaise with the local police and healthcare providers to ensure no additional pressure has been placed on them due to Project influx.

Residual Impact Significance

As a result of implementation of proposed additional measures, the residual impact on the community is considered **Negligible**.

9.4.11 Impact to Tourism and Recreational Sites

Discussion of Impacts

The baseline data confirmed that some tourism and recreational sites were located within the Regency of Karawang and Subang. **Table 9-17** summarises the key sites recorded during the baseline survey along with distance from the project footprint.

Table 9-17 Recorded Tourism and Recreational Sites in Karawang and Subang

No.	Name of Place	Project Facilities	Approximate Distance (km)
1	Pantai Pondok Bali	FSRU	7.87
2	Ekowisata Tambak Alas	CCGT power plant	8.16
3	Wisata Buaya Blanakan	CCGT power plant	8.26
4	Pantai Tanjung Baru	Transmission Line	5.67
5	Makan Syekh Quro	Transmission Line	4.25
6	Tugu Rawa Gede	Transmission Line	2.60
7	Waterboom Elmujira	Transmission Line	2.00
8	Tugu Proklamasi Rengasdengklok	Transmission Line	4.84
9	Tugu Kebulatan Tekad	Transmission Line	4.98

10	Rumah Pengasingan Soekarno	Transmission Line	4.98

The mobilisation of materials and also the construction activities during the construction phase potentially poses an impacts on these recreational activities and the visitors. Vibrations and emission may impact the integrity of the structures and traffic movements may cause congestion and challenges accessing the sites.

Impact Evaluation and Significance

Given the distance of the proposed power plant and access road and jetty impacts from emissions and vibration is not considered feasible. However, proximity to the transmission line has been evaluated.

The overall construction phase is planned to be completed within 36 months however traffic activities will be more intense during mobilisation of equipment and materials. **Table 9-17** above shows there are eight (8) tourism and recreational sites nearby the transmission line (between 2 km to 6 km from the right of way). The construction of the 118 towers is expected to be completed within 18 months; meaning on average the construction of one tower footing will be finished within 5 to 7 days. The number of trips to mobilise the material for the transmission line construction is estimated at 8 trips per day utilising mostly existing main roads nearby the tower locations which are considered not to pose significant impact to the public usage of the roads.

The distance to the tourism site Pantai Pondok Bali (beach) is approximately 8 km from the proposed location of the FSRU. The construction of the FSRU is estimated to be completed within 2 months. As such, the impact of the construction of the FSRU to the tourism activities in Pantai Pondok Bali is considered to be Negligible given the distance. The beach is on the other side of the bay from the jetty and as such construction impacts for this facility and the offshore pipeline are also not expected to impact recreational activities.

Wisata Buaya Blanakan (crocodile breeding farm) and Ekowisata Tambak Alas (ecotourism site) are located in Blanakan village in Subang Regency, around 8 km from the CCGT. Given that no construction activities are planned in this village impacts on these tourists attractions are unlikely. Access to the sites will be via a separate road to that utilised by the project (other than the main Jakarta to Cikampek) hence congestion/restricted access to the Project is not likely.

Assessing the proximity of the recreational and tourism sites to the Project location and the period of the construction phase that considerably short, the magnitude is assessed as being **Low**. Given that most of the recreational activities are undertaken during the weekends or during public holidays, the magnitude of the impact is deemed to be **Small**. As such the overall impact in relation to tourism and recreational sites is **Negligible.**

Table 9-18 Impact to Tourism and Recreational Sites Associated with the Project's Construction Activities

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

9.4.12 *Impact to Cultural Heritage*

Discussion of Impacts

Impacts to cultural heritage are mostly related to construction of the FSRU and the laying of the subsea pipeline. These activities may potentially impact the annual celebration of *Nadran*, a cultural ceremony to thank the sea on behalf of the coastal communities. The celebration involves traditional ships parading with hundreds of people participating. The event takes place annually in October each year over a period of one week.

Impact Evaluation and Significance

The installment of the FSRU and the laying of the subsea pipeline is expected to be completed within 13 months. As such, there will be a time when the construction activities are conducted at the same period of the *Nadran* celebration which may potentially pose negative impacts. Considering that *Nadran* is an annual activity with high value tradition important to the community, the sensitivity is assessed as being **High**. Although the location of the event will be limited in the Blanakan coastal area only, it is understood that during the festival, hundreds of people not only from Blanakan community will attend the ceremony. However, the ceremony will only last for around 1 week with most of the activities such as *wayang kulit*/ traditional puppet show, band and music festivals, night market, and other sports events conducted in the village and as such, the magnitude is assessed as **Small**. Based on the assessment, the overall rating for the impact of the construction activities to cultural heritage, particularly *Nadran* Celebration is **Moderate**.

Table 9-19 Impact to Cultural Heritage Associated with the Project's Construction Activities

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

Proposed Mitigation Measures

To mitigate the negative impacts, the Project is expected to implement the following measures:

- Implement a Chance Find Procedure in the event that cultural heritage is discovered during construction activities. Specifically, based on the IFC PS8 guidance note, *the procedure will include record keeping and expert verification procedures, chain of custody instructions for movable finds, and clear criteria for potential temporary work stoppages that could be required for rapid disposition of issues related to the finds…..the procedure will outline the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority, as well as any agreed consultation procedures. This procedure should be incorporated in the Management Program and implemented through the client's Environmental and Social Management System*;

- Maintain close coordination with the fishing communities and village authorities (particularly Blanakan) to understand the schedule and agenda of the events and optimise the construction schedule to minimise the impact on the festival (such as avoiding working nearshore during the festival);

- Socialise the offshore pipeline laying schedule to the community and the village authorities so they are well-informed about the potential risks and understand mitigation measures to take should any unexpected events occur during the event; and

- Deploy adequate health and safety personnel during the event in a close coordination with security officers such as police and army if needed.

Residual Impact Significance

As a result of implementation of the proposed additional measures, the residual negative impact to cultural heritage, particularly *Nadran* festival is **Minor**.

9.4.13 Disturbance to Public Marine Transportation and Fishermen Safety

The Project will likely have an impact on community safety and security especially the fishermen due to its marine transportation. All the material for the construction will be transported via Tanjung Priok Port up to seven times during the construction phase; in addition there will be two pontoon logistic barges alternating every three days and one pontoon lay barge used for pipe welding.

The area will also be utilised to mobilise other material and heavy equipment through the jetty for the construction of the CCGT Power Plant over a three (3) year period. The location surrounding the FSRU is used by the fishermen traveling to their fishing grounds. The increased marine traffic may impact the safety of the fishermen from Blanakan Village and the surrounding villages, in particular those in smaller vessels. This concern was expressed during consultations with the Blanakan fishing group based on previous experience of other large vessels traversing the bay.

The bay also has some marine traffic from vessels leaving or arriving at Tanjung Priok (~ 96 km as the crow flies from the FSRU) and other vessels associated with Pertamina's offshore activities (the Uniform platform is more than 10 km northeast of the FSRU). However as both are located more than 10 km away from the FSRU, cumulative traffic congestion is not anticipated to be an issue given the exclusion zone is only 500 m.

Impact Evaluation and Significance

As Pamanukan Bay is the main fishing ground for fishermen from Blanakan village, there is a potential for negative impacts to their safety while fishing in the area around the FSRU or when the barges are laying the pipelines to shore. Thus the mag and duration of construction i.e. three (3) months. Considering the safety issues in the past (an incident was recorded near Pertamina's platform in 2008) and the fact that the fishing communities are adaptable the sensitivity is assessed as **Medium**.

Therefore the significance of impact to fishermen safety is assessed as **Minor**. Disturbance to other marine traffic is assumed Negligible.

Table 9-20 Disturbance to Public Marine Transportation and Fishermen Safety

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

Proposed Mitigation Measures

To mitigate the impact, the Project is expected to implement the following measures:

- Coordinate with the relevant authorities i.e. *Kantor Kesyahbandaran Tanjung Priok* and Port Authority Class II in Tanjung Priok to communicate updates on Project shipping activities;
- Coordinate with *Kantor Kesyahbandaran Tanjung Priok* and Port Authority Class II in Tanjung Priok (and other key parties) regarding the pipe deployment plan and data of burial position and publish with the *Berita Pelaut Indonesia* (BPI) and Notice to Mariners (NTM);
- Ensure marker buoys are in place and chase boats are present to restrict access to marine vessels including fisherfolk during the offshore construction activities;
- Conduct consultation activities with the fishing groups prior to and during the construction activities to raise their awareness of the routes, activities and safety distances and exclusion areas; and
- Socialise the grievance mechanism to ensure the community groups understand its functionality and where complaints on accidents or near misses are submitted work closely with the complainant and EPC to close the issues out in a fair and timely manner.

Residual Impact Significance

As a result of implementation of the proposed additional measures, the residual Project negative impact to public marine transportation and fishermen safety will be **Minor** significance.

However should an incident (in particular a fatality of serious injury) occur this rating will need to be reviewed.

9.4.14 Community Safety Risk as a Result of Increased Traffic

Discussion of Impacts

The Project will result in increased traffic during the construction period as discussed previously. This will be most noticeable in and around the CCGT that will be constructed over a three year period and to a lesser extent in the villages with access to the transmission line and sub station. The vehicle movements will be transporting goods, equipment and materials to and from the site along the main road in Cilamaya Wetan as well as smaller village roads. Where possible materials will be sourced locally or from sources nearby.

In addition to traffic into Cilamaya from Tanjung Priok and Jakarta there will be movements back and forth to the jetty on the newly developed access road. The main traffic movements will be during the top soil removal at the power plant and the foundation laying for the access road, power plant and substation in Bekasi. These activities will require significant volumes of material and as such between one to two truck movements are likely every five (5) minutes over a 12-hour period during the peak construction periods.

The main toll roads that are used frequently for transportation from Jakarta to Cilamaya are in relatively good condition with typical road safety practices as is common in Indonesia. However the majority of the roads along the substation and transmission line are of a poor quality and narrow, passing through paddy land and villages with communities residing along the roadside.

The main roads in Cilamaya and to some extent the local roads are frequently used with vehicles, motorbikes and pedestrians as well as many warungs and street stalls along the local roads but with a lower level of caution or safety awareness. Motorbike helmets were rarely observed and road conditions are quite poor. No data was available on traffic incidents however during the surveys several traffic incidents were observed.

Impact Evaluation and Significance

As presented in **Table 9-21,** the magnitude of impact is assessed as being **Major** mainly due to the additional traffic volume, duration of construction i.e. 36 months at the power plant site, low level of community safety awareness and the fact that other roads users will be using the roads. This also considers the impact as a result of refuelling requirements at public facilities as well as congestion; both of which will impact other road users.

The material mobilisation, using heavy and large vehicles, is predicted to disrupt the traffic smoothness of roads from Cilamaya Wetan Village, Cilamaya Kulon Village, Tempuran Village, Kutawaluya Village, Rengasdengklok Village, and Karawang Barat Village.

This will increase the volume of traffic and may impact the safety of the community who reside along the road and who are commonly using the village road as the main access to conduct their day to day activities (access to markets, shops, schools, medical facilities etc.). Further traffic accidents are likely given the poor road conditions, traffic volumes and narrow condition of the roads as well as the unsafe practices by locals (more the two (2) person per motorbike, no helmets used, workers in the back of pickup trucks, lack of seatbelt use.

Table 9-21 Community Safety Risk Associated with Increase Project Traffic

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

Proposed Mitigation Measures

It is assumed that a range of management measures will be in place. In addition, the Project/EPCs are expected to implement the following additional mitigation measures:

- Developing and implementing effective logistics and transportation management plans;
- Consultation with the communities on key Project traffic routes, timing of peak movements, type of vehicles and heavy equipment and provision of road safety awareness to the surrounding community, through corporation with the local police and schools;
- The Project will erect traffic safety signs along routes and hot spots where vehicles frequent regularly;
- Undertake traffic safety awareness activities in the local schools in Cilamaya;
- Undertake road improvements along routes where construction vehicles will frequent often to ensure the conditions are maintained (particularly those that are road side);
- Ensure all Project drivers are trained in defensive driving and safety awareness and that all vehicles log in and out through their journey management plan;
- Enforce speed limit regulations to all Project construction vehicles, along with an emergency response procedures should any incidents with other road users or pedestrians occur; and
- The proposed grievance mechanism (set out in the SEP- **Annex C**) should be accessible for all communities to report concerns associated with safety and security. Where complaints on accidents or near misses are submitted the Project will undertake an immediate investigation.

Residual Impact Significance

As a result of implementation of proposed additional measures, the residual Project negative impact to traffic accidents will be Moderate. However should an incident (in particular a fatality or serious injury) occur with a community member, this rating will need to be revised.

9.4.15 Community Health and Safety Associated with Construction Activities

Discussion of Impacts

The construction of the CCGT will take an estimated 30 to 36 months with a significant presence of workers, vehicles and movements as discussed in previous chapters. The site itself is located within a residential area with communities residing along the site boundary to the south west including a school and mosque. The main road that these facilities are located on is also used frequently by local stalls and warungs; in particular in the evening.

The EPC (Samsung) plans to install temporary fencing around site boundary with a height of three (3) m, wire-mesh and post type security fence. For the southern part of site boundary an Electrolytic Galvanised Steel Sheet type fence is being considered to block visuals from the residential areas close by. As such access to the site will be carefully managed to only allow authorised personnel to enter the site. The controlled access will also help to avoid community accidents related to construction activities.

Impact Evaluation and Significance

Community safety around the power plant will be managed carefully to ensure no unauthorised access; similar to the security procedures currently with the SKG Cilamaya compression plant. The main area of concern would be children accessing areas where construction is being undertaken.

Given the security measures in place the sensitivity is **Low** although the magnitude would be **Medium** given the scale of the site. As such the overall impact rating in relation to community health and safety around the power plant is **Minor** during planned events. Unplanned events are discussed in **Chapter 10.**

Table 9-22 Community Health and Safety Risk Associated with Construction

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

Proposed Mitigation Measures

It is assumed that a range of management measures will be in place. In addition, the Project is expected to implement the following additional mitigation measures:

- Consultation with the communities on upcoming Project activities within the CCGT to inform them of any specific activities that may have H&S risks;
- The Project will post safety signs around the entrances to the site to inform community members of the risks and authorised access; and
- The proposed grievance mechanism (set out in the SEP) should be accessible for the fence line households around the power plant to report concerns associated with safety and security. Where complaints on accidents or near misses are submitted the Project will undertake an immediate investigation.

Residual Impact Significance

The residual impact related to community health and safety impacts will likely remain **Minor** given the measures that are proposed. However should an incident (in particular a fatality or serious injury) occur with a community member, this rating will need to be revised.

9.4.16 Summary of Social Impacts during Construction

A summary of the impact assessment for the construction period is provided in **Table 9-23**.

Table 9-23 Summary of Social Impacts during Construction

Receptor	Potential Impact	Impact Evaluation	Mitigation	Residual Impact
Fisher folk in Blanakan and Muara villages,	Loss of income due to restrictions and construction activities (perceived and actual)	**Moderate**	• Conduct regular socialisation and consultation activities in particular prior to commencing construction activities in order that fisherfolk are well informed of impacts, risks and mitigations; • Undertake a fish catch survey prior to construction and also monitor during construction and operations; • Ensure the Project's grievance mechanism is well socialised; • Compensation will be on a case by case basis and agreed by both parties involved as per the LRP; • Implement a relevant community development of the fishermen's needs; and • Prioritise employment for interested local fishermen where feasible.	**Minor**
Local communities residing near Project activities	Managing Community Expectations	**Major**	• Provide and communicate clear and factual information about the Project's needs; • To avoid over committing or promising employment; • To have clear stipulation of using local labour in the EPC contracts; and • To ensure the EPC liaise closely with the local village leaders and local government authorities to agree on the appropriate procedures for recruitment and hiring.	**Minor**
Local fish pond cultivators in Cilamaya, Muara and Blanakan	Damage to fishponds due to dust, waste disposal and other construction activities	**Moderate**	• Apply noise, dust, and vibration barriers to reduce the level of disturbance; • Establish a grievance mechanism; • Conduct regular socialisation and consultation activities; • Compensation will be on a case by case basis and agreed by both parties involved as per the entitlements matrix in the RP; and • Prioritise employment for interested local fish pond owners where feasible.	**Minor**
Local paddy owners and users along transmission line, substation and Cilamaya	Damage to paddy fields due to dust, waste disposal, flooding and other construction activities	**Moderate**	• Apply appropriate flood barriers and dust suppression techniques; • Socialise the grievance mechanism; • Conduct regular socialisation and consultation activities; • Compensation will be on a case by case basis and agreed by both parties involved as per the entitlements matrix in the RP; and • Prioritise employment for interested local farmers where feasible.	**Minor**
Villagers in Cilamaya and Muara	Loss in access to fields due to access road construction activities	**Minor**	• Socialise the grievance mechanism; • Conduct regular socialisation and consultation activities; and • Discuss with EPC and village head options to allow safe access through the construction works.	**Negligible**

Receptor	Potential Impact	Impact Evaluation	Mitigation	Residual Impact
Local villages in close proximity to construction activities	Adverse interaction with non local workers	**Major**	• Compulsory medical examinations for Project workers; • Training for all workers on the expected workforce behaviours; • Appropriate management of worker accommodation adhering to the IFC/EBRD guidelines, national and ILO specifications including mitigating impacts to community from waste disposal and effluent discharges; • Accommodation will be sited away from known sex worker hotspots (including the village of Blankan); • Conduct inductions and training refreshers on the Project's Code of Conduct and STIs; • Provision of onsite health clinic and resources for all workers and sib contractors; and • Conduct regular consultations with village leaders and implement a grievance mechanism (accessible to community and workers).	**Minor**
Non local workforce	Poor working and accommodation conditions	**Major**	• All workers will have a contract in place that adheres to Indonesian requirements that cites fair working terms and conditions, salary conditions, contract duration and worker rights. • All accommodation identified for use by construction workers comply with Indonesian, IFC and ILO standards i.e. safe structures, clean, and sanitary conditions, and easy access with separate arrangements for females and males; • Where large number of workers are involved transportation to and from the site is provided to manage congestion impacts; • Are impacts to the environment well managed i.e. proper disposal of wastes and effluents; • All workers have access to clean water for consumption and washing; • Appropriate H&S measures are in place such as access to a first aid kit, fire extinguishers and alarms and security; and • All workers have access to a grievance mechanism.	**Minor**
Cilamaya, Blanakan and Muara villages	Impacts to ecosystem services in particular food and freshwater	**Negligible**	• No additional mitigations are required	**Negligible**

Receptor	Potential Impact	Impact Evaluation	Mitigation	Residual Impact
Tourism and recreation sites in Karawang and Subang	Impacts on access and quality of tourism and recreation activities due to project traffic and/or construction activities	**Negligible**	• No additional mitigations are required	**Negligible**
Cultural Heritage (tangible and intangible) in Karawang and Subang	Impacts on access and quality of cultural heritage due to project traffic and/or construction activities	**Moderate**	• Implement a Chance Find Procedure in the event that cultural heritage is discovered. • Maintain close coordination with the fishing communities and village authorities (particularly Blanakan) to understand the schedule and agenda of the events and optimise the construction schedule to minimise the impact on the Nadran festival (such as avoiding working nearshore during the festival); • Socialise the offshore pipeline laying schedule to the community and the village authorities so they are well-informed about the potential risks and understand mitigation measures to take should any unexpected events occur during the event; and • Deploy adequate health and safety personnel during the event in a close coordination with security officers such as police and army if needed.	**Minor**
Blanakan village and festive goers for *Nadran*	Impacts are mostly related to the installation of the FSRU and the laying of the subsea pipeline affecting the annual celebration of *Nadran.*	**Moderate**	• Maintain close coordination with the fishing communities and village authorities to understand the schedule and agenda of the events and optimise the construction schedule to minimise the impact on the festival; • Socialise the offshore pipeline laying schedule to the community and the village authorities so they are well-informed about the potential risks and understand mitigation measures to take should any unexpected events occur during the event. • Deploy adequate health and safety personnel during the event in a close coordination with security officers such as police and army if needed.	**Minor**
Cilamaya village surrounding the power plant area	Influx resulting in increased pressure on infrastructure and services and creating social discontent	**Minor**	• Establish recruitment and employment plan based on Indonesian laws and international treaties ratified utilising local manpower agency; • Establish a grievance mechanism; and • The Project to liaise with the local police and healthcare providers to ensure no additional pressure has been placed on them due to Project influx.	**Negligible**
Local fishing folk from Blanakan and Muara	Health and safety impacts offshore	**Minor**	• Coordinate with the relevant authorities i.e. to communicate Project shipping activities; • Ensure buoys and chase vessels are in place when offshore construction activities are being conducted;	**Negligible**

Receptor	Potential Impact	Impact Evaluation	Mitigation	Residual Impact
			• Coordinate with *Kantor Kesyahbandaran Tanjung Priok* and Port Authority Class II in Tanjung Priok (and other key parties) regarding the pipe deployment plan; • Conduct consultation activities with the fishing groups; • Socialise the grievance mechanism; • Establish an ERP and safety markers; and • Undertake formal safety studies.	
Local villages in close proximity to construction activities and residing along transportation routes	Traffic congestion and incidents with community members and other road users	**Major**	• Consultation with the communities on key Project traffic routes; • Traffic safety signs along routes and hot spots; • Undertake road improvements; • Ensure all Project drivers are trained in safety awareness; and • Enforce speed limit regulations.	**Moderate**
Cilamaya communities residing around power plant	Community health and safety impacts due to construction activities	**Minor**	• Consultation with the communities on upcoming Project activities; • Post safety signs around the entrances; and • Grievance mechanism should be accessible to all.	**Minor**

9.5 *SOCIAL IMPACT DURING THE OPERATIONS PHASE*

9.5.1 *Disturbance to Fishing and Other Marine User Activities*

Discussion of Impacts

During the operations, the LNG will be transferred to the FSRU via an LNG Carrier with a total capacity of 125,000 m^3 to 155,000 m^3. The FSRU is designed to operate for more than 25 years. On-going maintenance will occur during the vessel life-cycle at the proposed mooring location.

As discussed previously, restriction zones around the FRSU will be applied in accordance with Indonesian *Government Regulation No. 5 Year 2010 regarding Navigation*, a minimum of 500 m.

In addition, there will be a restricted zone of 1,250 m in radius and a prohibited zone of 500 m in radius along the offshore pipeline route. Despite the pipelines being buried certain activities cannot occur, such as anchoring within the zone.

Known activities in the area include local fishing activities discussed in *Chapter 7* along with passenger ships travel from Tanjung Priok to Tanjung Mas and vice versa during Idul Fitri and offshore facilities owned by Pertamina PHE ONWJ (**Figure 9-8**).

Impact Evaluation and Significance

Impacts to passenger vessels are not likely given the location of the FSRU compared to the route taken by the vessels from Port to Port. Furthermore, interaction with the existing offshore oil and gas infrastructure is not considered an issue given the distance between the FSRU and the nearest platform (>5km).

Disturbance to fishing activities as a result of the FSRU operation is potentially less than compared to the construction. During the operation phase, marine traffic will only occur at particular time (such as LNG transfer and FSRU maintenance) located within the area of the Project facilities. Although fishing is prohibited above the pipeline (500 m radius); fishing may occur from time to time by local people and hence measures will be required to restrict this activity at this location. Similarly, access controls in relation to mangrove areas and fishing ponds with the Project area will also be restricted. Access to areas outside of the Project's control cannot be implemented as these areas are within government or private land. Enforcement of this provision will be conducted via communication with the marine and transport authorities and consultation with the local fishermen.

As such, the negative impact to fishing activities is assessed as being **Small** due to lower frequency and traffic volume. Considering that the impacted location will be limited to certain areas surrounding the facilities the fishermen can reroute their fishing lane quite easily to avoid the disturbance in the impacted area, hence the sensitivity is assessed as being **Medium**.

Therefore the significance of impact to disturbance to fishing activities during the operation of FSRU and associated facilities is **Minor** as summarised in **Table 9-24.**

Table 9-24 Disturbance to Fishing Activities Resulted from the FSRU and Associated Facilities

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

Proposed Mitigation Measures

To mitigate the impacts, the Project is expected to implement the following mitigation measures:

- Development and socialisation of a marine facilities management plan for operations to relevant stakeholders (fishermen and representative bodies and the community;
- Restrict access to project controlled areas (jetty, access roads, mangroves and fish ponds) to prohibit fishing activities. The Project will work closely with local fishermen and authorities in this regard;
- Coordinate with relevant authorities such as *Kantor Kesyahbandaran* Tanjung Priok and Port Authority Class II in Tanjung Priok regarding the operation activities plan and publish those in *Berita Pelaut Indonesia* (BPI) and Notice to Mariners (NTM);
- Coordination with the above government stakeholders will request the installations are included in communications and revised marine maps as well as installation of navigation shipping signs (if deemed necessary).
- Submit relevant data and report to relevant institutions such as Directorate General of Oil and Gas, Directorate General of Sea Transportation, Indonesian Navy Hydrography and Oceanography Department, Kantor Kesyahbandaran Tanjung Priok, and Directorate of Navigation;
- Provide compensation to the directly impacted fishermen due to the operation activities such as damage to fishing equipment;

- Monitoring of sea water quality (based on national and international standards) to ensure the FSRU activities do not impact seawater quality; and

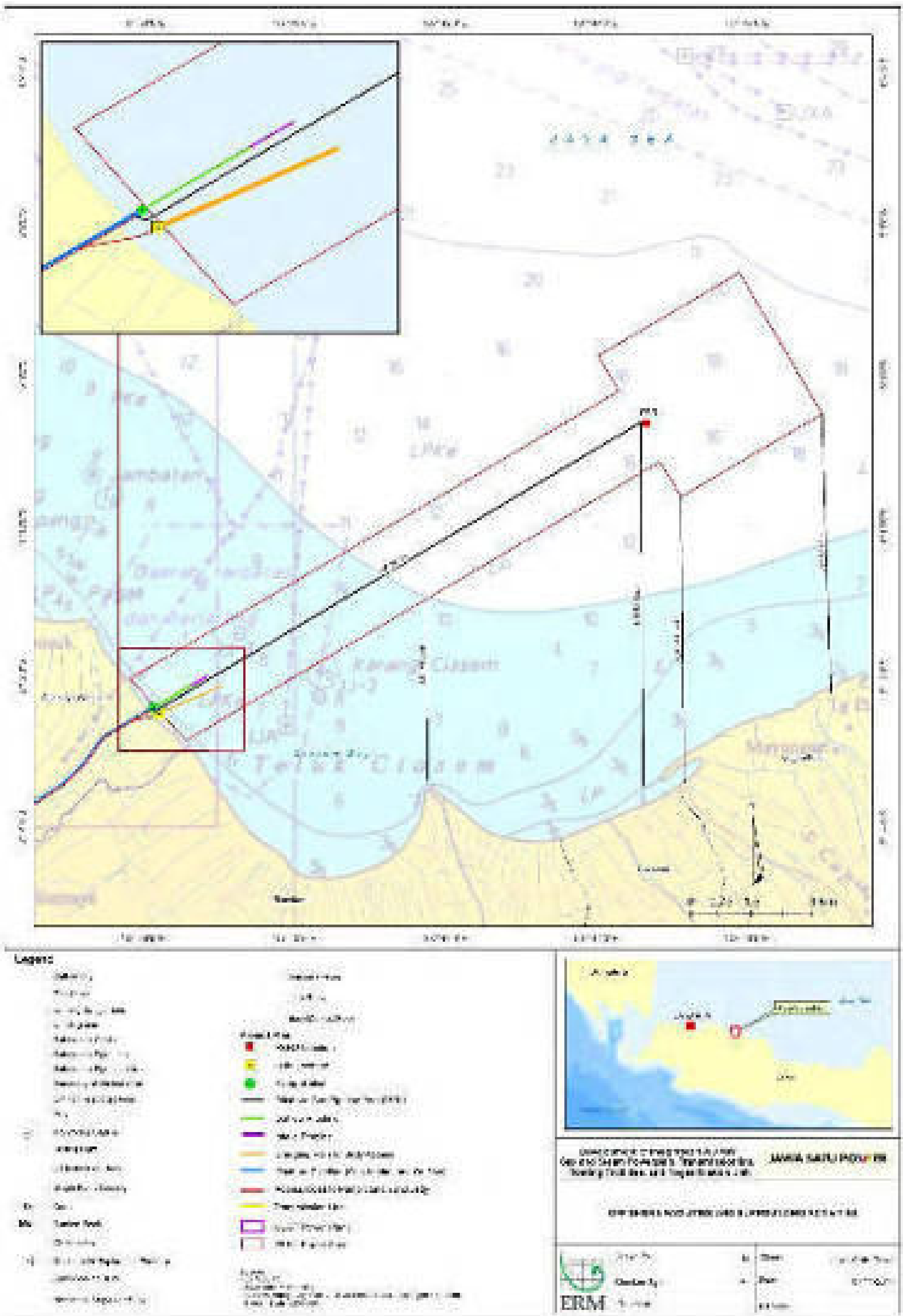
- Ensuring the Project grievance mechanism is accessible to the fishing communities in the Project area enabling them to report concerns/issues associated with the FSRU activities.

- The Project is to conducta fish catch survey of the local fishermen and map local fishing grounds. The findings of the survey will support to inform any future claims of impact or compensation from the Project.

Residual Impact Significance

As a result of implementation of the proposed mitigation measures, the residual Project negative impact to disturbance to fishing activities will be **Negligible.**

Figure 9-8 Location of Offshore Project Facilities and Existing Infrastructure



9.5.2 *Employment and Business Opportunities*

Discussion of Impacts

During the operations phase the total number of local workers that can be employed by the Project will be relatively limited as the majority of activities will require specific skills and competency (estimated across the Project at 200 depending on maintenance requirements). Around 95 workers will be based at the power plant site (housed within the SKG Cilamaya housing complex area). The majority of the skilled labourers will be likely recruited from outside the area, although priority will be given to the local community to fill the required unskilled positions with a 10% target for female employment.

The baseline study reveals most agricultural and fishing workers are keen to participate in the Project especially considering the large unemployment pool. There will also be a high expectation amongst the local construction workers anticipating operational employment.

Impact Evaluation and Significance

Viewed solely as the operations phase, the opportunities are considered as positive to the local area and economy. In particular given the power plant will be operating for 25 years and over; the opportunity to support its on-going activities (supported by a community development program) and considered as longer term, although limited in numbers compared to construction.

Proposed Mitigation Measures

To optimise the Project benefits to the local community the Project will implement the following additional mitigation measures:

- Carefully manage construction demobilisation; many local workers will have their contract end when pre commissioning commences, as such communications around operational employment levels should be widely disclosed to manage expectations;

- To plan for local workforce employment and provision of goods and services in advance (during construction) supporting training and capacity building so that locals can be considered for operational opportunities;

- To prioritise qualified local people in accordance with the needs of the Project;

- Provide and communicate clear information about the Project's requirements related to operational employment to ensure the community understand the opportunities and the scale and to prioritise locals where feasible; and

- Ensure the grievance mechanism is accessible for all communities to report concerns associated with Project employment / workforce recruitment.

Where complaints are submitted the Project will undertake an immediate investigation.

9.5.3 *Loss of Income due to Construction Demobilisation*

Discussion of Impacts

As mentioned previously, the demobilisation of construction workers; particularly related to the power plant that has the highest and longest local employment, requires careful management. Overall, there will be over 4,000 workers employed during the peak construction activities; this will decrease to a maximum of 300 during operations that will mostly consist of semi-skilled and skilled workers.

The construction workforce demobilisation will be carried out in accordance regulations from the Department of Manpower and Transmigration of Karawang Regency.

However, the baseline study indicates a large unemployment pool and a high expectation for Project employment. As such it is likely, due to the limited employment opportunities in the AoI and Project few opportunities will lead to many locals returning to agriculture or fishing (and as such a lower salary). This, in turn may influence public perceptions of the Project and may lead to community discontent.

Conversely there is also a risk that with the influx of migrants to the area seeking Project opportunities, a number of local contracts and business opportunities will be provided by them if the service is not available within the local community. This impact (non local Project benefits) was raised during the ESIA survey in Cilamaya as a community concern.
Impact Evaluation and Significance

As presented in **Table 9-25**, the significance of community unrest / upset due to the loss in income associated with construction demobilisation is identified as being **Moderate** significance. The magnitude is assessed as **Medium** due to the tendency that the impact is at the village to the regencial level of scale. Meanwhile the sensitivity is assessed as **Medium** due to small number of local workforce likely to be absorbed during the operation phase, the risks of influx of migrants to the area but the communities' ability to adopt.

Table 9-25 Construction Worker Demobilisation

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

Proposed Mitigation Measures

In order to mitigate potential impacts, particularly those resulting from the community expectation of employment opportunity during the transition period from the construction into the operation phase, the Project is expected to implement the following additional mitigation measures:

- The Project will inform the community about employment opportunities prior to operations to allow them to be in a position to respond for such opportunities;
- Where feasible the EPCs will provide local construction worker details to the Sponsors to optimise transfer of workers to the operations phase;
- The Project's grievance mechanism will be accessible for all communities to report concerns associated with Project employment / workforce recruitment; and
- The Project will develop relevant community development activities for the impacted communities; coordinating with relevant authorities particularly with the regional and local government to align programs to needs. The program will prioritise local directly impacted communities to participate.

Residual Impact Significance

As a result of implementation of the proposed additional measures, the residual Project impact on the community is considered to be **Minor** significance. This impact is discussed in the ESIA chapter.

9.5.4 Health and Safety of Local Fishermen

Discussion of Impacts

The exclusion zone will be applied around the FSRU location in accordance with the Indonesian *Government Regulation No. 5 Year 2010 regarding Navigation*. The regulation states that vessels or boats can operate outside the safety and security zones by keeping safe distance.

At the present, there are a number of operating Pertamina gas platform facilities in the area. These facilities also apply exclusion zones as stated by the *Government Regulation No 5 Year 2010 regarding Navigation*. The baseline study confirmed that the fishing communities in the area are aware of the exclusion zones however sometimes they violate the regulation by fishing within the restricted zones. The fishermen argued that those locations are abundant with fish as the result of the flaring system that attract fish during the night as well as the subsea platform structure that encourages marine life.

The fishing communities confirmed there was an accident in 2008 causing five casualties nearby one of the Pertamina platform's due to the fishermen entering the exclusion zone. Since then Pertamina has increased efforts to ensure the fishermen obey the exclusion zones by conducting regular patrols.

Impact Evaluation and Significance

The exclusion zones to be applied surround the FSRU is considered to be sufficient to manage the health and safety impacts from the FSRU, hence the magnitude is assessed as Small. However, considering the history of the safety issues in the past, the sensitivity is assessed as Medium.

Based on the QRA (**Annex H**) undertaken for the FSRU the societal risks to the fishermen are considered acceptable even based on very conservative assumptions (based on criteria stipulated in the British Standard EN 1473). Therefore the significance of impact to public marine transportation and fishermen safety is assessed as **Minor**.

Table 9-26 Disturbance to Public Marine Transportation and Fishermen Safety

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

Proposed Mitigation Measures

To mitigate the impacts, the Project is expected to implement the following mitigation measures:

- Development and socialisation of a marine facilities management plan for operation phase to relevant stakeholders include the community;
- Implement and enforce safety zones around the FSRU and pipelines to ensure the safety of fishermen and other marine users is well managed;

- Consultation with fishermen on marine safety, the Project shipping lanes, and exclusion areas;

- Regular patrol to ensure the exclusion zones are clear from any activities prohibited by the law;

- Establish an ERP and safety markers to identify the exclusion zone areas and undertake formal safety studies such as HAZOP; and

- Establish a grievance mechanism to be accessible for all community groups to report concerns associated with health and safety. Where complaints on accidents or near misses are submitted the Project will undertake an immediate investigation.

Residual Impact Significance

As a result of implementation of the proposed mitigation measures, the residual Project negative impact to disturbance to fishing activities will be **Negligible.**

9.5.5 Impact to Community Health and Safety

Discussion of Impacts

CCGT

The operation of the CCGT will be for +25 years with only a small presence of workers, vehicles and movements as discussed in previous chapters. The site itself is located within a residential area with communities residing along the site boundary to the south west. The main road that these facilities are located on is also used frequently by local stalls and warungs; in particular in the evening.

Fencing will be erected around site boundary to block visuals from the residential areas close by and manage access. Access will be carefully managed to only allow authorised personnel to enter the site.

The operation of the power plant will be in line with Indonesian and international safety standards with the appropriate safety considerations and zones in place. It is assumed the operator will undertake a HAZOP and other necessary safety studies. **Annex H** (QRA) provides a comprehensive overview of the potential risks of the operating power plant and associated facilities including the presence of the existing gas receiving station.

Transmission Line

According to the IFCs EHS Guidelines for Electric Power Transmission and Distribution:

"although there is public and scientific concern over the potential health effects associated with exposure to EMF (not only high voltage power lines and substations, but also from everyday household uses of electricity), there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern"

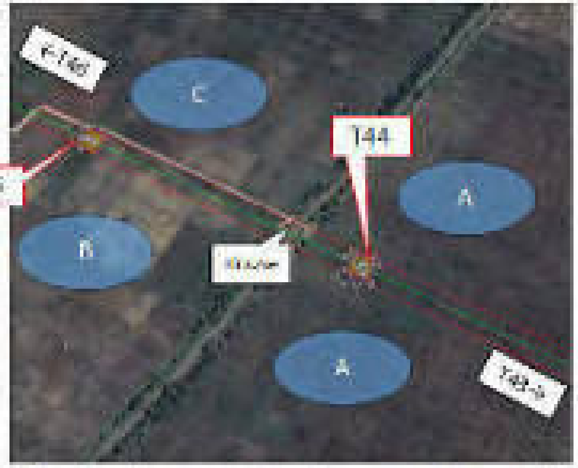
As such the Project has undertaken a number of steps (and will continue to) in order to design out and manage potential community impacts as a result of the construction and operation of the transmission line and substation acknowledging that PLN will be responsible for the operation of the transmission line.

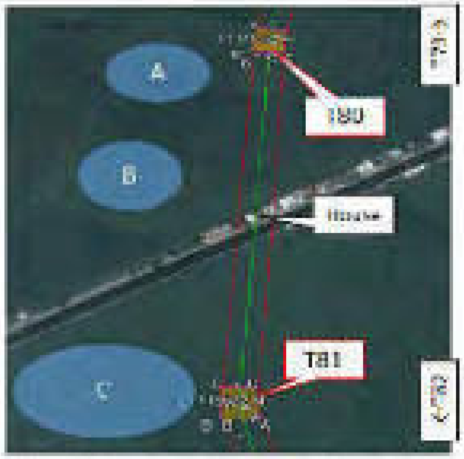
The tower footing locations for the transmission line have been rerouted for 24 towers to minimize resettlement impacts (physical and economic), address refusal to sell, impacts to the community resulting from the construction and operation of the transmission line, and also to avoid transactions with land owners with incomplete administrative documents.

However once operational the transmission line will cross over approximately four permanent residential areas along with a number of farmer huts, foodstalls and public facilities.

The Project conducted a series of activities prior to finalizing the route. Firstly, Poyry, the Sponsors' technical advisor conducted a desk top survey to understand the most appropriate transmission line route from a technical and societal point of view. This was followed by the land advisors, Kwarsa, conducting an inventory work to identify the land owners of the potential land to be acquired and and houses/buildings under the cable. This was then proceeded with the land purchasing process (on a willing seller-willing buyer basis) in accordance with the procedure set out in the Resettlement Plan (**Annex I**). Based on this data the Sponsors confirmed the current TL route; efforts were made to avoid housing below the transmission line cable however in six cases this was not feasible. Further justifications on why these houses could not be avoided are set out in *Chapter 4*.

Figure 9-9   Transmission Line Justifications

Subject Towers	T2 - T3	T44 - T45
Detail area		
Mitigation Efforts	To avoid the house between T2 and T3, Kwarsa approached the land owner of A in 2017 however, they refused to sell his land.	To avoid the house between T44 and T45, Kwarsa approached land owners of A, B and C in 2017, however, all three landowners refused to sell.

Subject Towers	T67- T68	T80 – T81
Detail area		
Mitigation Efforts	To avoid the house between T67 and T66 in 2017, Kwarsa approached land owners of A, B and C in 2017, however, all of the land owners refused to sell their land.	To avoid the house between T80 and 81 in 2017, Kwarsa approached land owners of A, B and C in 2017, however, the result was as follows. - Land Owner A and B: Neither land owner owned appropriate land documentation which is required for the land title transfer process to obtain HGB, therefore the purchase could not progress. - Land Owner C: He did not own the appropriate land documentation and refused to sell the land.

Subject towers	T94 - T95	T102 – T103
Detail area		
Mitigation Efforts	To avoid the Cow shed between T94 and T95, Kwarsa approached land owners of A and B, however, the result was as follows. - Land Owner A: He didn't own appropriate land documentation which was required for land title transfer process to obtain HGB, therefore we gave up to purchase this land. - Land Owner B: The negotiation with land owner B failed since he requested the project to buy a much larger area than requested.	There are many housing and buildings in this area, therefore it was not possible to avoid all buildings. The route selected minimize the society risks as much as was feasible.

Table 9-27 Sensitive Receptors Impacted by the Transmission Line RoW

Village	Tower	Type of building
Cilamaya, Karawang Regency	T04-T05	5 units of food stalls and warehouse
Sukatani, Karawang regency	T09-T10 and T-11-T12	2 units of farmer huts
Jayanegara, Karawang Regency	T29-T30	1 unit of farmer hut
Pagadungan, Karawang regency	T36-T37	1 unit of farmer huts
Pancakarta, Karawang Regency	T41-T42 and T43-T44	2 unit of farmer huts
Lemahkarya, Karawang Regency	T44-T45	House and food stalls
Waluya, Karawang Regency	T67-T68	2 units of food stall
Karyasari, Karawang Regency	T80-T81	3 units of houses and 1 ware house
Mekarjati, Bekasi Regency	T92-T93	Public sanitation facility and Terrace of a small mosque
Bantarjaya, Bekasi Regency	T93-T94	House
Tunggakjati and Karangmekar, Bekasi Regency	T94-T95	Cow sheds and office
Karangmekar, Bekasi Regency	T95-T96	3 units Small semi-permanent house (around 3M2) and family graveyard, fishpond
Karangmekar, Bekasi Regency	T96-T97	Fishpond
Karangmukti	T106-T107	Graveyard and house

Figure 9-10 illustrates the receptors located underneath the current transmission line right of way.

Figure 9-10 Location of Receptors below the Transmission Line Right of Way

Village	Tower	Affected objects	Picture
Cilamaya, Karawang Regency	**T04-T05**	**5 units of food stall and warehouse**	
			
Sukatani, Karawang regency	**T09-T10 and T-11-T12**	**2 units of farmer hut**	

			
Jayanegara, Karawang Regency	**T29-T30**	**1 farmer's hut**	

Pagadungan, Karawang regency	**T36-T37**	**1 unit of farmer hut**	
Pancakarta, Karawang Regency	**T41-T42 and T43-T44**	**2 unit of farmer hut**	

			
Lemahkarya, Karawang Regency	**T44-T45**	**House and food stall**	

Waluya, Karawang Regency	**T67-T68**	**2 food stall units**	
Karyasari, Karawang Regency	**T80-T81**	**3 units of houses and 1 ware house**	

Mekarjati, Bekasi Regency	**T92-T93**	**Public sanitation facility and Terrace of a small mosque**	
Bantarjaya, Bekasi Regency	**T93-T94**	**House**	

Tunggakjati and Karangmekar, Bekasi Regency	**T94-T95**	**Cow sheds and office**	 

			
Karangmekar, Bekasi Regency	**T95-T96**	**3 small semi-permanent house (around 3M2) and family graveyard, fishpond**	

	T96-T97	**Fishpond**	

Karangmukti	**T102-T103**	**Graveyard and houses**	
			

When considering the transmission line a number of community concerns have been raised during the consultations along the right of way from the AMDAL, land acquisition and ESIA processes. The main concerns has been related to radiation from the transmission line and also the potential for electrocution. Given the right of way passes close to around a number of villages and is of a high voltage (500 kv) these concerns need to be considered carefully.

The transmission line has been designed to minimise noise impacts through insulation and the potential for electrocution through built in cutback as such if there is any break in the cable there is no risk of any form of electrocution due to the circuit breakers in place. The Project will ensure design mitigations in line with the regulations are implemented to address community health and safety concerns, in particular for those residing (or with structures) below the transmission line.

The maximum magnetic and electric fields resulting from the modelling are 14.86 µT and 3.21 kV/m, respectively; the safe limit value determined by the INIRC/WHO is 100µT and 5kV/m for general public exposures respectively as such the project is well within these limits.

In addition the Project is adopting minimum horizontal free space of the proposed Transmission Line Tower is 17 m as per the requirement of Indonesian Standard i.e. *SNI 04.6918-2002, regarding Free Space and Minimum Free Distance of High-voltage Transmission Line and Extra High-voltage Transmission Line*. In addition, the minimum vertical distance has been set as 9m above any building and 12 m above land to manage potential community health impacts. These distances have been set by PLN to address potential community health issues.

A comparison of the EHS sector guidelines and the Projects transmission line design and proposed mitigations are discussed in **Table 9-28**.

Table 9-28 Comparison of the IFC's EHS Power Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution

Issue	IFC Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, 2007	Proposed Project Design/Mitigations
Critical Habitat	*Site transmission and distribution rights-of-way, access roads, lines, towers, and substations to avoid critical habitat through use of existing utility and transport corridors for transmission and distribution, and existing roads and tracks for access roads, whenever possible.*	No critical habitat was identified along the transmission line. The area of Modified habitat beneath the transmission line is estimated to be 182.96 ha. However, the habitat impact associated with the transmission line will be minimal and restricted to impacts from the construction of the footings and access tracks as such this impact are considered minor. Mitigations that will be applied include the use of bird deflectors on the length of the power line, moveable markers of contrasting colours, removal of thin neutral or earth wire above the high voltage transmission lines where feasible, insulating cables close to poles and hanging insulators under cross arms and poles.
Acoustics	*Noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona. Noise produced by power distribution lines or transformers does not carry any known health risks. The acoustic noise produced by transmission lines is greater with high voltage power lines (400-800 kilo volts [kV]) and even greater with ultra-high voltage lines (1000 kV and higher). Measures to mitigate this impact may be addressed during project planning stages to locate rights-of-way away from human receptors, to the extent possible. Use of noise barriers or noise cancelling acoustic devices should be considered as necessary.*	The Acoustic Assessment results identify that predicted project noise levels (Leq, 1 hour) associated with the 500 kV transmission line are at or below the most stringent night time IFC noise criteria for receptors situated at distances ≥ 30 metres from the transmission line centre alignment. Predicted 500 kV transmission line project noise levels are however above this criteria value for receptors situated < 30 metres transmission line centre alignment. The results identify that negligible or minor impacts are anticipated at the closest and/or potentially most affected receptors along the transmission line alignment. Operational noise verification and compliance monitoring is recommended to measure and compare the 500 kV transmission line noise level contributions to the predicted values and the criteria.
EMF	*Recommendations applicable to the management of EMF exposures include:* • *Evaluating potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).* • *Exposure to Time-varying Electric, Magnetic, and Electromagnetic Fields" following reviews of all the peer-reviewed scientific literature, including thermal and non-thermal effects. The standards are based on evaluations of*	The maximum magnetic and electric fields resulting from the modelling are 14.86 μT and 3.21 kV/m, respectively for the proposed 500kV tower configuration directly below the line (at 1 meter above the ground surface) and reduce rapidly with distance from the lines. The safe limit value determined by the INIRC/WHO is 100μT and 5kV/m for general public exposures respectively as such the project is well within these limits.

	biological effects that have been established to have health consequences. The main conclusion from the WHO reviews is that exposures below the limits recommended by the ICNIRP international guidelines do not appear to have any known consequence on health. • *Considering siting new facilities so as to avoid or minimize exposure to the public.* • *Installation of transmission lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g. schools or offices), should be avoided.* • *If EMF levels are confirmed or expected to be above the recommended exposure limits, application of engineering techniques should be considered to reduce the EMF produced by power lines, substations, or transformers.*	The Project has rerouted the transmission line right of way three times to avoid the right of way being in close proximity to sensitive receptors, however there are a number of cases where rerouting is not feasible. The minimum horizontal free space of the proposed transmission line tower is 17 m as per the requirement of Indonesian Standard i.e. SNI 04.6918-2002, regarding Free Space and Minimum Free Distance of High-voltage Transmission Line and Extra High-voltage Transmission Line. Further, the minimum vertical distance has been set as 9m above any building and 12 m above land to manage potential community health impacts.
Bird and bat collisions	*Recommended prevention and control measures to minimize avian and bat collisions and electrocutions include:* *1. Aligning transmission corridors to avoid critical habitats (e.g. nesting grounds, heronries, rookeries, bat foraging corridors, and migration corridors);* *2. Maintaining 1.5 meter (60-inch)11 spacing between energized components and grounded hardware or, where spacing is not feasible, covering energized parts and hardware;* *3. Retrofitting existing transmission or distribution systems by installing elevated perches, insulating jumper loops, placing obstructive perch deterrents (e.g. insulated "V's"), changing the location of conductors, and / or using raptor hoods;* *4. Considering the installation of underground transmission and distribution lines in sensitive areas (e.g. critical natural habitats);* *5. Installing visibility enhancement objects such as marker balls, bird deterrents, or diverters.*	The project is proposing to establish the following mitigation to address impacts to birds and bats including: • Use of bird deflectors on the length of the power line. The deflectors will increase line visibility by thickening the appearance of the line for easier detection by avifauna; • Moveable markers of contrasting colours (e.g. black and white) that protrude above and below the line, and be placed 5-10 m apart; • Removing the thin neutral or earth (shield) wire above the high voltage transmission lines where feasible, and where this is not possible, marking the line to make it more visible; • Minimising the vertical spread of power lines. Having lines in a horizontal plane reduces collision risk; • Habitat manipulation to influence flight activity and bird behaviour, e.g. tree lines under the high voltage lines to increase visibility; • Insulating cables close to poles, at least 70 cm on both sides and around perching areas, and up to at least 140cm; and • Hanging insulators under cross arms and poles, provided the distance between a likely perch (mainly the transmission tower crossarm) and the energised parts (conductors) is at least 70 cm.

Electrocutions	*In order to manage electrocution the IFC proposes use of signs, barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers, particularly in urban areas), and education / public outreach to prevent public contact with potentially dangerous equipment and grounding conducting objects (e.g. fences or other metallic structures) installed near power lines, to prevent shock.*	The project has built in circuit breakers that in the event of a cable snapping, the electricity will be immediately cutback as such there is no risk of electrocution to communities in proximity of the right of way. In addition. there will be appropriate safety signage around the tower footings and the area fenced off restricting access.
ROW Width	*Right-of-way widths for transmission lines range from 15 to 100m depending on voltage and proximity to other rights-of-way (typical range is between 15 and 30m).*	The proposed right of way for the Project is 34 m (17 m from each side of the transmission line).

Impact Evaluation and Significance

Given the close proximity to the power plant and transmission line and the fact that health and safety is a major concern for the communities the sensitivity is rated **High**. However, the Magnitude is considered small due to the limited likelihood of an incident or health impact.

Based on the QRA undertaken for the power plant both individual risks and societal risk to the off-site population in the vicinity of offshore and onshore pipelines and power plant facilities are not exceeding to "Not Acceptable" region as per EN standards. Meaning that based on international quantitative risk standards the Project is not considered as a risk to the local population based on the current design and mitigations proposed.

Community perceptions and concerns related to the transmission line and power plant are high and as such this impact is considered **Moderate**.

Table 9-29 Community Health & Safety Impacts

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

Proposed Mitigation Measures

To mitigate the negative impacts, the Project is proposed to implement the following measures:

- Implement and enforce exclusion zones around the FSRU and off shore pipeline and restrict access to the power plant.
- Disclose the EMF and noise results of this ESIA and conduct consultation with transmission line communities in relation to mitigations to be implemented and concerns;
- Conduct further targeted consultations with the permanent household residents directly under the transmission line to discuss the design mitigations to manage health and safety risks and also discuss their potential concerns. Should the household request to be relocated prior to the operation of the transmission line the Project will consider relocation of these households;
- Conduct regular clearance of the vertical height to ensure the area is safe as required by the regulation; at least 9 m above the roof of housing/buildings;

- Conduct regular checking/ maintenance to ensure the safe condition of the tower and the cable. The transmission line has been designed to minimise the potential for electrocution through a built in cutback system as such if there is any break in the cable there is no risk of electrocution due to the circuit breakers in place. Additional mitigations such as earthing of metal clad houses under the right of way may be undertaken should they be identified. The Project will follow the regulations on community H&S for transmission lines as per the regulations.

- The Project will also erect H&S signage along the transmission line and at the tower footing areas, that will also be fenced off, to educate individuals on the safety measures and hazards.

- Develop an Emergency Response Plan (ERP) to be implemented to evacuate the community in the vicinity of the facilities and minimise the impact in the case of a major accident occurring;

- Formal Safety Studies such as Hazard and Operability (HAZOP) Study, Safety Integrity Level (SIL) Study, etc., should be conducted for the Jawa-1 Project facilities during the detailed engineering stage to ensure process hazards are well controlled;

- Update the QRA Study regularly (per 5 years) to assess the potential off-site population and marine traffic growth;

- As part of the Projects SEP implementation socialisation activities will be conducted discussing the potential risks and H&S measures that Project is adopting with communities along the transmission line, power plant and coastal area to ensure that the communities are aware about the safety risk and understand what to do in a case of emergency;

- As part of the SEP engagement and ESMP implementation the Project will also conduct H&S socialisation activities targeting local schools to inform them of the dangers of the construction activities, traffic and transmission line; and

- Socialise the Project's grievance mechanism to the community to enable them submit grievances.

Residual Impact Significance

As a result of implementation of the proposed mitigation measures, the residual Project negative impact to disturbance to fishing activities will be **Minor.**

9.5.6 *Summary of Social Impacts during Operations*

A summary of the social impact assessment for the operations is provided in **Table 9-30**.

Table 9-30 Summary of Social Impacts during Operations

Receptor	Potential Impact	Impact Evaluation	Mitigation	Residual Impact
Fisher folk in Blanakan and Muara villages,	Loss of income due to restrictions and exclusion zone and operations of FSRU	**Minor**	• Conduct regular socialisation and consultation activities; • Ensure the Project's grievance mechanism is well socialised; • Compensation, as per the LRP, will be on a case by case basis and agreed by both parties involved; • Coordinate with relevant authorities regarding operation activities plan; and • Submit relevant data and report to relevant institutions.	**Negligible**
Local communities residing near Project activities	Construction demobilisation and reduced local incomes	**Moderate**	• The Project will inform the community about employment opportunities prior to operations; • Where feasible the EPCs will provide local construction worker details to the Sponsors to optimise transfer of workers to the operations phase; • The Project's grievance mechanism will be accessible for all communities; and • The Project will develop relevant community development activities for the impacted communities; coordinating with relevant authorities to prioritise local directly impacted communities to participate.	**Minor**
Fisherfolk in Blanakan and Muara villages,	Cultural Heritage disruption (Nadran festival)	**Minor**	• Maintain close coordination with the fishing communities and village authorities (particularly Blanakan) to understand the schedule and agenda of the events to minimise the impact on the Nadran festival from operational activities (if any).	**Negligible**
Fisherfolk in Blanakan and Muara villages,	Health and safety of local fishing groups	**Minor**	• Development and socialisation of a marine facilities management plan; • Consultation with fishermen on marine safety; • Regular patrol to ensure the exclusion zones are clear from any activities prohibited by the law; • Establish an ERP and safety markers to identify the exclusion zone areas; • Undertake formal safety studies such as HAZOPs and QRA updates; and • Implement a grievance mechanism.	**Minor**
Local villages residing by CCGT and transmission line	Health and safety of unplanned events occurring at power plant or along the transmission line	**Moderate**	• Conduct regular clearance of the clear zone to ensure the area is safe as required by the regulation; • Conduct regular checking/ maintenance to ensure the safe condition of the towers and the cable; • Ensure appropriate signage is erected at the substation and transmission line to educate the public on the potential dangers and hazards.	**Minor**

Receptor	Potential Impact	Impact Evaluation	Mitigation	Residual Impact
	(EMF, noise and electrocution)		• Conduct targeted consultations with the permanent household residents directly under the transmission line -should the household request to be relocated the Project will consider relocation of these households; • Develop a community emergency response plan and socialise it to the relevant communities to ensure that the communities are aware about the safety risk and understand what to do in a case of emergency; • Undertake updates of the formal Safety Studies such as Hazard and Operability (HAZOP) Study, Safety Integrity Level (SIL) Study, etc., to make sure process hazards are well controlled; and • Conduct a series of H&S focussed consultation activities with the transmission line communities and schools to discuss the design, H&S management measures and their potential concerns and socialise the project's grievance mechanism to the community to enable them submit grievances.	

10 UNPLANNED AND NON-ROUTINE EVENTS

10.1 INTRODUCTION

An unplanned event is defined as 'a reasonably foreseeable event that is not planned to occur as part of the Project, but which may conceivably occur as a result of Project activities (e.g. accidents), even with a low probability.

Unplanned events may occur during any phase of the Project. This Section describes the high-level assessment of potential unplanned events associated with the Project, based on discussions that took place during the Scoping exercise and provides an assessment of the potential impacts on the receiving environment.

10.2 QUANTITATIVE RISK ASSESSMENT

A QRA Study (**Annex H**) was performed for the FSRU, subsea and onshore pipelines and CCGT Power Plant that pose a major accident hazard to the surrounding off-site public.

The QRA focused on risks related to fire and explosion hazards associated with the transport, storage and use of hazardous material. The associated failures may be partial or catastrophic because of corrosion, fatigue, etc., and were taken into account for the detailed analysis in the QRA.

10.2.1 Review of Hazardous Materials

LNG on board the LNG CARRIER and FSRU, and natural gas associated with the FSRU were the major hazardous material considered in this QRA Study, while the other dangerous goods including marine diesel oil, marine gas oil, lubricating oil, nitrogen, calibration gas, etc. were also taken into account. Hazardous materials considered included:

10.2.2 Review of Potential Major Accident Events (MAE)

The MAEs identified included:

- LNG: Pool fire; Flash fire; and VCEs;
- Natural Gas: Jet fire; Flash fire; Fireball; and VCE;
- Hydrogen: Jet fire; Flash fire; Fireball; and VCE; and
- Other Dangerous Goods: Pool fire and flash fire.

In addition a review of the applicable past industry incidents at similar facilities worldwide was conducted

Hazardous scenarios arising from facilities were identified as loss of containment of LNG, natural gas, hydrogen and other dangerous goods. The potential initiating events which could result in the loss of containment of flammable material including LNG, natural gas, hydrogen and diesel are listed below:

- Collision with other passing / visiting marine vessels;
- Mooring line failure;
- Dropped objects from crane operations on the FSRU;
- General equipment/piping failure (due to corrosion, construction defects etc.);
- Sloshing;
- LNG containment system failure; and
- Natural hazards.

Ship Collision

The Indonesian Government Regulation No. 5 Year 2010 regarding Navigation, article 38 describes two (2) zones for navigational aids, which are:

- Prohibited zone within 500 m radius from the outermost point of a navigational aids installation or building; and
- Limited zone within 1,250 m radius from the outermost point from the prohibited zone.

These zones are set to protect the navigational aids from other activities. Furthermore, article 40 explains that marine ships/ vessels can only pass outside these two (2) zones. Based on this regulation, the likelihood of having passing vessels in the vicinity of FSRU is deemed to be unlikely.

As such, the failures due to ship collision incidents is unlikely, nevertheless, the ship collision failure has been taken into account in the unloading arm failure frequency, as suggested in the UK HSE, which was incorporated and assessed in this QRA Study.

Mooring Line Failure

The mooring lines at the FSRU may fail due to various reasons such as extreme loads, fatigue, corrosion and wear, and improper selection of mooring lines etc. Upon failure of the mooring lines, drifting of LNG CARRIER or FSRU may occur leading to potential failure of unloading arms and collision impact with another vessel, with ultimately potential release of LNG or natural gas. Mechanical integrity program (including testing and maintenance) for the mooring lines, as well as tension monitoring system for the mooring lines are provided at the FSRU.

10.2.3 Dropped Objects from Supply Crane Operation

Supply cranes are provided at the FSRU for lifting operations. Swinging or dropped objects from crane operation may lead to potential damage on the LNG or natural gas pipework and subsequent loss of containment. Generally, lifting activity is not expected at FSRU during normal operation. However, during certain circumstances where lifting is required; safety management system will be in place to minimise the dropped object hazard.

Even with supply crane operation, the lifting equipment operation procedure will be in place to ensure that any lifting operation near or over live equipment should be strictly minimised. If such lifting operation cannot be avoided, lifting activities will be assessed. Also, adequate protection covers will be provided on the existing facilities in case the operation of lifting equipment has a potential to impact live equipment at the FSRU. Process isolation will also be achieved in case that live equipment protection becomes impractical.

General Equipment/ Piping Failure

Loss of integrity of the equipment and piping may occur because of material defects, construction defects, external corrosion etc., and leading to loss of containment of LNG and natural gas. Material defect may occur due to wrong materials being used during construction. Construction defect may result from poor welding.

Sloshing

Under high wind or sea conditions, excessive motion while operating partially filled LNG cargo tanks may lead to membrane damage and loss of membrane structural integrity. In addition, boil off gas will be vented to atmosphere, where safety impact may occur if the vent gas is ignited. The cargo tanks are generally either full (inbound voyage) or empty (outbound voyage), hence the chance of sloshing during transit is minimised. In case of the unforeseen need to depart the berth before fully unloading of LNG, the LNG CARRIER or FSRU can conduct an internal cargo transfer between tanks such that sloshing would not be a potential hazard. Annulus between membrane and ship structure is also monitored for hydrocarbon presence, with vent to safe location. Flame arrestors are also provided at vent location to minimise the chance of vent gas ignition. Therefore, considering adequate safety systems are in place to minimise the chance of sloshing, this scenario was not considered as a significant contributor to the overall risk.

Natural Hazards

Indonesia is included in areas prone to earthquake disasters due to its geographical position in a very active tectonic zone. However based on epicentre data from the main earthquakes in Indonesia the location of the power plant is not within a high seismic activity. The site is in a low land vulnerability zone that rarely/almost never has land movements occurring.

In anticipating the dangers of the earthquake, the Government of Indonesia has a standard earthquake resistance planning regulations for building structures (SNI-03-1726-2012 on Procedures for Earthquake Resistance Planning for Building and Non Building Structure). As such the Project is adhering to this standard in the construction of the power plant.
The power plant is not located in a known high seismic area based on data from the Ministry of Public Works and People's Housing (PUPR). Furthermore, no tsunami have been recorded as affecting the project location over the past 20 years.

These natural hazards have already taken into account in the design, as such, the historical failure database are deemed sufficient covering all possible failure modes. Based on data presented in **Chapter 7**; the risk is considered low however has been considered in the engineering design.

QRA Findings

The QRA concludes that both individual risks and societal risk to the off-site population near the Jawa-1 Project facilities do not exceed to "Not Acceptable" with the following recommendations to be implemented:

- A Safety Zone covering the individual risk contour of 1E-06 per year to manage the off-site population in the vicinity of the FSRU;
- Emergency response plan to be implemented to evacuate the community in the vicinity of the Project; and
- Formal Safety Studies such as Hazard and Operability (HAZOP) Study, etc., should be conducted during the detailed engineering stage to make sure process hazards are well controlled.

These mitigations have been included in the Project's ESMP (**Chapter 12**).

10.3 POTENTIAL SOURCE OF IMPACTS

The remaining of this chapter discusses the risks associated with the following unplanned and non-routine events:

- Impacts to air quality due to the emissions from diesel powered engine-generators required to start-up the main power plant (i.e. black start) and for safe shutdown in the event of loss of main power supply;

- Soil and Groundwater Contamination due to Contaminated Fill Material during Project Construction;
- Spillage of hazardous materials onshore;
- Accidental release of vessel wastes offshore;
- Traffic accidents and vessel collision;
- Accidental release of hydrocarbons or chemicals offshore;
- Dropped objects;
- Natural hazard event (flooding); and
- Transmission line break.

The approach adopted in the assessment of impacts from unplanned events considers the likelihood of such an event occurring, and should it occur, its associated consequence on the environment and public health and safety.

10.4 *ASSESSMENT APPROACH AND CRITERIA*

The methodology used to assess the risks associated with unplanned events differs from the impact assessment methodology set out in **Chapter 3** of this Report. Impacts resulting from unplanned events are defined as being a combination of the likelihood (or frequency) of incident occurrence and the consequences of the incident should it occur. The assessment of likelihood takes a qualitative approach based on professional judgement, experience from similar projects and interaction with the Engineering Team.

Definitions used in the assessment for likelihood and consequence are set out in **Table 10-1** and **Table 10-2**.

Table 10-1 Significance Criteria for Unplanned Events - Likelihood

Likelihood describes the probability of an event or incident actually occurring or taking place. It is considered in terms of the following variables:	
Low	The event or incident is reported in the industry, but rarely occurs.
Medium	The event or incident does occur but is not common.
High	The event or incident is likely to occur several times during the Project's lifetime.

Table 10-2 Significance Criteria for Unplanned Events - Consequence

The potential consequence of an impact occurring is a culmination of those factors that determine the magnitude of the unplanned impact (in terms of the extent, duration and intensity of the impact). **Consequence in unplanned events is similar to magnitude of planned events and is classified as either:**	
Minor	Impacts of low intensity to receptors/resources across a local extent, that can readily recover in the short term with little or no recovery/remediation measures required.

The potential consequence of an impact occurring is a culmination of those factors that determine the magnitude of the unplanned impact (in terms of the extent, duration and intensity of the impact). **Consequence in unplanned events is similar to magnitude of planned events and is classified as either:**	
Moderate	Impacts of Low to Medium intensity across a local to regional extent, to receptors/resources that can recover in the short term to medium term with the intervention of recovery/remediation measures.
Major	Exceeds acceptable limits and standards, is of Medium to High intensity affecting receptors/resources across a regional to international extent that will recover in the long term only with the implementation of significant/remediation measures.

Once a rating is determined for likelihood and consequence, the risk matrix in **Table 10-3** is used to determine the impact risk significance for unplanned events.

The prediction takes into account the mitigation and/or risk control measures that are already an integral part of the Project design, and the management plans to be implemented by the Project.

Table 10-3 Unplanned Events Risk Significance

Risk Significance Rating				
	Likelihood	**Low**	**Medium**	**High**
Consequence	**Small**	Minor	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

Table 3.2 in **Chapter 3** of this Report outlines the definitions of impact significance for planned Project activities. The definitions of Minor, Moderate and Major significance are also applicable for unplanned events.

It is not possible to completely eliminate the risk of unplanned events occurring. However, the mitigation strategy to minimise the risk of the occurrence of unplanned events is outlined in **Table 10-4.**

Table 10-4 Mitigation Strategy for Unplanned Events

Strategy	Description
Control	It aims to prevent an incident happening or reduce the risk of it happening to ALARP through: • Reducing the likelihood of the event (e.g. preventative maintenance regimes, reducing chemical usage, traffic calming and speed limits, community road safety awareness training, implementation of state-of-the-art blowout preventative equipment, procedures and training); and • Reducing the consequence (e.g. bunds to contain spilled fuels, fire protection); and a combination of both of these.
Recovery/ Remediation	Includes contingency plans and response including Emergency Response Pan and Oil Spill Contingency Plan.

In general, a variety of safety management plans and mitigation measures will be developed to further reduce potential impacts to the onshore and offshore environment as set out in **Chapter 12**.

This includes the overall Emergency Response Plan (ERP) that defines an organisational structure and provides a framework for responding to a major accident event. These mitigation measures in terms of prevention, control, protection serve to reduce the likelihood, extent and duration of adverse impacts resulting from an unplanned event.

Therefore, the potential impact of unplanned and non-routine event during construction and operations phases at onshore and offshore environment are assessed together.

10.5 SPILLAGE OF HAZARDOUS MATERIALS ONSHORE

10.5.1 *Assessment of Impact*

Spillages of chemicals (including biocides) hydrocarbons, and other hazardous materials are considered unplanned events with the potential for significant environmental or social effects. Contaminated or polluted surface water or soil can directly affect human health through direct contact, or via the infiltration of contamination into groundwater aquifers known to occur under the site.

Surface water, soil and groundwater contamination may occur on all parts of the Project (power plant, electricity transmission line, river water supply pipeline and gas supply pipeline) during the construction phase due to accidental leaks or spills of chemicals or hazardous materials such as oils, lubricants or fuel from heavy equipment, and improper chemical/fuel storage. Spills and leaks may occur during vehicle/equipment operation, fuelling, and maintenance and from the temporary storage of fuels, oils, lubricants and other hazardous waste types.

Additionally, chemical cleaning during the pre-commissioning activities may impact surrounding sensitive receptors, should leakages of cleaning chemicals occur. Such spills can impact surface water quality either due to direct discharge or indirect discharge due to storm water runoff. In addition, discharges of oily bilge or ballast water from barges could impact surface water quality during construction.

Temporary storage of fuels, oils, lubricants and other hazardous waste types is also a source of spills and leaks. Any such spills can impact groundwater quality due to leaching through soil during periods of rainfall. This is particularly the case during the initial phases of construction where machinery will be undertaken works on exposed soils.

Contaminated or polluted soil can directly affect human health through direct contact with soil, or via the infiltration of soil contamination into the aquifers known to occur under the site. Accidental release or spill of can be toxic to flora and fauna locally and downstream if substances are released into the aquatic environment.

Based on experience with similar projects, the total approximate quantities of hazardous materials that could be a potential source of impact during this stage include:

- 30,000 L/month diesel fuel;
- Small, infrequent quantities of lubricants, oil; and
- Hydrostatic testing chemicals.

Accidental releases from operational activities, including the natural gas supply pipeline, and insulant chemicals from operation of the transmission line, have the potential to impact surrounding surface water, soil and groundwater. There is the potential for deoxygenation of the soil and groundwater due to natural gas leaks from the gas supply pipeline.

A further risk during the operational phase is from a potential spill of back up fuel (should this be used to provide a backup fuel supply during breaks in the natural gas supply). These discharges may have a direct impact on the soil quality and surface water, which in turn may cause secondary impacts to groundwater. Leakage from chemical storage facilities may result in surface water, soil and groundwater contamination.

Further risks during the operational phase are from the handling of hazardous materials and potential spill from back-up fuel (should this be used to provide a back-up fuel supply during breaks in the natural gas supply). These discharges may have a direct impact on water or soil quality that in turn could have ecological implications.

10.5.2 *Impact Evaluation and Significance*

At any stage of construction or during the operational phase, there is the possibility that a major hydrocarbon and chemical spill could occur. Even with the application of the latest industry standards and consideration of the highest standards of safety, unplanned events may still occur due to human error, equipment failure and other procedural aspects.

In general, the impacts of such spills will be localised and of relatively short duration, whereas fuel oil may be more persistent. The likelihood of such an occurrence taking place would be **Low**, but the potential consequence could be **Large**, dependent on the sensitivity and importance of receptors affected.

Therefore, the risk significance from Hydrocarbon and Chemicals Spills and Releases is ranked as **Moderate.**

Table 10-5 Unplanned Events Risk Significance

Risk Significance Rating				
	Likelihood	Low	Medium	**High**
Consequence	**Small**	Minor	Minor	**Moderate**
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

10.5.3 *Mitigation Measures, Management and Monitoring*

During soil disturbing activities, the mitigation measures developed with regards to surface water quality (**Chapter 8**) will serve to prevent soil contamination through limiting TSS loading in surface water bodies.

A waste management plan, including hazardous wastes will be developed with the proposed measures to prevent and respond to chemical and hydrocarbon spills are:

- Hazardous materials storage areas will be sited on sealed areas and provided with locks to prevent unauthorised entry;
- Secondary containment to accommodate 110% of the largest volume of material, with appropriate drainage connection and/or provision for removal of spilled liquids, will be provided around places of fuel and hazardous materials storage such as oil filled transformers, oil pumps and tanks, generators, chemical storage houses etc. to contain any hazardous spills and to exclude surface water run-off from entering the contained area;

- All hazardous materials will be segregated and stored according to their material safety data sheet (MSDS), transported and disposed in an appropriate manner;

- All vehicles are to be equipped with spill control kits to contain and clean small spills and leaks;

- Vehicle servicing areas, vehicle wash bays and lubrication bays will, as far as practical, be located within roofed and cemented areas. The drainage in these covered areas will be connected to sewers via an oil/water interceptor.

- Any refuelling activities will only take place within a designated area of hard standing with spill kits present;

- All mobile equipment is to be equipped with spill or drip trays to contain spills and leaks of hazardous materials i.e. chemicals, hydrocarbon oils etc.;

- Equipment and vehicle maintenance scheduling is to be undertaken such that they are continually monitored for potential or actual leaks;

- A training program will be implemented to familiarise staff with measures to be taken to prevent spills and leaks, and for emergency procedures and practices related to contamination events;

- Mitigation measures/ monitoring programme with regard to accidental events/ spills shall be communicated to the EPC Contractor at the commencement of the Project implementation;

- For any spills or leaks, once the initial emergency response has been implemented, an appropriate clean up and monitoring plan is to be developed. This is to take into account the type of spill and its extent. It is also to include provisions for monitoring of soil and groundwater quality to track potential or actual migration of the contamination through the soil and groundwater profiles; and

- Develop a SEP that includes neighbouring countries and impacted communities to ensure that impacts arising from spills are managed effectively.

10.5.4 Significance of Residual Impact

Based upon the implementation of the above management and mitigation measures, the residual impact level of the potential impact sources is reduced to **Minor**.

10.6 *DEGRADATION OF HABITAT AND MORTALITY TO MARINE FAUNA FROM ACCIDENTAL RELEASE OF VESSEL WASTE*

The FSRU and support vessels will generate solid wastes, including non-hazardous wastes (e.g. paper, plastics, waste metal and glass, putrescible in the form of food waste) and/or hazardous wastes (e.g. used oil, batteries, oil filters).

There will be no planned discharge of these wastes to the marine environment. However, accidental discharge or loss of such wastes overboard may occur which may lead to impacts to marine fauna and habitats, which include pollution and contamination of the marine environment, and secondary toxicity and physical effects on marine fauna through ingestion or entanglement.

10.6.1 *Impact Evaluation and Significance*

The existing Natural Habitat supports relatively depauperate (lacking in variety) benthic communities, there are existing sources of contamination, and there is no Critical Habitat is present within the Area of Influence.

Benthic surveys completed nearshore and along the pipeline route indicate that there are no significant areas of corals and other benthic primary producer habitat, with the nearest corals located 5 km from the pipeline route.

A range of infauna and epifauna were identified in the nearshore area, crustaceans were very well represented within the surveyed mangrove area and it is possible that endangered species of sea cucumber occur in this region, but the Project area is not considered to provide unique habitat for these species. Individual large marine fauna such as marine mammals may occur in the Project area on occasion, but it is not known to support them in significant numbers.

The likelihood of the accidental discharge of solid waste marine habitats and fauna species to be impacted is considered to be **Medium**.

Impacts resulting from the routine management of solid hazardous and non-hazardous wastes are expected to be negligible, as there will be no planned discharge of solid wastes to the marine environment. Discharge of solid wastes has the potential to create a localised change in water quality and temporary ecological impacts (e.g. changes in the availability of light, certain nutrients and/or dissolved oxygen).

Solid wastes may also be blown off the vessel, which could have the potential to result in fauna mortality or injury through ingestion or entanglement. Windblown waste would be rare as wastes will be stored in closed containers. Given the localised nature of impacts, the magnitude of effect from the accidental release of solid wastes is likely to be **small**, resulting in an impact significance of **Minor** (**Table 10-6**).

Table 10-6 *Assessment of Impacts on Marine Habitat and Fauna from the Accidental Release of Solid Wastes*

Risk Significance Rating				
Likelihood		Low	**Medium**	**High**
Consequence	**Small**	Minor	**Minor**	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

10.6.2 *Mitigation Measures, Management and Monitoring*

It is recommend that the following mitigation measures be applied in relation to solid waste management, in accordance with MARPOL 73/78 Annex V:

- Implementation of a Waste Management Plan.
- Bins available for the segregation of waste in accordance with the vessel Waste Management Plan, and bins are fitted with lids/cargo nets for waste with potential to be wind-blown (e.g. paper, cardboard).
- Solid hazardous and non-hazardous wastes generated will be either incinerated or appropriately disposed of at a licensed onshore facility in accordance with the Waste Management Plan.

10.6.3 *Significance of Residual Impact*

In view of the implementation of mitigation measures, the residual impact significance remains **Minor**.

10.7 TRAFFIC ACCIDENTS AND VESSEL COLLISIONS

10.7.1 *Assessment of Impacts*

10.7.1.1 *Vehicle Movements*

The movement of materials between laydown/ storage areas, of structures to dismantling yards and of wastes to treatment and disposal facilities and workers from work camp(s) to Project areas, is likely to result in an increase in traffic on public road networks, thereby increasing the risk of accidents with other road users and pedestrians, and injuries/fatalities of wildlife.

10.7.1.2 *Vessel Activity*

Similarly, increased movements and presence of marine vessels throughout the duration of construction and operational phases will give rise to an increase in collision risks to shipping and fishing vessels.

It is unclear how many marine vessel movements will occur on a daily basis, however similarly to the terrestrial environment, it is expected that marine collisions will have the potential to be significant.

Collisions and capsizes could result in loss of inventory leading to hazardous material spills which would impact water quality and affect associated marine biodiversity and benthic communities (**Section 10.8**) and/or risk to community of worker safety.

10.7.2 *Impact Evaluation and Significance*

Based on the current understanding of Project activities and the existing environment it is expected that during construction the likelihood of a collision occurring will be High for vehicle activities onshore given the predicted number of vehicle movements to and from the construction sites. Offshore the use of marker buoys and support vessels to monitor the presence of other sea users during construction will result in a Medium likelihood of vessel incident.

Land based collisions are likely to be localised. However, marine collisions may require a recovery of receptors/resources in the short term to medium term with the intervention of recovery/remediation measures. However a prohibited zone will be established around the FSRU area. Such zone covers both prohibited zone and restricted zone i.e. the prohibited zone is an area with a radius of 500 m starting from the outmost side of the installation; the restricted zone is the area with radius of 1,250 m starting from the prohibited zone.

From the above information, the overall impacts have been assessed to be of **Major** Significance for onshore (vehicle) incidents and **Moderate** for offshore (vessel) incidents.

Table 10-7 Unplanned Events Risk Significance – Vehicle Incident

Risk Significance Rating				
Likelihood		**Low**	**Medium**	**High**
Consequence	Small	Minor	Minor	Moderate
	Medium	Minor	Moderate	**Major**
	Large	Moderate	Major	Major

Table 10-8 Unplanned Events Risk Significance – Vessel Incident

Risk Significance Rating				
Likelihood		**Low**	**Medium**	**High**
Consequence	Small	Minor	Minor	Moderate
	Medium	Minor	**Moderate**	**Major**
	Large	Moderate	Major	Major

10.7.3 Mitigation Measures, Management and Monitoring

The proposed measures to prevent and respond to traffic accidents and marine vessel collisions are:

Onshore:

- Project ERP to incorporate Project vehicle activities;
- Develop and implement a traffic management plan. This should detail access routes, quality of existing roads, measures that will be implemented to minimise the risks associated with transporting materials and workers to and from site, including factors such as fatigue management and ensuring all employees observe recommended speed limits; Bus workers between the accommodation camp and the Project area. This will reduce the amount of traffic generated by the Project;
- Ensure all employees complete training prior to driving any Project vehicle. The content of the training should be tailored to the employee's role;
- Explore opportunities to work with local stakeholders to increase awareness within local villages about the hazards associated with traffic;
- Develop, communicate and implement Journey Management Plans for heavy equipment, construction and transport vehicles and worker buses; and
- Undertake stakeholder engagement with the local community for both traffic road user groups and stakeholders living at settlements adjacent to

traffic roads used during construction including updating and inform the community in the Traffic Management Plan.

Offshore:

In addition to the controls of notification to the relevant authorities, use of marker buoys to detail the marine safety exclusion zone and use of support vessels to intercept other sea users, the following mitigation is required:

- Undertake stakeholder engagement with marine environment users including the fishing community and other users. This include inform location of exclusion zones and better organisation of general vessel movements;
- Vessels to meet MARPOL[1] requirements including developing a Shipboard Oil Pollution Emergency Plan (SOPEP);
- Implement Adverse Weather Working Standard;
- Mark the presence of construction areas with appropriate lighting to reduce the risk of collision with other marine users;
- Prepare a Collision Risk Management Plan; and
- Use of Automatic Radar Plotting Aid (ARPA), Radar Early Warning System (REWS) and Vessel Traffic Surveillance System (VTS) where applicable to all contracted vessels.

10.7.3.1 Significance of Residual Impact

In view of the implementation of mitigation measures to manage the likelihood of such an event occurring, the residual impact significance is deemed to be **Moderate** for onshore vehicle incidents and **Minor** for vessel incidents.

10.8 ACCIDENTAL SPILLS OF HYDROCARBONS OR CHEMICALS OFFSHORE

Accidental spills of hydrocarbons and chemicals could occur from various sources such as:

- A refuelling incident;
- Vessel collision leading to a rupture of vessel fuel tank;
- Equipment leaks; or
- Leaks from storage areas.

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[1] The International Convention for the Prevention of Pollution from Ships.

The FSRU will contain fuel oil tanks including service tanks of approximately 3,000 m^3 and lube oil tanks including sump tanks of 175 m^3.

Accidental spills of hydrocarbons and chemicals could result in impacts to marine fauna and avifauna through physical contact, ingestion, inhalation and absorption. Degradation of habitat can also occur as hydrocarbons have the potential to persist in the environment long after a spill event. Effects of hydrocarbons in these systems have the potential to have long-term impacts on fish and wildlife populations.

10.8.1 Impact Evaluation and Significance

The significance of impacts associated with accidental release of hydrocarbons and chemicals is discussed and presented in **Table 10-9**.

Marine fauna most at risk include cetaceans such as dolphins and fish. Avifauna at risk include any bird species foraging at sea or on the shoreline.

Cetaceans such as dolphins are air breathing mammals and theoretically vulnerable to exposure to hydrocarbon spill impacts through the inhalation of evaporated volatiles once the crude has surfaced. They are smooth-skinned, hairless mammals. Given the nature of their skin, hydrocarbons do not tend to stick to their skin and they are not expected to be sensitive to the physical effects of oiling. Ingested hydrocarbons, particularly dissolved aromatics can be toxic to marine mammals as they can remain within the gastro-intestinal tract and be absorbed into the bloodstream and thus irritate and/or destroy epithelial cells in the stomach and intestine. Marine mammals may also be susceptible to indirect toxic effects through ingestion of contaminated prey.

Studies of bottlenose dolphins found that they were able to detect and actively avoid a surface slick after a few brief contacts and that there were no observed adverse effects with the surface slick (*Smith et al., 1983*). It is not known if other marine mammals potentially present in the area are able to similarly detect and avoid hydrocarbon slicks.

The potential for significant impacts to cetaceans as a result of ingestion of hydrocarbons is limited due to the low numbers of cetaceans expected to be present in the area that may be contacted by hydrocarbons from a spill.

Fish also have a natural avoidance instinct for many hydrocarbons (*Hoar et al., 1997)* and are therefore unlikely to be exposed to high concentration of dissolved aromatic or entrained hydrocarbons.

Birds foraging at sea have the potential to directly interact with oil on the sea surface some considerable distance from terrestrial habitats in the course of normal foraging activities. Surface plunging species that readily rest on the sea surface are most at risk.

Direct contact with surface hydrocarbons may result in dehydration, drowning and starvation and is likely to foul feathers, which may result in hypothermia (*AMSA 2015a*). Impacts may include damage to external tissues, including skin and eyes, and internal tissue irritation in lungs and stomachs (*Clark 1984*). Toxic effects may also result where hydrocarbons are ingested, as birds attempt to preen their feathers (*Jenssen, 1994*).

Although marine mammal species of conservation significance are known to occur within Indonesia; there are no confirmed records of their presences from the surveys conducted within the Project area. Important marine habitats such as nesting beaches are also not associated with the coastline at the Project area. This was confirmed by the fishing communities consulted during the AMDAL process.

Avifauna which may be present around the potentially impacted habitat are discussed in **Chapter 7**. A total of 53 bird species were recorded within the proposed Project area. According to IUCN Red List, 49 species are listed as Least Concern (LC) and one (1) species is listed as Near Threatened (NT), which is *Charadrius javanicus*.

The survey encountered seven (7) species of Ardeidae family. This family belongs to the Order Pelecaniformes, and includes herons, egrets, bitterns, night-herons and allies. These birds live in all kinds of wetlands, from open marshlands with shallow water to coastal areas, through tidal flats and mangroves (*Hoyo, Elliott, Sargatal, & Collar, 2002*). The presence of birds is highly dependent on the habitat quality, therefore a hydrocarbon spill reaching such habitats is likely to impact the number of species present.

Of particular concern are the potential impacts from an oil spill at sea reaching coastal areas, which have a concentration of sensitive receptors (e.g. corals, marine mammals nesting grounds, important bird migratory pathways, fishing grounds or the impacts from a spill on land in sensitive areas (e.g. protected habitats, areas of high conservation value), into water courses or in built up areas affecting the public.

The coastal area of the Project jetty and pipeline landfall locations exhibits mangroves in areas. The impacts of hydrocarbons on mangroves include damage as a result of smothering of lenticels (breathing pores) on pneumatophores or prop roots or by the loss of leaves (defoliation) due to chemical burning (*Duke, et al., 1999*). Thorhaug (1987) concluded that while defoliation of mangroves was a common occurrence when exposed to hydrocarbon slicks, massive mortality was not always the ultimate outcome. Mangrove death is predicted whenever more than 50% of the leaves are lost (*Evans, 1985*).

It is also known that mangroves take up hydrocarbons from contact with leaves, roots or sediments, and it is suspected that this uptake causes defoliation through leaf damage and tree death (*Wardrop et al., 1987*). The recovery of mangroves from shoreline oil accumulation can be a slow process, due to the long term persistence of oil trapped in anoxic sediments and subsequent release into the water column. (*Burns et al., 1993*).

The sensitivity of marine fauna and avifauna to hydrocarbon spills is considered to be **Medium**. The magnitude of effect due to Accidental Spills of Hydrocarbons and Chemicals, considering likelihood of the event occurring and volume of potential marine diesel release is ranked as **Medium**. The overall magnitude of this impact is therefore **Moderate**.

Table 10-9 Assessment of Impacts from Accidental Hydrocarbon or Chemical Spills

Risk Significance Rating				
Likelihood		**Low**	**Medium**	High
Consequence	Small	Minor	Minor	Moderate
	Medium	Minor	**Moderate**	Major
	Large	Moderate	Major	Major

10.8.2 *Mitigation Measures, Management, and Monitoring*

It is recommended that the following mitigation measures be applied in relation to Invasive Marine Species during construction:

- Vessels will have Shipboard Oil Pollution Emergency Plan (SOPEP) and spill kits on vessels;
- Chemicals and lubricants to be stored as per SDS and in bunded area;
- Vessel will be of suitable standard and build quality;
- Vessels will maintain visual, radio and radar watch at all times, and will implement lighting, shapes and practices in accordance with COLREGS; and
- A Marine Oil Spill Contingency Plan will be developed and personnel trained in its implementation.

10.8.3 *Significance of Residual Impacts*

In view of the implementation of mitigation measures as reducing the likelihood of such an event occurring, the significance of residual impacts is predicted to be **Minor.**

10.9 *IMPACTS TO AIR QUALITY FROM DIESEL GENERATORS*

10.9.1 *Assessment of Impact*

The Project will be equipped with twelve 2MWel (24MWel total) diesel powered engine-generators required to start-up the main power plant (i.e. black start) and for safe shutdown in the event of loss of main power supply from the Jawa-Bali 500 kV grid. The exhaust emissions to air from the generators can result in elevated ambient concentrations of NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$ and subsequent short term impacts on ambient air quality. Although the generators are expected to be used infrequently and for a limited duration, the short term impacts on air quality can be significant while in operation.

The likely impacts to air quality have been have been determined using the USEPA AERMOD dispersion model version 16216r. Two scenarios were considered:

- Scenario 1: Black start; and

- Scenario 2: Emergency shut down.

The detailed assessment methodology and findings of each scenario are presented in **Annex D**. This section presents a summary of those findings and the risk significance based on the likelihood of occurrence.

10.9.2 *Impact Evaluation and Significance*

The diesel engine generators are only required when the main electrical grid is down and unable to provide power to the power plant. Information sourced from PLN, Indonesia's government owned electricity corporation, indicates that since its establishment, the Jawa-Bali 500 kV grid has experienced one complete black out in 1997, and a partial black out in 2005. It is therefore considered extremely unlikely that the requirement to use the generators will coincide with main grid failure. On this basis the loss of power from the main grid and the subsequent requirement to use the generators is considered an emergency/unplanned event and the likelihood of occurrence is **Low**.

The air quality impact assessment presented in **Annex D Chapter 6** indicates that the consequence (magnitude) of the impact resulting from a black start and shut down scenario is **Moderate** at worst. Contour maps showing dispersion from the stacks are presented in **Figure 10-2** to **Figure 10-6**.

Figure 10-1 Scenario 1: Nitrogen Dioxide (NO_2) 1-Hour Maximum Process Contribution (PC) – 99.9 percentile (Human Health)

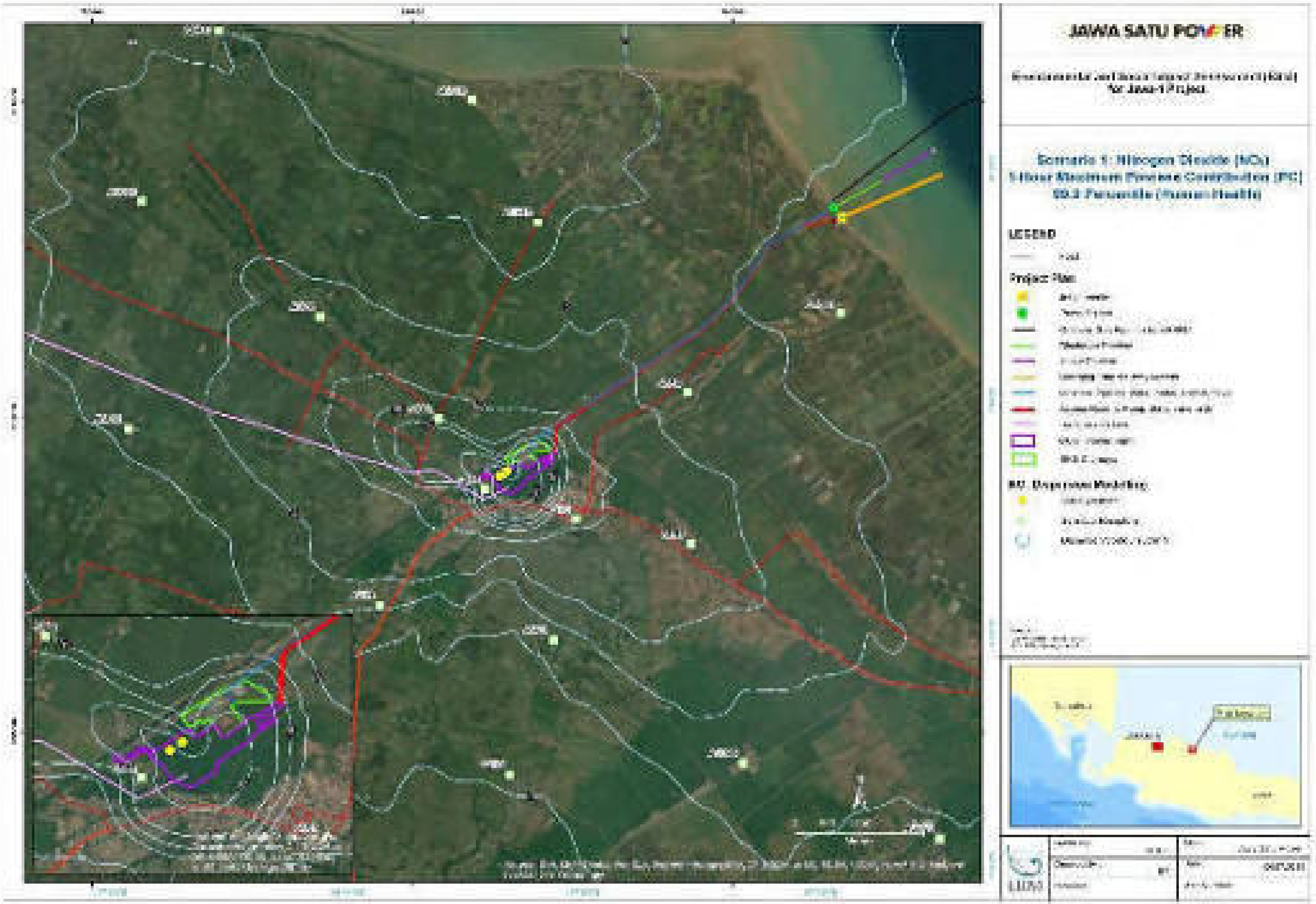


Figure 10-2 Scenario 1: Nitrogen Dioxide (NO_2) 1-Hour Maximum Predicted Environmental Concentration (PEC) – 99.9 percentile (Human Health)

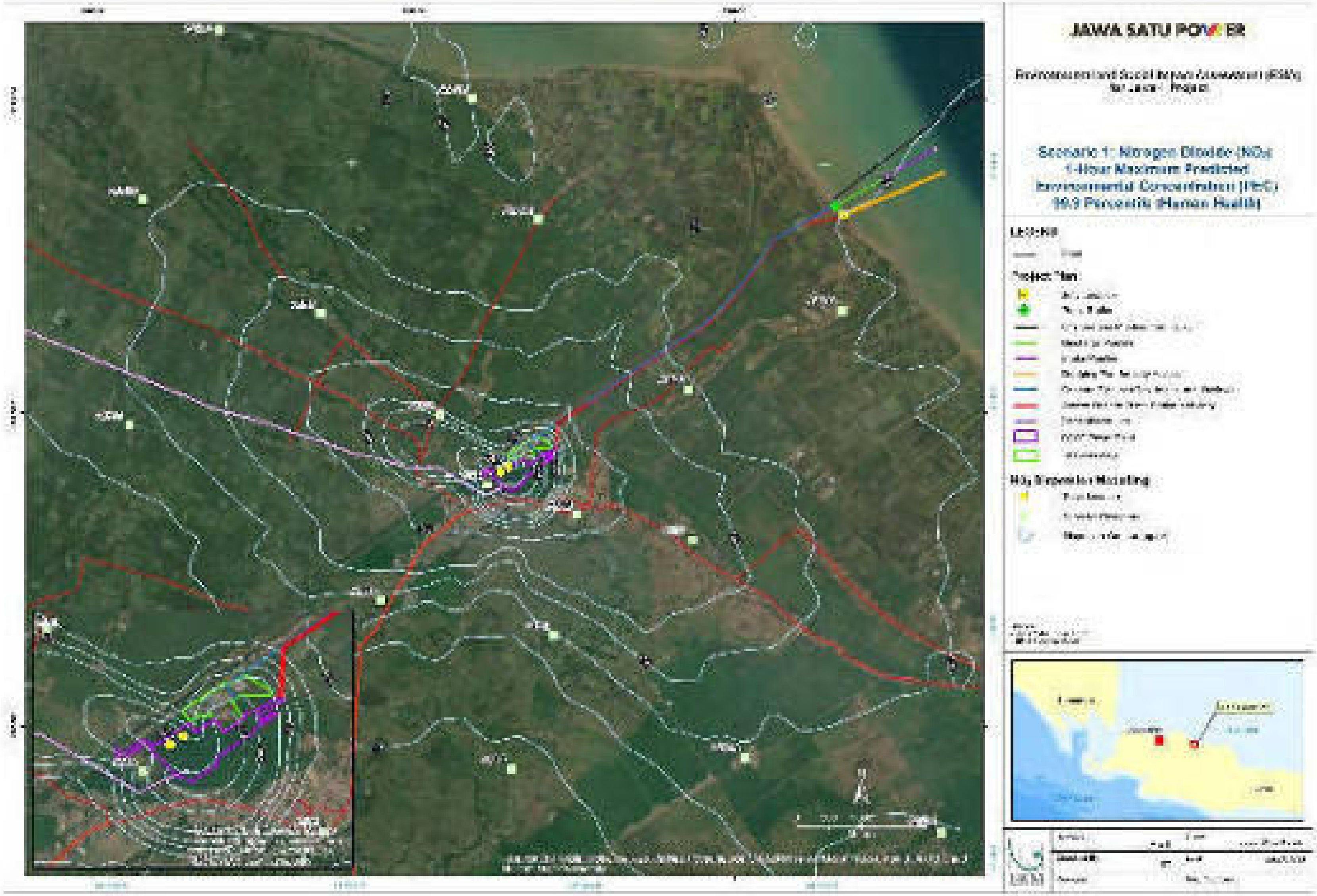


Figure 10-3 Scenario 1: Sulphur Dioxide (SO_2) 1-Hour Maximum Process Contribution (PC) – 99.9 percentile (Human Health)

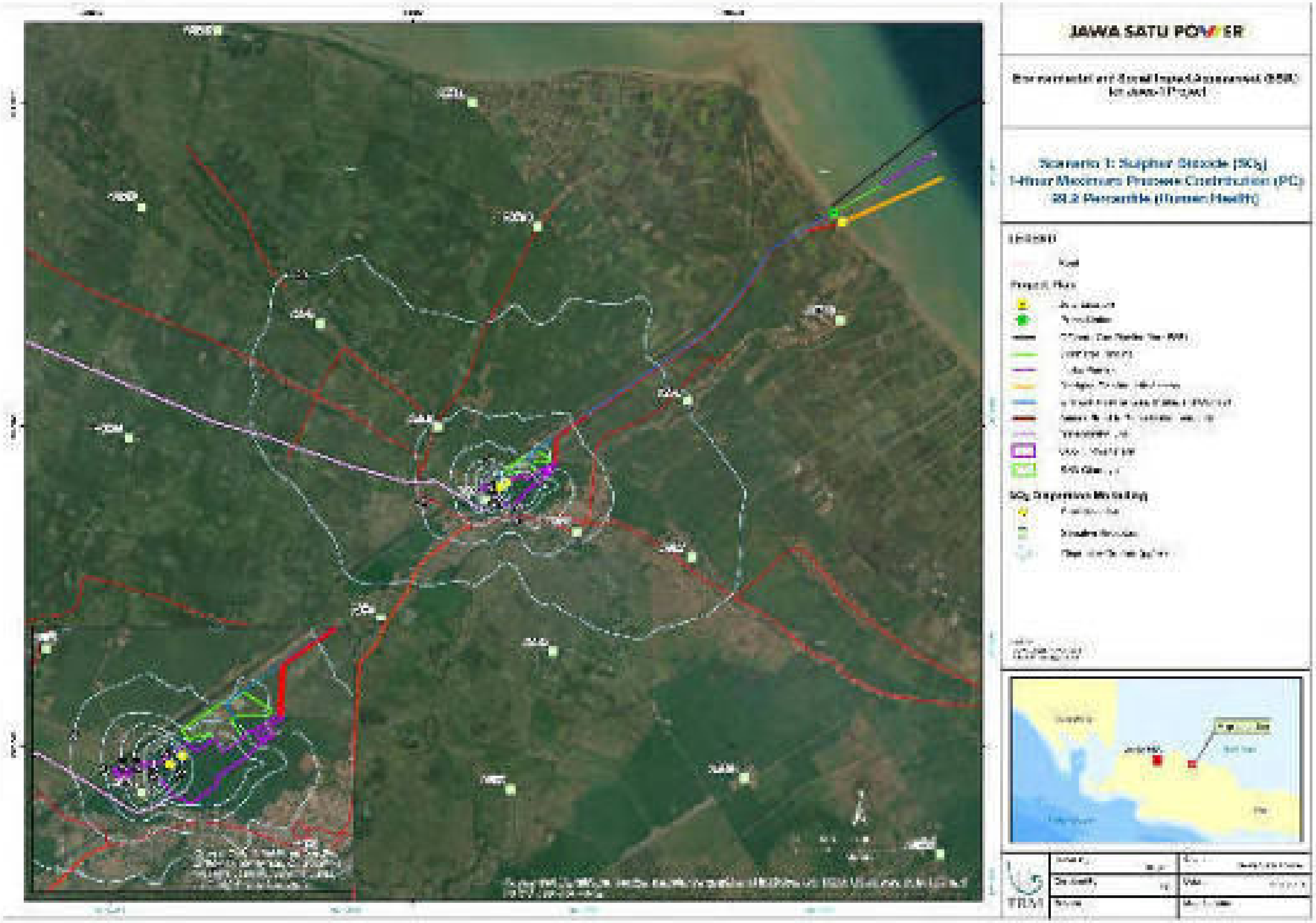


Figure 10-4 Scenario 2: Nitrogen Dioxide (NO_2) 1-Hour Maximum Process Contribution (PC) – 99.9 percentile (Human Health)

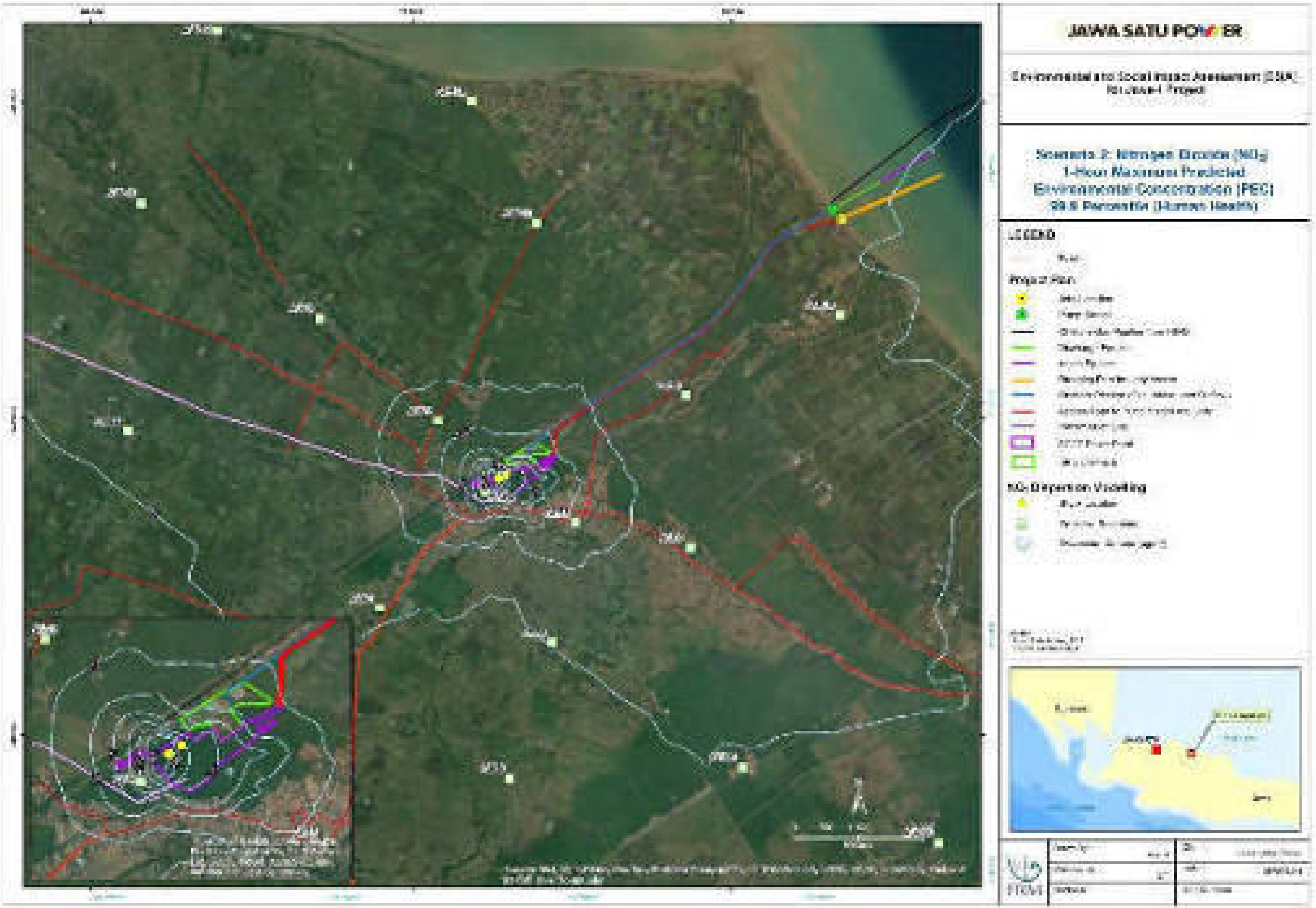


Figure 10-5 Scenario 2: Nitrogen Dioxide (NO_2) 1-Hour Maximum Predicted Environmental Concentration (PEC) – 99.9 percentile (Human Health)

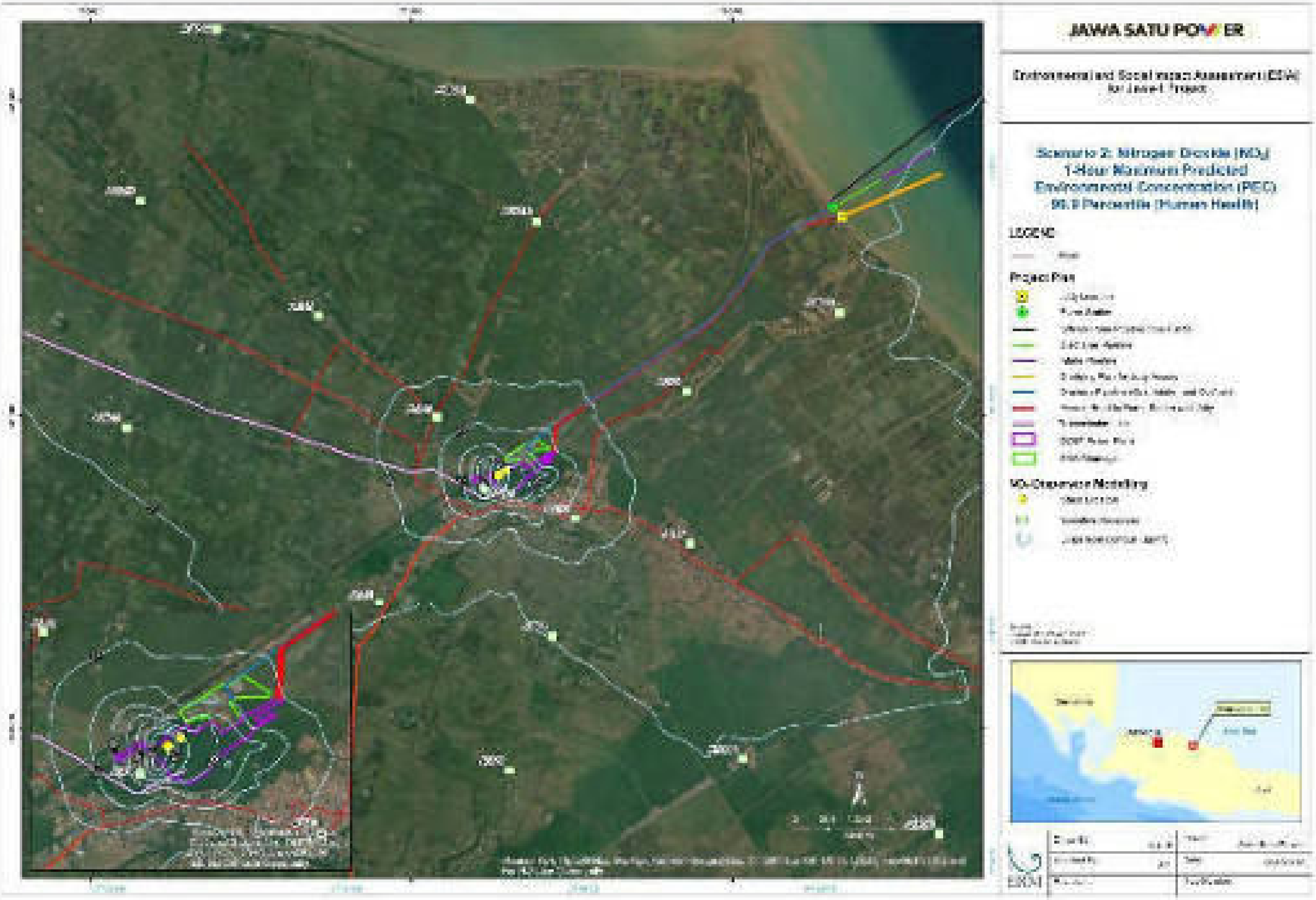
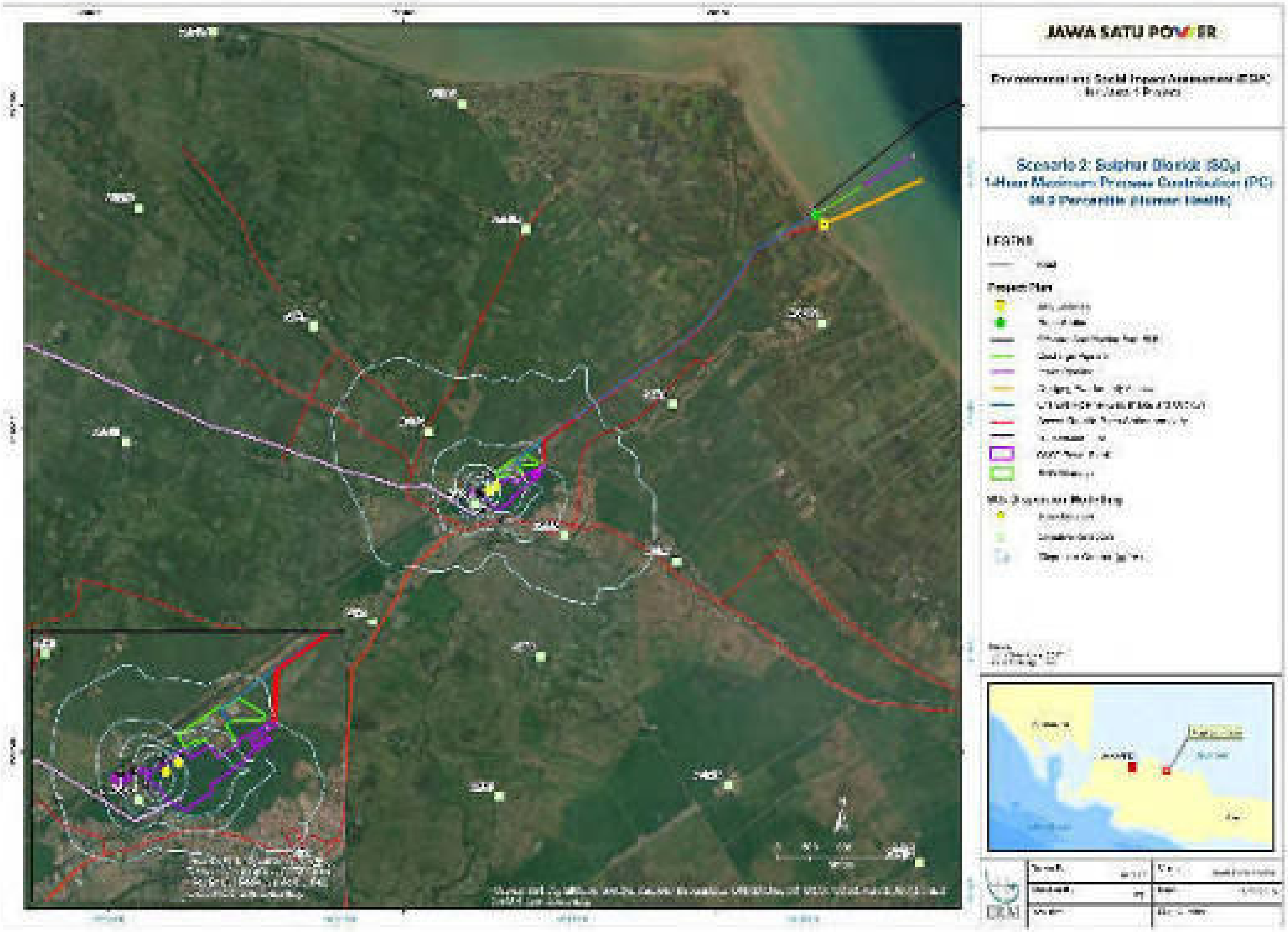


Figure 10-6 Scenario 2: Sulphur Dioxide (SO_2) 1-Hour Maximum Process Contribution (PC) – 99.9 percentile (Human Health)



The risk significance from the operation of diesel engine generators is ranked as **Minor** at worst.

Table 10-10 Assessment of Impact on Air Quality due to Emissions to Air from Diesel Engine Generators

Risk Significance Rating				
Likelihood		**Low**	Medium	High
Consequence	Small	Minor	Minor	Moderate
	Medium	**Minor**	Moderate	Major
	Large	Moderate	Major	Major

10.9.3 *Mitigation Measures, Management and Monitoring*

The proposed management and mitigation measures to minimise impacts on ambient air quality resulting from the use of diesel engine generators are as follows:

- The simultaneous operation of all twelve diesel engine-generators will only occur when required and for the amount of time necessary to black start the power plant. The operator will endeavour to reduce this time period as much as is feasible to minimise impacts on ambient air quality;
- All engine-generators will be routinely checked and maintained in accordance with the manufactures specifications. This routine maintenance will ensure that the operational performance of the engine-generator is maintained at a high level throughout the operational lifetime of the Project;
- Diesel fuel with a maximum sulphur content of 0.5% will be used at all times.

10.9.4 *Significance of Residual Impact*

In view of the implementation of mitigation and management measures, the residual impact significance remains **Minor**.

10.10 *DROPPED OBJECTS*

10.10.1 *Assessment of Impact*

Materials and supplies during operation will be transported by supply vessels in the offshore environment. Similar to the onshore environment, any construction activities and transfer operations there is the risk of objects being dropped.

In the marine environment similarly to the construction phase should materials lost at sea be inert, there will be little risk to the environment.

However, drums/containers of chemicals, fuel, oil or other environmentally hazardous materials pose a potential pollution hazard unless they can be recovered undamaged. This has the potential to impact the seabed, benthic communities, other marine life and users of the marine environment such as fishermen and other local recreational users.

In the case of large structures lost to sea such as during the deployment of pipelines, the risk to the marine environment would primarily be the potential of collision with vessels working within the area/ disrupting fishing activities. Equipment or structure impacting the seabed would have a direct impact to corals, where present.

10.10.2 *Impact Evaluation and Significance*

Based on current understanding of the Project it is expected that the likelihood of objects being dropped during construction and operation will be **High**.

As outlined above the sensitivity of the environment will vary across the Project area. Considering the likelihood of an event occurring, the consequence for dropped objects is considered as **Minor** based on the likelihood outlined above and the fact that the extent and duration of any impacts will generally be small.

From the above information, the overall impacts have been assessed to be of **Moderate** Significance.

Table 10-11 Dropped Objects Impact Significance

Risk Significance Rating				
Likelihood		**Low**	**Medium**	**High**
Consequence	**Small**	Minor	Minor	**Moderate**
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

10.10.3 *Mitigation Measures, Management and Monitoring*

The proposed measures to prevent and respond to dropped objects are:

- Develop Standard Operating Procedures and Permit to Work Systems;
- Restrict the lifting path to avoid critical/ sensitive equipment;
- Lift loads within the maximum lifting capacity of crane systems only; and

- Recover (wherever practicable) objects which are accidentally dropped into the sea.

10.10.4 *Significance of Residual Impact*

The residual impact significance of dropped objects is assessed to be **Minor**.

10.11 NATURAL HAZARDS

10.11.1 *Potential Impacts*

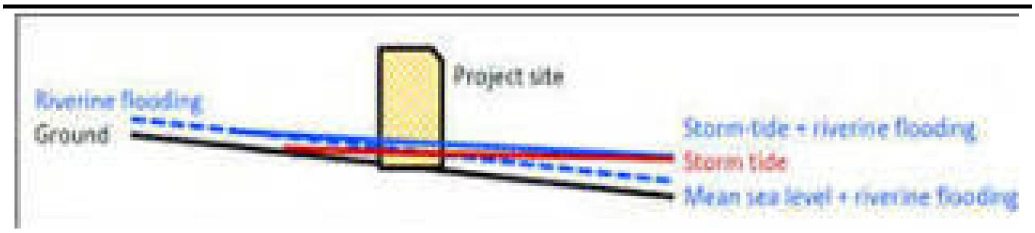
Of the natural hazards known to occur in Indonesia earthquakes and tsunamis have been scoped out based on the project location (in a low seismicity area where no tsunamis have been recorded over the past 20 years). However the area is prone to flooding during the wet seasons and heavy rains. As such the Cilamaya Flood Study conducted by Pöyry Energy GmbH did not take into account a scenario of tsunami. Although it did include a phenomenon of storm surge which is similar but varies in magnitude (tsunamis are 10 m or more) and causes. Per the report results, post flood mitigation measures , the site and neighbouring areas should not face any additional inundation (due to the project) when compared to the baseline scenario. The Project has based assumptions on historical secondary data sources such as the National Board for Disaster Management which categorises the Site to have low risk from tsunamis and hence flood impacts were not considered significant.

The Project site is situated between the Cilamaya Main River and Cilamaya Irrigation Canal. Due to location it is vulnerable to flooding due to:

- Riverine flooding – inland flooding;
- Extreme storm-tidal conditions along with sea level rise – coastal flooding; and
- Combination of both inland and coastal flooding.

The three (3) schematic flood scenarios are shown in **Figure 10-7**.

Figure 10-7 Schematic of Flood Scenarios



The Project area experienced a number of major floods over the last few years. The Project area and its vicinity were flooded on March 17, 2014. It was reported that this flooding event was not caused due to extreme basin-wide rainfall-runoff analysis but by the waterways being jammed by debris and so, inadequate drainage due to blockage. In addition, long time Cilamaya residents reported flooding inundation from Cilamaya River on January 18, 2013. This was caused due to extreme rainfall and associated runoff in the Cilamaya River basin.

10.11.2 *Assessment and Approach*

ERM referred to the flood risk assessment report titled 'Cilamaya Flood Report' completed by Pöyry Energy GmbH December 2017 for the proposed Cilamaya Combined Cycle Gas Power Plant in West Java, Indonesia. The objective of the study was to determine 100-year flood water levels for the design of the flood dike around the proposed Project area. The approach comprised of hydrological analyses that included flow regionalisation approaches and rainfall-runoff modelling which were used to compute 100-year flood hydrographs for the Irrigation Canal (729 m^3/sec – peak flow) and the Cilamaya River (600 m^3/sec – peak flow).

Prior to the study, it was not clear if the main flood risk to the Project area originates from Cilamaya Irrigation Canal or from Cilamaya Main River. In addition, tidal storm surges may significantly influence the flood situation in combination with backwater effects.

In the study area, several other larger and smaller irrigation canals are operated. Their discharge capacities seem to be limited in terms of cross-sections and by structures as bridges and inverted syphons. Thus, these other canals were not considered as relevant factors of flood risk to the Project area and were not studied in detail. Hence, major focus of the study is to evaluate the riverine flood risk associated with Cilamaya Main River and Cilamaya Irrigation Canal at Projects area, and tidal flood risk associated with tides, storm surge and sea level rise impact at the Project area.

Hydrologic Analysis

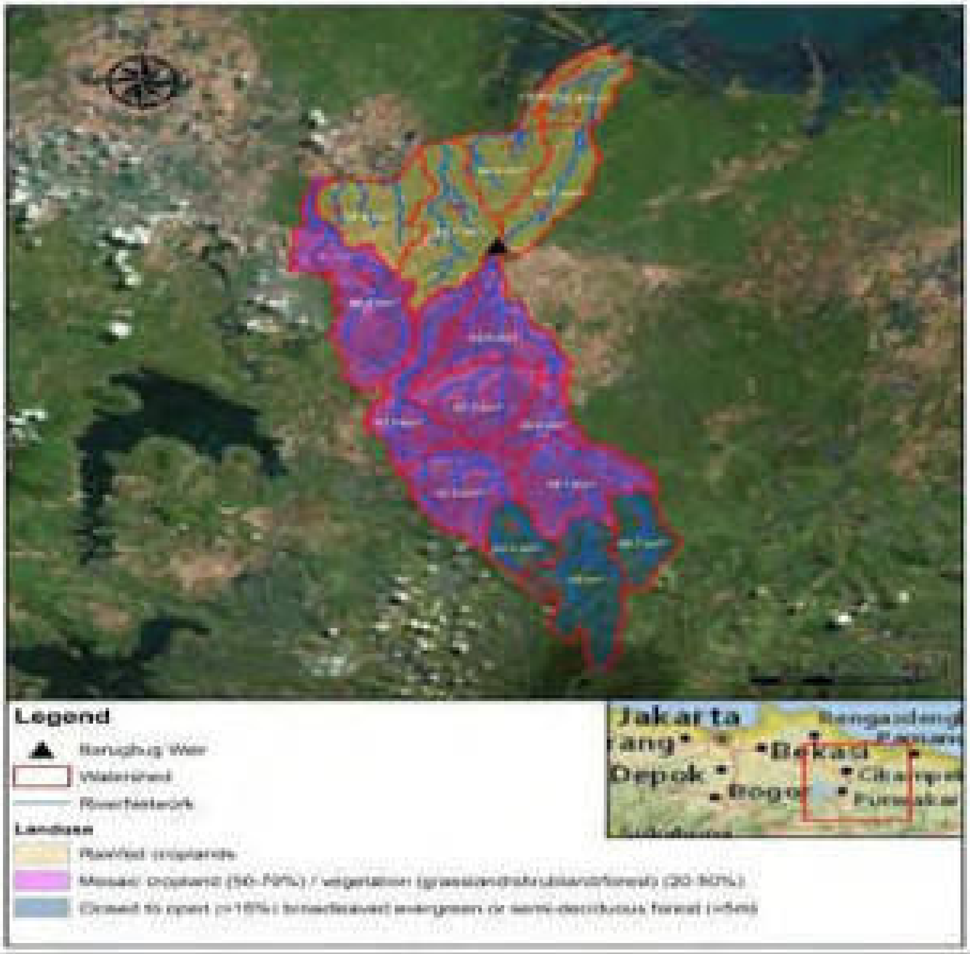
A 2D-hydraulic model was built from LiDAR-based Digital Terrain Model (DTM), cross-sectional surveys and sea bed elevations, after ground-truthing and modifying some of the input-data. In order to account for the uncertainties in the data input, a set of conservative model assumptions were made.

Model simulation was run for Project state (site area was excluded from active discharge domain), to understand the changes in flow direction due to the flood dike. The objective of the study was to determine 100-year flood water levels for the design of the flood dike around the proposed Cilamaya Combined Cycle Gas Power Plant. For that purpose, hydrological analyses were carried out using rainfall–runoff modelling in order to obtain the 100-year design flood hydrograph.

This hydrologic analysis was supported with flood regionalisation approaches. Details of hydrologic analysis are summarised below in subsequent sections. Hydrologic analysis needs catchment delineation of the Cilamaya River and the Cilamaya Irrigation Canal, which contributes flow at Project area. Catchment and sub catchment/sub basins were delineated using a Digital Elevation Model (DEM) in GIS.

Figure 10-8 presents the catchment of the Project area and gives an overview of the determined sub-basins. Major land uses and area values of each sub basin are highlighted.

Figure 10-8 Project Catchment Area



Rainfall-Runoff Modelling

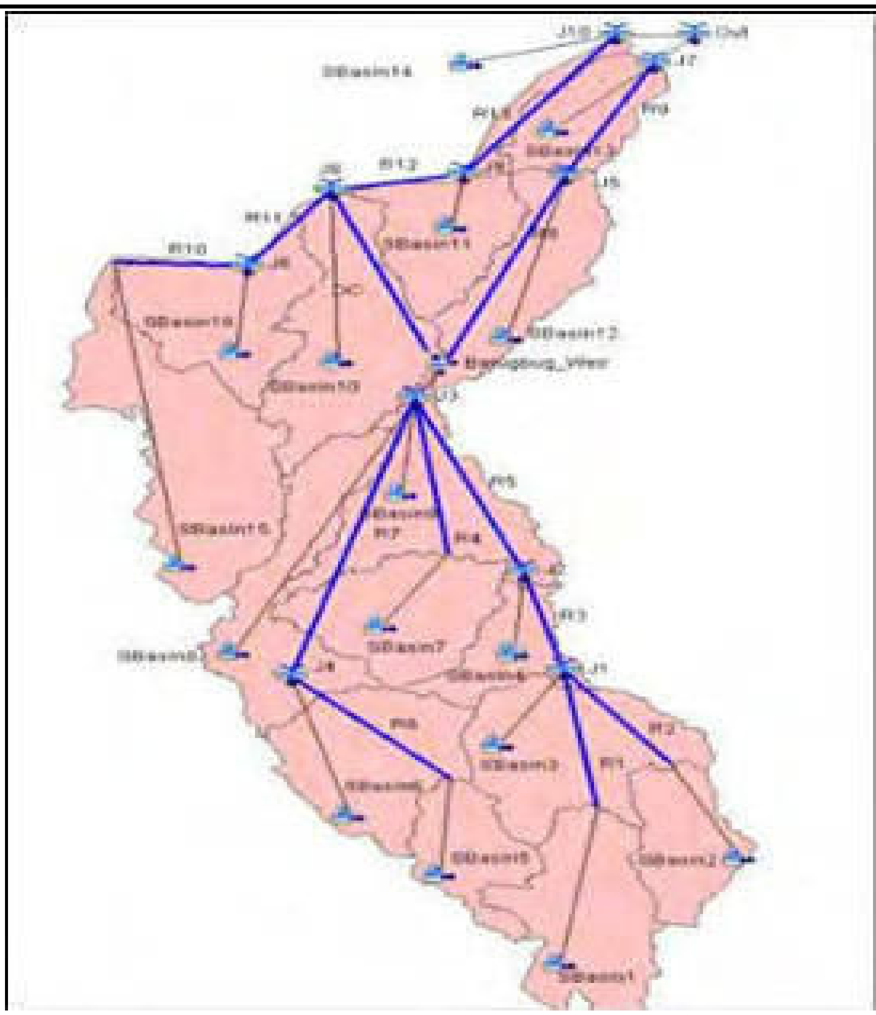
Hydrologic Modelling System (HEC-HMS) software by USACE-HEC was used to obtain the design flood hydrograph at Project area. HEC-HMS is designed to simulate the complete hydrologic processes of event-based scenarios.

The software includes many traditional hydrologic analysis procedures such as event infiltration, unit hydrographs, and hydrologic routing. This study used Soil Conservation Service (SCS; presently known as USDA Natural Resources Conservation Service) based hydrologic analysis procedure.

Figure 10-9 shows the setup of the HEC-HMS[1] model. It consists of a basin model (catchment) and a meteorological model (precipitation). The basin model converts atmospheric conditions (precipitation) into streamflow at the sub-basin outlets.

These outlets are connected by river reaches which account for flood routing. The basin model consists of sub-basins (SBasin), river reaches (R), junctions (J) and the diversion at Barugbug weir. Barugbug weir is located approximately 20 km upstream the Project area and it consists of two spillways for diverting floods into the Cilamaya main river (J7) and via the Ciherang River into the Cilamaya Irrigation Canal (J10).

Figure 10-9 Overview of the HEC-HMS Model



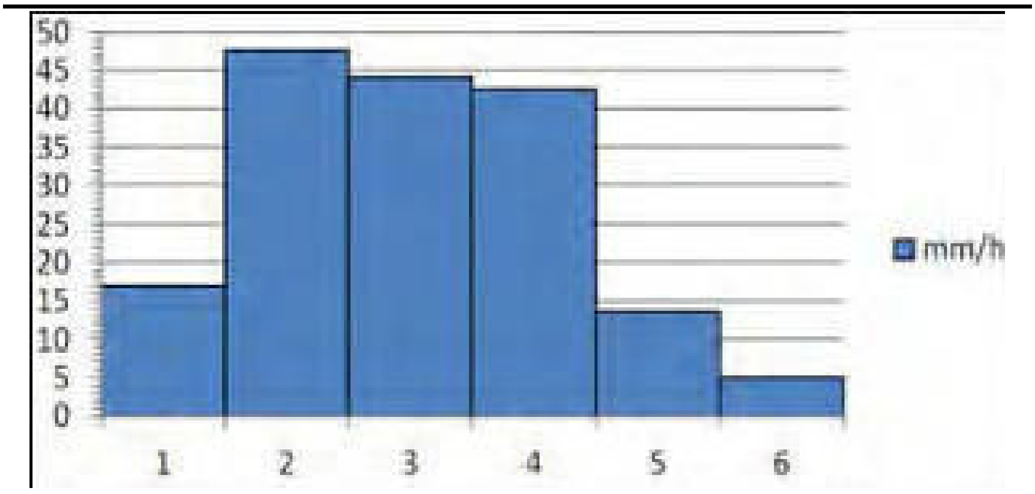
[1] The Hydrologic Modeling System (HEC-HMS) is designed to simulate the precipitation-runoff processes of dendritic drainage watershed basins. HEC-HMS is a product of the Hydrologic Engineering Center within the U.S. Army Corps of Engineers.

Design storm rainfall input for the HMS meteorological model was obtained by a combination of 100-year point precipitation estimate, areal reduction, and consideration of IDF curves, critical storm duration and temporal storm pattern.

Design storm hyetograph with a total accumulative precipitation of 170 mm was given as input to the HMS model and shown below in **Figure 10-10**.

The rainfall-runoff HMS model was roughly evaluated with flood data from January 18, 2013 before estimating the 100 year design flood in the Project area. Limited rainfall and spillway data documented in the Barugbug weir's operator notebook was used to evaluate the model.

Figure 10-10 100 Year Design Storm Hyetograph Input

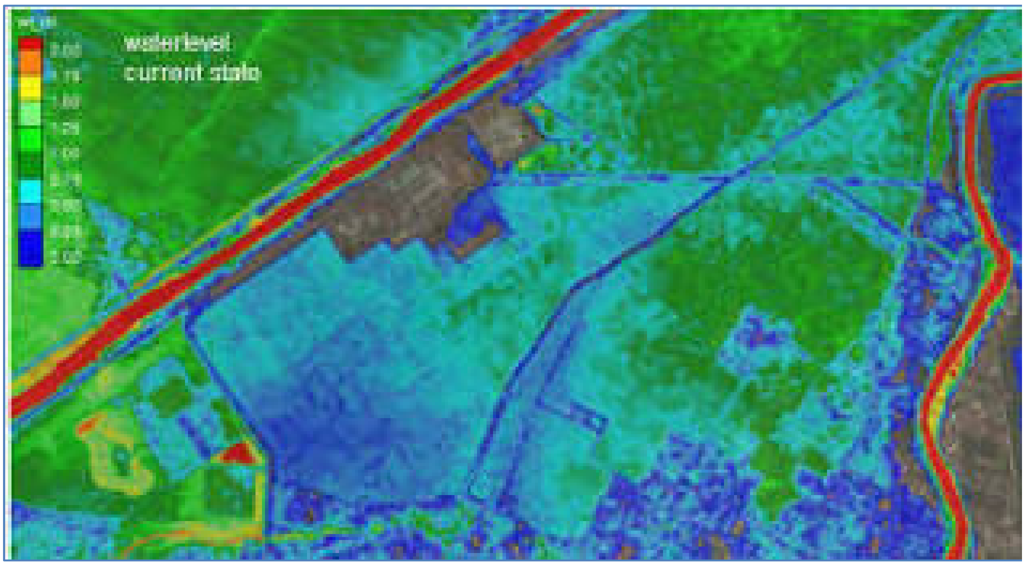


10.11.3 Assessment of Impacts

The flood report (*Pöyry, 2016a*) focused on dike design around the periphery of site area based on 100-year return period water level. This 100-year return period water level risk was quantified by hydraulic model development with Project state scenario i.e. site area within the flood dike was excluded from the modelling domain. The presented 100-year flood scenarios for the current state and the project state were established from hydrological rainfall-runoff modelling resulting in discharge hydrographs followed by hydrodynamic modelling resulting in flood depths, water levels and flow velocities[1].

[1] Methodology, data and details: Pöyry's Cilamaya Flood Study. Final Report, July 2016

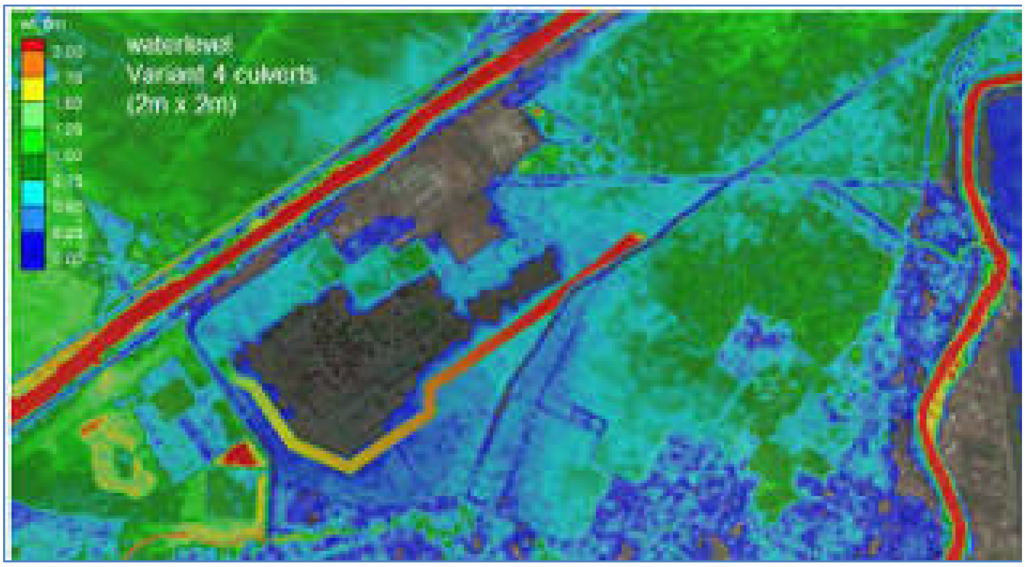
Figure 10-11 Simulated 100-yr flood depths in m for Current State



The current state model analysis (without the project implemented) shows large inundated areas including residential zones south of the project site as well as areas in the north.

The project state model analysis reveals flooded areas similar to the current state.

Figure 10-12 Modelled Flood Inundation at CCGT Power Plant



The overall project-induced changes in terms of maximum depths at a 100-yr flood scenario are presented in **Figure 10.13**. Areas with reduced flood depth include among other residential zones south of the site. Areas with higher flood depth cover the swale itself (the swale's purpose is to bypass floods around the site and by that alleviate flooding) and areas north of the site which are mostly flooded in the current state up to approximately 0.5 m depth or more.

Figure 10-13 Project-Induced Overall Changes in Maximum Depths (in m.)

Note: Semi-transparent: No change (+/- 1 cm). Reduction in green, increased depths in blue.

10.11.4 Flood Impacts due to Project

Impacts due to the Project-induced changes to the maximum water level flooding in the vicinity of the site area was quantified by another hydraulic model development with current state scenario i.e. site area was included in the modelling domain, and comparing it with Project state scenario.

Table 10-12 Severe Flood Impact Significance

Risk Significance Rating				
Likelihood		**Low**	**Medium**	**High**
	Small	Minor	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

10.11.5 Mitigation, Measures, Management and Monitoring

In order to prevent inundation on Project area and to avoid the Project impact, the following mitigation recommendations were made:

- A flood dike with height varying from 5.5 to 4.2 m above MSL will be constructed to avoid the site area getting inundated;
- A 25 m trapezoidal drainage canal/swale system around the flood dike is planned to compensate for increased water level in the vicinity of the site due to Project. Such drainage system should compensate for blocked flow paths due to dike, and the effect of the proposed swale is to intercept floodwaters along the flood dike and convey them downstream; and

- Four (4) two (2) m x two (2) m concrete box culverts under the access road will be constructed.

In addition, following general measures are being suggested to avoid the flood impact during construction phase. Typically, these measures are likely to be the same for operational phase:

- There is high probability of natural drainage system being blocked by debris associated with construction activities. It is important to mention that there is an existing small drainage canal runs along the periphery of site boundary in the direction of SW to NE. It is recommended to avoid the canal clogging with debris/grasses otherwise this can lead to flooding the site and its vicinity area, associated with back flow;

- The Project will implement a comprehensive storm water drainage plan to drain the flow from site area. The final design is still underway;

- Emergency pump / generator set up is recommended to install at site area to discharge the flood water to nearby stream/canal in case of extreme flooding event;

- It is recommended to clean natural stream/canals for adequate drainage near to site area before arrival of normal monsoon; and

- It is recommended to keep critical equipment at high-elevated area within the site premises to avoid any damage associated with water logging.

10.11.6 Significance of Residual Impact

Based on the final hydraulic model simulation and the mitigations proposed the residual impact is assessed as **Minor**.

Table 10-13 Summary of Unplanned / Non-Routine Impacts

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
Accidental spill of hazardous material onshore	Soil Groundwater	Deterioration of groundwater quality.	**Moderate**	• Hazardous materials storage areas will be sited on sealed areas and provided with locks to prevent unauthorised entry; • Secondary containment to accommodate 110% of the largest volume of material, with appropriate drainage connection and/or provision for removal of spilled liquids, will be provided around places of fuel and hazardous materials storage such as oil filled transformers, oil pumps and tanks, generators, chemical storage houses etc. to contain any hazardous spills and to exclude surface water run-off from entering the contained area; and • All hazardous materials will be segregated and stored according to their material safety data sheet (MSDS), and will be disposed in an appropriate manner.	**Minor**
Accidental spill of hazardous material onshore	Soil Groundwater	Deterioration of groundwater quality.	**Moderate**	• All vehicles are to be equipped with spill control kits to contain and clean small spills and leaks; • Vehicle servicing areas, vehicle wash bays and lubrication bays will, as far as practical, be located within roofed and cemented areas. The drainage in these covered areas will be connected to sewers via an oil/water interceptor; • Any refuelling activities will only take place within a designated area of hard standing with spill kits present; • All mobile equipment is to be equipped with spill or drip trays to contain spills and leaks of hazardous materials i.e. chemicals, hydrocarbon oils; and • Equipment and vehicle maintenance scheduling is to be undertaken such that they are continually monitored for potential or actual leaks.	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
Accidental spill of hazardous material onshore	Soil Groundwater	Deterioration of groundwater quality.	**Moderate**	• A training program will be implemented to familiarise staff with measures to be taken to prevent spills and leaks, and for emergency procedures and practices related to contamination events; • Mitigation measures/ monitoring programme with regard to accidental events/ spills shall be communicated to the EPC Contractor at the commencement of the Project implementation; • For any spills or leaks, once the initial emergency response has been implemented, an appropriate mean up and monitoring plan is to be developed. This is to take into account the type of spill and its extent. It is also to include provisions for monitoring of soil, surface water and groundwater quality to track potential or actual migration of the contamination through the soil and groundwater profiles; and • Develop a SEP that includes neighbouring countries and impacted communities to ensure that impacts arising from spills are managed effectively.	**Minor**
Accidental spill of hydrocarbon or chemicals offshore	Marine biodiversity	Pollution and contamination of the marine environment, and secondary toxicity and physical effects on marine fauna	**Moderate**	• Vessels will have Shipboard Oil Pollution Emergency Plan (SOPEP) and spill kits on vessels; • Chemicals and lubricants to be stored as per SDS and in bunded area; • Vessel will be of suitable standard and build quality; • Vessels will maintain visual, radio and radar watch at all times, and will implement lighting, shapes and practices in accordance with COLREGS; and • A Marine Oil Spill Contingency Plan will be developed and personnel trained in its implementation.	**Minor**
Accidental spill of vessel wastes offshore	Marine biodiversity	Pollution and contamination of the marine environment, and secondary toxicity	**Minor**	• Implementation of a Waste Management Plan; • Bins available for the segregation of waste in accordance with the vessel Waste Management Plan, and bins are fitted with lids/cargo nets for	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
		and physical effects on marine fauna		waste with potential to be wind-blown (e.g. paper, cardboard); and • Solid hazardous and non-hazardous wastes generated will be either incinerated or appropriately disposed of at a licensed onshore facility in accordance with the Waste Management Plan.	
Natural Hazards: Flooding	Cilamaya households residing around the power plant	During heavy rainy seasons areas around the site are prone to flooding. The presence of the site may increase this	**Moderate**	• A flood dike with height varying from 5.5 to 4.2 m above MSL will be constructed to avoid the site area getting inundated; • A 25 m trapezoidal drainage canal/swale system around the flood dike will be constructed to compensate for increased water levels near the site due to Project. • Four (4) two (2) m x two (2) m concrete box culverts under the access road will be constructed. • Ensure the proximity canal flows with no clogging due to debris/grasses to avoid flooding of the site and its vicinity area; • Implement a comprehensive storm water drainage plan to drain the flow from site area. • Emergency pump / generator set up will be installed at site area to discharge the flood water to nearby stream/canal in case of extreme flooding event. • It is recommended to clean natural stream/canal for adequate drainage near to site area before arrival of normal monsoon.	
Air quality impacts from diesel generators	Communities residing around the power plant in Cilamaya	The Project's black start diesel powered engine-generators' emissions to air from the generators can result in elevated ambient	**Minor**	• The simultaneous operation of all twelve diesel engine-generators will only occur when required and for the amount of time necessary to black start the power plant. The operator will endeavour to reduce this time period as much as is feasible to minimise impacts on ambient air quality; • All engine-generators will be routinely checked and maintained in accordance with the manufactures specifications. This routine maintenance will ensure	**Minor**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
		concentrations of NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$ and subsequent short term impacts on ambient air quality.		that the operational performance of the engine-generator is maintained at a high level throughout the operational lifetime of the Project; • Diesel fuel with a maximum sulphur content of 5ppm will be used at all times.	
Dropped object	Marine biodiversity	Physical impact, potential contamination if hazardous and not recovered	**Moderate**	• Develop Standard Operating Procedures and Permit to Work Systems; • Restrict the lifting path to avoid critical/ sensitive equipment; • Lift loads within the maximum lifting capacity of crane systems only; and • Recover (wherever practicable) objects which are accidentally dropped into the sea.	**Minor**
Vehicle accident	Community Health & Safety	Injury or mortality of community member(s); and • Release of hazardous material	**Major**	• Project ERP to incorporate Project vehicle activities; • Develop and implement a traffic management plan. This should detail access routes, quality of existing roads, measures that will be implemented to minimise the risks associated with transporting materials and workers to and from site, including factors such as fatigue management and ensuring all employees observe recommended speed limits; • Bus workers between the accommodation camp and the Project area. This will reduce the amount of traffic generated by the Project; • Ensure all employees complete training prior to driving any Project vehicle. The content of the training should be tailored to the employee's role; • Explore opportunities to work with local stakeholders to increase awareness within local villages about the hazards associated with traffic; • Develop, communicate and implement Journey Management Plans for heavy equipment, construction and transport vehicles and worker buses; and	**Moderate**

Activity/Aspect	Receptor	Potential Impacts	Impact Evaluation Significance (Pre-Mitigation)	Mitigation	Residual Impact
				• Undertake stakeholder engagement with the local community for both traffic road user groups and stakeholders living at settlements adjacent to traffic roads used during construction including updating and inform the community in the Traffic Management Plan.	
Vessel incident	Fishing/shipping	Injury or mortality of community member(s)	**Moderate**	• Undertake stakeholder engagement with marine environment users including the fishing community and other users. This include inform location of exclusion zones and better organisation of general vessel movements; • Vessels to meet MARPOL requirements including developing a SOPEP; • Implement Adverse Weather Working Standard; • Mark the presence of construction areas with appropriate lighting to reduce the risk of collision with other marine users; • Prepare a Collision Risk Management Plan; and • Use of Automatic Radar Plotting Aid (ARPA), Radar Early Warning System (REWS) and Vessel Traffic Surveillance System (VTS) where applicable to all contracted vessels.	**Minor**

11 *CUMULATIVE IMPACT ASSESSMENT*

11.1 *OVERVIEW*

The cumulative impact assessment (CIA) for the Project is undertaken in accordance with the IFC Performance Standards, the IFC's Good Practice Handbook: Cumulative Impact Assessment and Management Guidance for Private Sector in Emerging Markets (the "IFC Handbook") and ADB's Safeguards Policy Statement 2009.

Cumulative impacts are generally considered as those, which are additive or interactive in nature that arises as a result of an impact from the Project interacting with an impact from another activity to create an intensified impact:

"*…result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted. Cumulative impacts are limited to those impacts generally recognised as important on the basis of scientific concerns and/or concerns from Affected Communities*" (*IFC, 2017*).

IFC PS 1 requires that an environmental assessment should also address cumulative impacts. The objective of the cumulative impact assessment is to identify those environmental, social or health aspects that may not be on their own constitute a significant impact but when combined with impacts from past, present or reasonably foreseeable future Project activities or other projects/activities may result in a larger and more significance impact.

In order to gain an understanding of the Project's overall contribution to impacts within the AoI a CIA is required. Whilst total cumulative impacts due to multiple projects within a given area should be identified within government led spatial planning efforts (generally as part of a Strategic Environmental Assessment), the Sponsor needs to determine the degree to which it is contributing to these overall cumulative impacts on Valued Environmental and Social Components (VEC). In this regards, the objectives of the CIA are:

- Use the outcomes of the preceding chapters of this ESIA to determine spatial and temporal boundaries, identify VEC's and all development and external natural and social stressors affecting them;

- Recognise and identify how the Project, along with other existing and future projects may contribute to cumulative impacts on the predicted future condition of the identified VEC's; and

- Develop measures to ensure these are avoided and/or minimised to the greatest extent possible.

To achieve these objectives and gain a better understanding of the cumulative impacts, this Chapter presents the cumulative assessment that has been undertaken largely in accordance with the *IFC's Good Practice Handbook: Cumulative Impact Assessment and Management Guidance for Private Sector in Emerging Markets* (the "IFC Handbook"). This has been supplemented by further guidance such as:

- The European Union's "Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions" (1999);
- The Canadian Environmental Assessment Agency's "*Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act*" (2012);
- The USA NEPA Council on Environmental Quality's "*Considering Cumulative Effects under the National Environmental Policy Act*" (1997); and
- ADB's Environmental Assessment Guidelines (2003).

It is important to recognise that the Project has limited capacity to influence the environmental and social performance of external facilities (other than the SKG Cilamaya Gas Compression plant) and also has limited access to the relevant environmental and community information required to undertaken a detailed CIA.

11.2 ASSESSMENT APPROACH AND CRITERIA

The CIA has been undertaken following the subsequent eight-step process outlined in **Figure 11.1**.

The CIA forms part of the overall ESIA, the general conditions and trends of the VEC's have previously been identified (established during the environmental and social baseline condition assessments in **Chapter 7**), as are the impacts from the Project (outlined in **Chapter 8** and **Chapter 9**) and the proposed mitigation, management and monitoring measures (set out in **Chapter 12**).

Given this, VEC's and impacts have been easily established, with an emphasis placed on the steps pertaining to the CIA and impacts management.

Emphasis in developing the methodology for this CIA been placed upon following a largely qualitative approach, allowing for identification of general trends and developing appropriate management, mitigation and monitoring measures.

This is primarily due to the lack of accurate and specific data on surrounding projects. Given this approach, the majority of the methodology relies upon the use of professional judgements, complimented by ERM's understanding of the

Project, experience with similar projects in similar settings, and the elements of the ESIA.

The eight step process is based on the IFC CIA six stage approach as set out in **Figure 11-1**.

- **Steps 1, 2 and 3**: Key activities include identifying VECs, identifying the temporal and spatial boundaries of the CIA and identifying sources of cumulative impacts.

- **Steps 4 and 5**: Define the level of detailed assessment, VECs, their spatial and temporal extent, the potential impacts on them, existing condition, sensitivity to change, resilience/recovery time, existing stressors and trend in condition. This information is taken directly from the ESIA.

- **Steps 6 and 7**: Assessment of the contribution of the Project to the predicted cumulative impacts arising from interactions between the sources of cumulative impact and the VECs. Evaluation of the significance of predicted cumulative impacts to the viability/sustainability of the affected VECs.

- **Step 8**: Design and implementation of mitigation measures additional to those already identified in the ESMP (**Chapter 12**) required to manage the Project's contribution to the predicted cumulative impacts. This includes not only management of impacts where the Project has control but also consultation and liaison with third parties where impacts are outside of the Project's direct control.

11.2.1 Determine Spatial and Temporal Boundaries and VEC

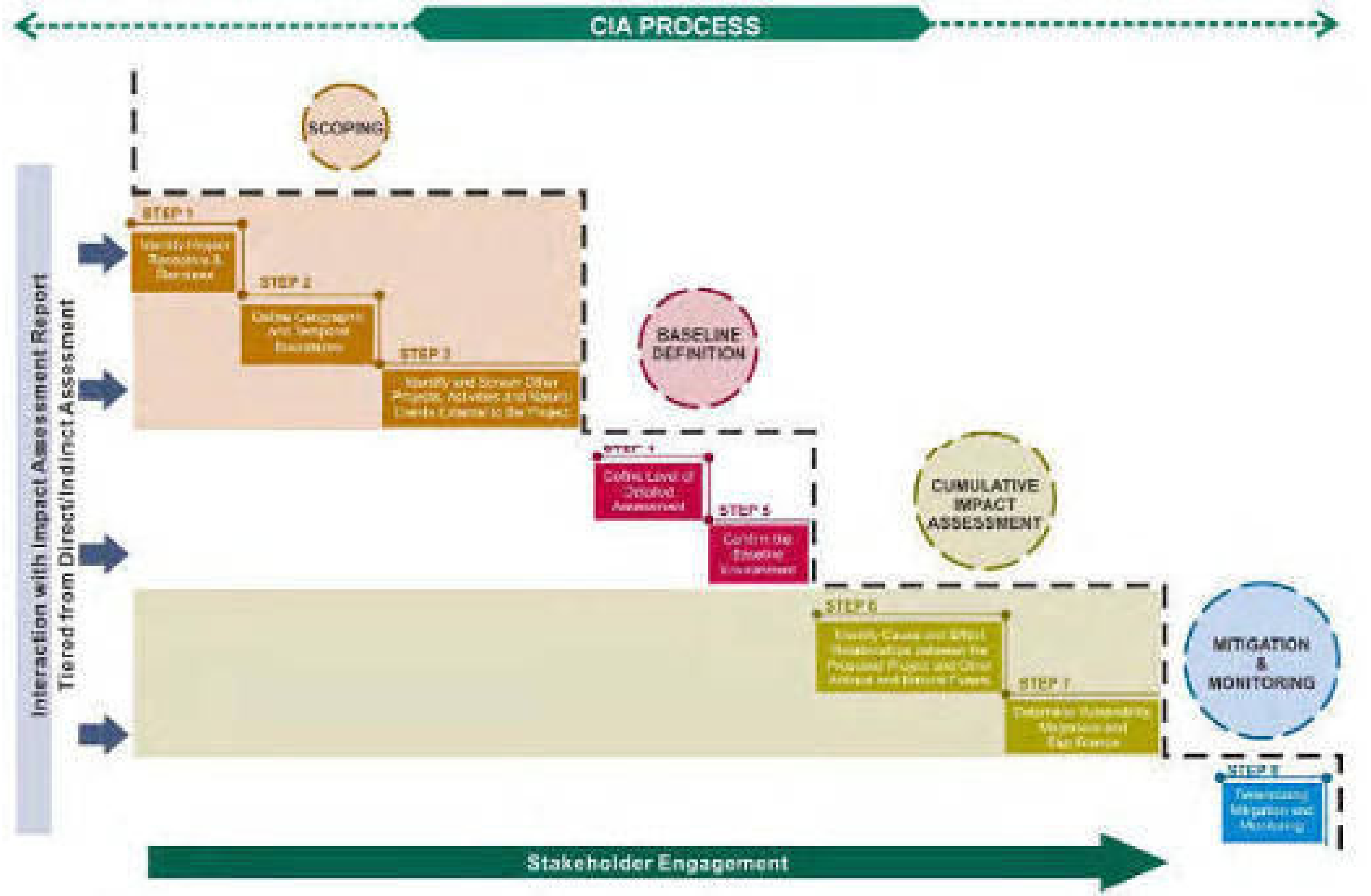
The methodology used in the setting of the spatial and temporal boundaries is largely qualitative and based upon the general "rules of thumb" suggested in the IFC's Handbook. The following factors have been set within the methodology:

- Temporal boundaries have been set based on a desktop review of available information pertaining to other proposed Projects within the area;

- ERM's understanding of the projects currently within and proposed to be developed within the local area; and

- Geographic boundaries are a composite of the location of the identified VEC assessed impacts of the Project and the degree to which they may overlap with other external projects and stressors to impact upon an identified VEC.

Figure 11-1 General RCIA Methodology



11.2.2 *Identify VECs and their Present Conditions*

The identification of VEC is largely drawn from work previously undertaken, supplemented by stakeholder engagement. VECs are defined as:

- Those defined as sensitive receptors within the ESIA such as the school located in close proximity to the power plant and main transportation route (a sensitive receptor for the purposes of air quality modelling);
- Any particular resource or ecosystem service identified as being utilised by sensitive receptors such as fishermen reliant on the rounds in the vicinity of the offshore pipelines and FSRU; and
- Those identified as part of stakeholder engagement, regardless of whether or not they meet either of the above definitions.

11.2.3 *Identify all Developments, External and Social Stressors Affecting the VECs*

External developments, also known as reasonably foreseeable future actions (RFFA), are identified utilising knowledge gained through the ESIA, stakeholder engagement and the interpretation of readily available external data.

The outcomes of these considerations will be a simple binomial decision, i.e. yes the Project is likely and therefore will be included within the CIA, or no, it is unlikely and therefore will not be included within the CIA.

The second step is to determine the extent of the various impacts of these projects. This allows a decision to be made as to whether there is the potential for an overlap in Project impacts that could lead to a measurable cumulative impact. Key to this are the following elements:

- Identification of appropriate geographical/spatial boundaries, where potentially interacting projects are not located close enough, or sufficiently linked through various ecological and social processes, for relevant impacts to overlap, cumulative impacts are less likely;
- Identification of temporal boundaries, where the schedules of various components of projects do not overlap in time, particularly with regards to the construction phase of large projects, cumulative impacts are less likely. Additionally, where projects are short term, cumulative impacts will generally be of a limited duration;
- Consideration of impact type. Whilst there may be no direct geographical overlap in project boundaries, there is the possibility that their offsite impacts may directly overlap elsewhere and cause offsite cumulative impacts. Examples are discharges into the river and offshore air pollutant emissions, and social impacts associated with overall migration influx;

- Determination of any aggravating factors that may be evident within a particular project identified for inclusion within the CIA. This includes elements such as the size of the project, environmental management performance, and the regulatory regime under which it operates; and

- Identification of potential externalities, that is the Project's ability to influence (either positively or negatively) the behaviours of other operations in the area. (This may be possible with SKG Cilamaya gas compressor plant).

External natural and social stressors unrelated to a single project or source are not considered as this are assumed to be captured as part of the current Project baseline conditions (**Chapter 7**) and the impact assessment (**Chapter 8** and **Chapter 9**).

11.2.4 Identification and Assessment of Impacts

A largely qualitative approach was adopted to enable the focus on identification of trends across the various projects in the area, their temporal and spatial interactions and how these are likely to impact upon VEC.

Whilst impacts arising from the Project have been defined and assessed in isolation, it can be difficult to accurately quantify cumulative impacts as there can be a high degree of uncertainty in interactions with other projects and activities that may be occurring in the area as well as a lack of confirmed project information.

Therefore, the impacts are to be assessed qualitatively based on the identified trends and grouped according to impact type, rather than VEC, in accordance with the overall methodology adopted for the ESIA. The CIA is also based on the assumption that all assessed residual impact levels within the ESIA are achievable.

It is recognised at this stage that this approach may not be accurately able to define the cumulative impacts from a purely VEC-cantered perspective (i.e. proposed actions impact on VEC + other past, present and future impacts on VEC = Cumulative Impacts).

However given the clustered nature of the human VECs, the large scale extent of the environmental VEC (such as the groundwater system, which is also heavily relied upon by human VECs) it can be assumed that all impacts will accumulate to each VEC.

Therefore attempting to address impacts by nature is a suitable approach and is able to produce effective management, mitigation and monitoring measures.

11.2.5 *Development of Management, Mitigation and Monitoring Measures*

Based upon identification of broad impact trends, broad scale mitigation measures will need to be developed. Generally, these are based upon:

- Effective application of, and adherence to, the mitigation hierarchy in environmental and social management of the specific contributions by the project expected cumulative impacts. This is generally achieved through stringent implementation of the measures developed specifically for the Project; and

- Development of best efforts to engage in, enhance and/or contribute to a multi-stakeholder, collaborative approach to implementing management actions which are beyond the capacity of an individual project proponent.

Any measures developed to address concerns identified within this CIA will take into account these general concepts. There also needs to be scope to develop these measures further when detailed information regarding projects becomes available.

11.2.6 *Identification of VEC and their Present Conditions*

The ESIA identifies and describes the current condition of a range of Sensitive Receptors, defined as VEC for the purposes of this CIA. These are:

- Air quality and operational noise and vibration receptors in close proximity to the Project area;

- Surface water quality;

- Traffic on the main road into Cilamaya and access roads to transmission line;

- Terrestrial biodiversity and particularly the potential presence of conservation significant habitats and species. This includes the mangrove area at the north of Cilamaya Bay by the proposed jetty location;

- Marine biodiversity and benthic communities and particularly a decline in water quality and seabed conditions as a result of sedimentations increases during dredging and movement of vessels and anchoring activities;

- Nearby communities who will be exposed to potential benefits associated with job opportunities, but also potentially negative impacts associated with worker influx and potentially, increasing prices for goods and services (in particular in Cilamaya area); and

- Fishing communities that may be impacted by Project activities. There appear to be varying degrees of reliance on fishing as a source and it is likely that intermittent fishing activities currently occur within the area to be affected by the Project;

- Shipping and navigation across Ciasem Bay such as traffic to and from Tanjung Priok; and

- Those identified as part of stakeholder engagement, regardless of whether or not they meet either of the above definitions.

11.2.7 Identification of External Natural and Social Stressors

The Project is situated largely within the vicinity of residential areas and a small cluster of industrial facilities within a broader semi-rural environment.

Based upon a desktop review of readily available online information and site investigations, there are two (2) key projects under construction/planned within the immediate Project area.

Pertagas has been operating its Gas Compression Station (SKG) since the mid 1970's. The site is located adjacent to the proposed power plant and will also share the onshore pipeline right of way; shore the right of way separate.

Offshore PT Pertamina Gas (Pertagas). PT Pertamina Hulu Energi Offshore North West Java operates a series of plaforms, over 10 km away from the FSRU. The baseline conditions discussed in this ESIA already considered these activities and given no change in their activities is anticipated no cumulative impact form these activities is considered.

The listed projects represent those that are relatively large in scale/impact and are likely to generate significant environmental and social impacts as shown in **Table 11-1**.

Table 11-1 Known nearby Development Projects and Activities

Project Name	Comments	Anticipated Impact Types
Within five (5) km radius from project facilities		
Operational Gas Compression Station (SKG).	The power plant is located adjacent to an operating Gas Compression Station (SKG) of PT Pertamina Gas (Pertagas). The gas compressed at the station is supplied with gas from PT Pertamina Hulu Energi Offshore North West Java (PHE ONWJ) via a buried ROW onshore and offshore to a series of platforms >10km offshore.	• Air emissions. • Noise. • Waste.
Upgrade of Jalan Cilamaya – Cikalong	Public Works Office - Human Settlements and Spatial Planning (PUPR) Karawang Regency is planning to upgrade of Jalan Cilamaya – Cikalong in 2018. The local authority is also expecting that PT Pertamina in Cilamaya to co-operate during the construction phase and during road maintenance. The 10-km road is located within five (5) km from the proposed CCGT Power Plant.	• Traffic; • Noise; and • Unplanned and Non-Routine Event.
Within 10 km radius from project facilities		
High Speed Train Jakarta-Bandung	The High-Speed Train Jakarta Bandung is developed by PT Kereta Cepat Indonesia China, a joint venture formed in October 2015 between a consortium of Indonesian state-owned companies, and China Railway International. The proposed rail link will be 150 km long, with an approximate train speed estimated to be between 200km/hr and 250km/hr. The construction phase of this USD$ $5.5bn project will last for three (3) years, with completion scheduled for 2019. This includes a station in Karawang nearby the Jakarta-Cikampek Toll Road i.e. approximately 10 km from the proposed Cibatu II/Sukatani Substation.	• Traffic; and • Unplanned and Non-Routine Event.
Within 20 km radius from project facilities		
PT Pertamina Hulu Energi Offshore North West Java offshore pipelines and plaforms	PT Pertamina Hulu Energi Offshore North West Java operates a series of offshore pipelines and platforms off the coast of North Java.	• Air emissions • Marine quality; • Marine traffic; and • Unplanned event.
Inland Waterways/Cikarang-Bekasi – Javan Sea by PT Pelabuhan Indonesia II	The development of 45 km Inland Waterways will link Tanjung Priok in Jakarta, with the hinterland area of Cibitung-Cikarang in Bekasi (i.e. within 10 km from Cibatu II/Sukatani Substation) and Cikampek in Karawang (i.e. within 20 km from the proposed CCGT Power Plant), where major industries are located, through a river-canal route. The project, included in the list of strategic national projects, is estimated to cost IDR3.4trn (USD$255.6m) and is expected to bring down logistics costs by 20% to 25%. It is expected to be completed by 2019.	• Traffic; • Surface Water; and • Unplanned and Non-Routine Event

11.2.8 Scope Finalisation

Table 11-2 presents the outcomes of scoping, based upon identified VEC, assessed Project impacts, the identified external projects, and the summary of trends.

The core outcome of this table is that cumulative impacts will be assessed with regards to the following key impact types:

- Air Quality;
- Noise;
- Employment and Business Opportunities;
- Increased Pressure on Community Infrastructure and Services; and
- Community Health and Safety.

The remainder of impacts either have already been assessed in a cumulative manner within the ESIA, or the Project will only have negligible impacts and therefore will not contribute to any broader cumulative impacts to VEC.

Table 11-2 Scoping of Impacts on Sensitive Receptors

Impact Type	VEC's Likely to be Impacted	Existing Assessment in ESIA	CIA Scope
Air Quality	In general, the VEC is likely to be impacted are those people residing in the various villages along the main transportation routes in Karawang and Cilamaya.	**Chapter 9** of this Report presents the outcomes of detailed air quality modelling during both construction and operation phases. The assessment captures only the predicted future emissions from the Project plus the existing baseline.	A qualitative assessment will be undertaken, focusing on identification of ways in which cumulative air quality impacts may occur and appropriate mitigation strategies to adopt.
Noise	In general, the VEC is likely to be impacted are those people residing in the various villages along the main transportation routes in Karawang and Cilamaya.	**Chapter 9** of this Report presents the outcomes of detailed noise assessment during both construction and operation phases. The assessment captures only the predicted future noise levels from the Project plus the existing baseline.	A qualitative assessment will be undertaken, focusing on identification of ways in which cumulative noise impacts may occur and appropriate mitigation strategies to adopt.
Employment and Business Opportunities	The VEC is likely to be impacted are those people residing in the residing along the main transportation routes of the Project.	Positive social impacts from the Project include impacts to employment and economy during both the construction and operation phases, were assessed as part of **Chapter 9** of this Report.	A qualitative assessment will be undertaken, focusing on identification of ways in which cumulative impacts may occur to VEC and develop appropriate mitigation strategies.
Increased Pressure on Community Infrastructure and Services	The VEC is likely to be impacted are those people residing in the residing along the main transportation routes of the Project.	**Chapter 9** of this Report presents a detailed assessment of impacts relating to Community Health & Safety during construction and operations phase. None of these were considered cumulatively.	A qualitative assessment will be undertaken, focusing on identification of ways in which cumulative impacts may occur to VEC and develop appropriate mitigation strategies.
Community Health & Safety	The VEC is likely to be impacted are those people residing in the residing along the main transportation routes of the Project.	**Chapter 10** of this Report presents an assessment of impacts relating to Community Health & Safety during construction and operations phase. None of these were considered cumulatively.	A qualitative assessment will be undertaken, focusing on identification of ways in which cumulative impacts may occur to VEC and develop appropriate mitigation strategies.

11.3 AIR QUALITY IMPACT ASSESSMENT

11.3.1 *Project Impacts*

The Project was identified to have a number of potential impacts to air quality, particularly with regards to ambient air quality in the local community (also defined as VEC's). To mitigate these impacts, during both construction and operation, a range of mitigation measures have been developed to manage potential impacts.

The IFC Performance Standard 1 (Paragraph 5) defines the broader Project area to include *"… areas potentially impacted by cumulative impacts from further planned development of the Project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken."*

In addition, the IFC Performance Standard 1 (Paragraph 6) states that the *"… assessment will also consider potential trans-boundary effects, such as pollution of air, or use or pollution of international waterways, as well as global impacts, such as the emission of greenhouse gases."*

11.3.2 *Relevant Cumulative Impacts with Other Projects*

Within the study area it is primarily the operation of a flare at the SKG Pertamina Gas facility located immediately to the north east of the Project site that could lead to cumulative impacts on air quality at sensitive receptor locations. It should be noted, however, that during normal operation the flare will combust only small quantities of gas to maintain a pilot light and emissions to air are considered small. Although the flaring rates and periods of flaring at the facility are not known, it is considered acceptable to assume that emission form the flare will have been captured within the baseline assessment presented in **Annex D** and as such have already been assessed within the air quality impact assessment.

Additionally, during the Project construction phase, the upgrade of Jalan Cilamaya to Cikalong and the construction of the High Speed Train (Jakarta-Bandung) are ongoing. Both will involve intensive construction works in close proximity to some of the Project sites that may affect air quality conditions, particularly as a result of increased traffic and construction dust.

11.3.3 *Specific Mitigation Measures for Cumulative Impacts*

During the construction phase, the Sponsors and EPCs have committed to using BAT including construction vehicles of an acceptable quality with appropriate emission tests, which will reduce the overall contribution to cumulative emissions and air quality. It is recommended that the Project engage with local government agencies (MoEF in particular) to ensure regular monitoring of air emissions in these hotspots is conducted. Where required additional mitigation measures are put in place to ensure emission levels remain below the accepted standards.

11.4 *NOISE IMPACT ASSESSMENT*

11.4.1 *Project Impacts*

Noise impact assessments are generally based on predicting project-specific levels at the closest and/or most affected receptors and then comparing these to criteria or management levels that apply to the type of emission being considered.

The Project was identified to have a number of potential noise impacts, particularly in and around the power plant during construction. Other potential but less significant noise impacts were also identified at and near the power plant, the transmission line alignment and the substation for select construction and operational components.

Based on the magnitude and extent of these potential impacts a range of project-specific noise reducing mitigation measures e.g. the use of noise barriers, have been developed to minimise impacts during both construction and operation. A set of management measures, provisions, safeguards and contingencies e.g. monitoring have also been established as documented in **Chapter 12** of this report, and the **Annex E** acoustics assessment.

In the case of the projects construction and operational emissions, the IFC 1.7 Noise criteria values have been applied. They are the most stringent of local and international noise thresholds and include two key limit types.

The first are fixed values defined for a) residential, institutional and educational receptors and then b) industrial and commercial receptors that address potential direct impacts from a development. They are most relevant to areas where the existing conditions are generally quiet. The second is a permissible increase in existing noise levels.

The latter criterion is derived based on existing noise levels (background + 3dB) for the area and for the majority of receptors (especially those near the power plant) this has formed the basis of the project-specific construction and operational noise assessment such that existing conditions (incl. industrial noise) contributions are considered as part of the assessment approach.

11.4.2 *Relevant Cumulative Impacts with Other Projects*

During the Project construction phase, the upgrade of Jalan Cilamaya to Cikalong and the construction of the High Speed Train (Jakarta-Bandung) are ongoing. Both will involve intensive construction works in close proximity to some of the Project sites that may elevate noise levels, particularly as a result of increased construction traffic and construction noise.

During the Project operational phase, the ongoing use of other nearby industrial sites will occur e.g. the SKG plant, Pertamina's existing Gas Compressor Station. The main noise component/source at SKG Cilamaya are the three gas compressors which are driven by Solar Centaur gas turbines; these other industrial noise sources (combined with the noise from the project) may elevate noise levels at nearby some receptors.

These features were considered for the assessment of both construction and operational phases with a set of outcomes established to address these potential emissions as far as is practicable for the emissions under the Projects control, as summarised in **Chapter 11.4.3** below.

11.4.3 Specific Mitigation Measures for Cumulative Impacts

As noted in **Chapter 11.4.1** a range of project-specific noise reducing mitigation measures e.g. the use of noise barriers, have been developed to minimise impacts and a set of noise management measures, provisions, safeguards and contingencies e.g. monitoring have also been established as documented in **Annex E** acoustics assessment. These will assist to reduce noise levels and minimise impacts from the project itself (during both construction and operational phases) and as a result cumulative emissions will be lower to the extent possible for those emissions under the projects direct control.

During the construction phase, the Sponsors and EPCs have committed to using BAT including noise barriers, implementation of a community grievance mechanism and community consultation to provide advance notice of potentially noisy construction periods. These mitigations have been proposed with the aim of reducing the impacts of Project noise to as acceptable a level as possible.

As discussed in the previous chapter, it is recommended that the Project engage with local government agencies (MoEF in particular) to ensure regular monitoring of noise levels in these construction areas is conducted. Where required additional noise mitigation measures are put in place to ensure levels remain below the accepted standards.

11.5 BIODIVERSITY IMPACT ASSESSMENT

11.5.1 Project Impact

The Project is not able to relocate the shoreline development area (ie jetty and pump house) to avoid mangrove areas due to technical reuirements. As such there is a need to offset 330 m^2.

11.5.2 Relevant Cumulative Impacts with Other Activities

As Indonesia has lost over 40% of its mangroves since the 1970s it has one of the highest rates of mangrove loss in the world. Mangrove deforestation accounts for 6% of the total annual forest loss in Indonesia which is equivalent to 50,000ha per annum (Ministry of Forestry Indonesia, 2014).

The northern Javan Coast has suffered considerable mangrove forest loss over decades and is likely to have further loss of remnant areas through increases in coastal development. Both protected areas located to the East (Muara Gembong) and West (Tanjung Sedari and Muara Cimanuk) of the project area contain large areas of remnant mangroves.

11.5.3 Specific Mitigation Measures for Cumulative Impacts

As stated above the Project will result in a loss of 330m^2 of mangrove forest however this area will be offset within the vicinity of the project area to achieve a no-net-loss of biodiversity values. The cumulative impact however due to other coastal developments in the area is likely to result in further loss of mangrove patches along the coastline.

11.6 SOCIO-ECONOMIC CUMULATIVE IMPACT ASSESSMENT – EMPLOYMENT AND BUSINESS OPPORTUNITIES

11.6.1 Project Impacts

The communities surrounding the Project area are aware of the potential positive impacts on employment and business opportunities. This was confirmed through the public consultation activities undertaken for the AMDAL and ESIA (and discussed in **Chapter 9**).

The community in and around the Cibatu sub station and close to Cilamaya expect to be employed by the Project and be involved in the procurement of goods and services such as provision of materials for construction, food catering and non-local workforce accommodation.

To enhance the benefits of this impact, the Project will implement measures including primarily engaging relevant stakeholders e.g. village leaders to provide as much information as possible regarding employment and business opportunities to the local communities.

11.6.2 *Relevant Cumulative Impacts with Other Projects*

The Project, when considered along with the Jakarta-Cikampek Toll Road and the upgrade of Jalan Cilamaya, will contribute to the local economy within the area (and develop local construction skills), providing a significant boost to the local and regional economics. There will be substantial opportunities for skilled and unskilled labour associated with all of these projects.

11.6.3 *Specific Mitigation Measures for Cumulative Impacts*

The Sponsor to give consideration to sharing information regarding its local content plan and skills training program with the village leaders and relevant government agencies i.e. local manpower agency (*Dinas Ketenagakerjaan*) so that proposed hiring plans are understood. A collaborative and integrated approach can lead to better outcomes and assist in seeing potential cumulative positive economic impacts realised and appropriately distributed throughout the local population.

11.7 *INCREASED PRESSURE ON COMMUNITY INFRASTRUCTURE AND SERVICES*

11.7.1 *Project Impacts*

The demands from the Project on the local services and infrastructure are anticipated to be high; in particular during the peak construction period. The Project will require accommodation for non-local workers in Cibatu, along the transmission lines villages and in Cilamaya and the surrounding villages. In some periods there are expected to be more than 1,500 workers residing in the community. In addition to this there will be a requirement for local health provision, waste disposal, provision of electricity and provision of clean water. Furthermore the workforce will be expected to adhere to a strict code of conduct.

The Project's EPCs are preparing worker management and logistics plans to ascertain how the above impacts will be managed in order to reduce potential community impacts. The Project also intends to coordinate with local stakeholders such as the police, local government and healthcare providers.

11.7.2 *Relevant Cumulative Impacts with Other Projects*

The Project, when added to the proposed projects within the area, may result in increased pressure on the local communities' infrastructure and services; in particular addressing waste management and social risks (excessive alcohol use has been reported as a concern within the Project area amongst youth and commercial sex workers are known to be present in the areas of Blanakan and Bekasi).

11.7.3 *Specific Mitigation Measures for Cumulative Impacts*

The Sponsors and EPCs are planning to implement a range of measures to comprehensively address Project impacts to community services/ wellbeing through effective consultation and socialisation of the Project's Code of Conduct. It is also recommended that coordination is undertaken with the relevant authorities to understand manpower schedules in particular hotspots and the requirements each Project may have from local services.

11.8 SOCIO-ECONOMIC CUMULATIVE IMPACT ASSESSMENT – COMMUNITY HEALTH AND SAFETY

11.8.1 *Project Impacts*

The impact assessment noted a number of impacts to community health and safety, which would be caused by the Project, particularly during the construction phase. Those of relevance for this CIA include:

- An increase in vehicles, particularly construction vehicles, leading to an increased potential for accidents to occur;
- An increase in STIs as the result of the introduction of a large non local construction workforce into the area; and
- Daily construction activities in close proximity to residential areas which could lead to an incident with a community member.

Measures to mitigate these impacts have been proposed within **Chapter 9** and **Chapter 10** and summarised in the ESMP (**Chapter 12**). They primarily involve the implementation of an effective SEP for the Project, preparation of a community emergency response plan (ERP), controlled access to construction areas and signage as well as safe driving practices by construction drivers.

11.8.2 *Relevant Cumulative Impacts with Other Projects*

It is likely that the upgrade of Jalan Cilamaya – Cikalong may result in some traffic congestion issues in particular if the construction activities coincide during the same period as the power plant construction and coastal activities. The 10-km road is located within 5 km from the proposed CCGT Power Plant.

In addition to traffic congestion risks associated with traffic incidents and construction activities posing a risk to local communities residing close by and other road users. Currently the schedule, construction plan and manpower activities are unknown.

11.8.3 *Specific Mitigation Measures for Cumulative Impacts*

The Sponsors and EPCs are planning to implement a range of measures to comprehensively address Project impacts to community health and safety. It is unlikely that the Project will be able to influence the activities conducted for the construction of the Jakarta-Cikampek Toll Road however more so with the upgrade of Jalan Cilamaya to Cikalong given the proximity to the site and expectation of the local government for Project support. As such detailed discussions with the PUPR in Karawang will be necessary to ensure appropriate coordination and mitigation of cumulative impacts.

12 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

12.1 OVERVIEW

The ESIA process has identified the key environmental, social and community health issues, impacts associated with the Project requiring the implementation of a wide range of mitigation measures.

The necessary actions required to manage these issues, impacts and risks are presented in this Environmental and Social Management Plan (ESMP); these are the mitigation and monitoring measures that have been identified through the impact assessment, and other best practice measures designed to avoid, minimise or reduce negative impacts and enhance positive impacts.

The objectives of an Environmental and Social Management Plan (ESMP) are to:

- Identify the set of responses to potentially adverse impacts;
- Define the responsibilities for implementation and monitoring;
- Determine requirements for ensuring that mitigation and management measures are implemented effectively and in a timely manner; and
- Describe the means for meeting those requirements.

The purpose of this Chapter is to demonstrate how the mitigation commitments made through the IA Process will be put into practice, monitored and upheld.

The content of this chapter is crucial to bridge the findings of the IA with the implementation of the mitigation measures and to provide an early framework of management systems/monitoring regimes that will help to deliver these IA commitments.

Specifically, this ESMP Chapter provides information and instructions on how commitments of the Project will be managed from pre-construction through the construction and operation phases.

12.2 OBJECTIVES

The ESMP is a living document which:

- Incorporates the Environment and Social mitigation measures identified as a result of the ESIA process into a comprehensive framework to facilitate and ensure appropriate management throughout the Project cycle;

- Provides a framework to incorporate commitments into the Project plans and procedures for activities that have risks, as identified in the IA;
- Presents responsibilities for meeting ESMP requirements including the provision of training;
- Identifies the detailed management plans which will need to be developed for implementation throughout the various phases of the Project by the EPCs and operators; and
- Defines the monitoring and reporting program.

12.3 RESPONSIBILITY FOR IMPLEMENTING THE ESMP

The key parties and their primary roles in implementing the ESMP are as follows:

- **Sponsors** - Responsibility for the implementation of the Project to the required Applicable Standards of the Government of Indonesia and Lender consortium;
- **EPC Contractors** – responsible for complying with ESMP requirements under the contract; and
- **Sub-contractors** – responsible for complying with ESMP requirements as applicable under the EPC contracts.

12.4 POLICY & COMMITMENT TO ENVIRONMENTAL MANAGEMENT

The ESMP detailed management plans will be developed to align to the Sponsors' and EPCs' HSE policies. These will be developed by the Sponsors prior to NTP and operations.

12.4.1.1 Sponsor

The Sponsors (PT JSP and PT JSR) are a Consortium of Pertamina, Sojitz and Marubeni as discussed previously in this ESIA.

12.4.2 *EPC Contractors - Construction*

12.4.2.1 General Electric

GE has an established management systems for quality (ISO 9001). In terms of HSE GE has established an "e-Framework" which has been mapped to ISO14001/OHSASN18001.

12.4.2.2 Samsung C&T Corporation

Samsung C&T Corporation (Samsung) has an established management systems for Quality (ISO 9001), Safety (OHSAS 18001) and Environment (ISO 14001).

Figure 12-1 Samsung EHS Policies

12.4.2.3 PT Meindo Elang Indah

PT Meindo Elang Indah (Meindo) has established a management system for Quality (ISO 9001), Safety (OHSAS 18001) and Environment (ISO 14001).

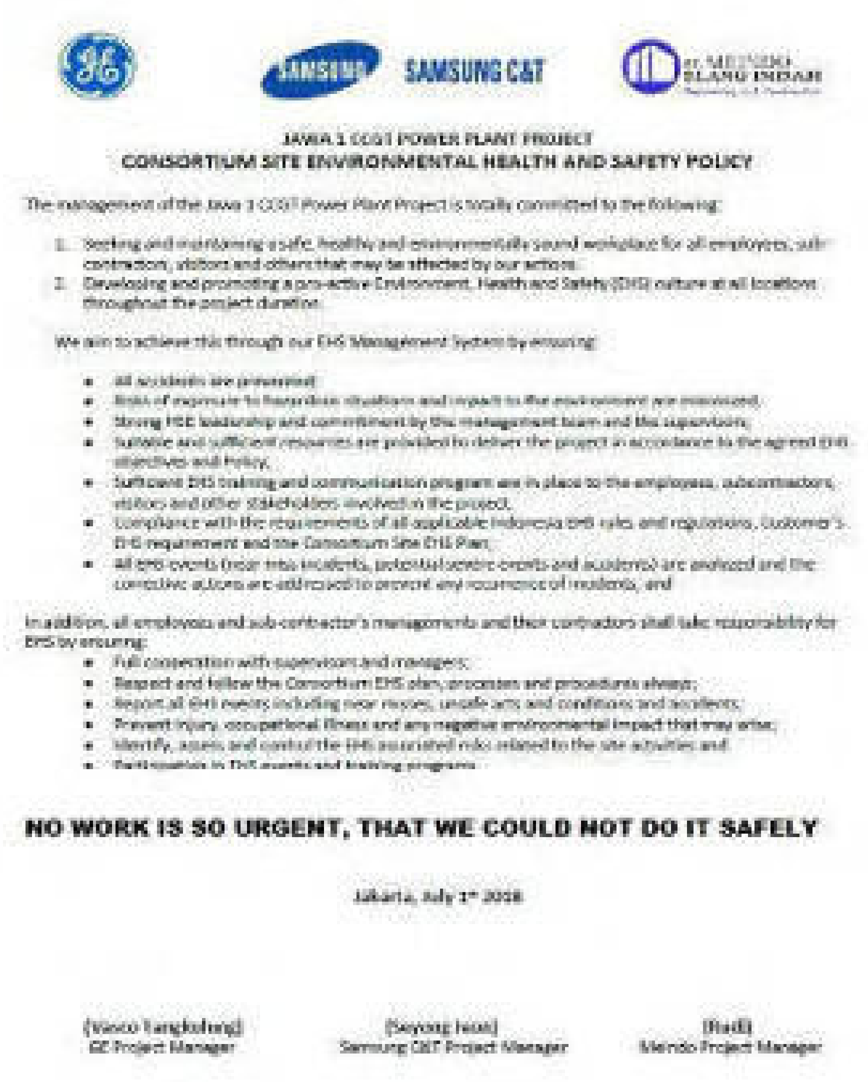
Figure 12-2 Meindo EHS Policies

12.4.2.4 *EPC Consortium*

The EPC consortium consists of GE, Samsung and Meindo has developed an HSE Policy applicable during the construction activities (refer to Figure 12.3). In addition, the consortium has also developed the following policies:

- Stop Work Policy;
- Alcohol and Drug Policy;
- Smoking Policy; and
- EHS & Zero Incident Policy.

Figure 12-3 EPC Consortium EHS Policy



JAWA 1 CCGT POWER PLANT PROJECT

CONSORTIUM SITE ENVIRONMENTAL HEALTH AND SAFETY POLICY

The management of the Jawa 1 CCGT Power Plant Project is totally committed to the following:

1. Seeking and maintaining a safe, healthy and environmentally sound workplace for all employees, sub-contractors, visitors and others that may be affected by our actions.
2. Developing and promoting a pro-active Environment, Health and Safety (EHS) culture at all locations throughout the project duration.

We aim to achieve this through our EHS Management System by ensuring:

- All accidents are prevented;
- Risks of exposure to hazardous situations and impact to the environment are minimized;
- Strong HSE leadership and commitment by the management team and the supervisors;
- Suitable and sufficient resources are provided to deliver the project in accordance to the agreed EHS objectives and Policy;
- Sufficient EHS training and communication program are in place to the employees, subcontractors, visitors and other stakeholders involved in the project;
- Compliance with the requirements of all applicable Indonesia EHS rules and regulations, Customer's EHS requirement and the Consortium Site EHS Plan;
- All EHS events (near miss incidents, potential severe events and accidents) are analyzed and the corrective actions are addressed to prevent any recurrence of incidents, and

In addition, all employees and sub-contractor's managements and their contractors shall take responsibility for EHS by ensuring:

- Full cooperation with supervisors and managers;
- Respect and follow the Consortium EHS plan, processes and procedures always;
- Report all EHS events including near misses, unsafe acts and conditions and accidents;
- Prevent injury, occupational illness and any negative environmental impact that may arise;
- Identify, assess and control the EHS associated risks related to the site activities and
- Participation in EHS events and training programs.

NO WORK IS SO URGENT, THAT WE COULD NOT DO IT SAFELY

Jakarta, July 1st 2018

([illegible]) GE Project Manager

([illegible]) Samsung C&T Project Manager

([illegible]) Meindo Project Manager

Source: GE Power, 2018

12.4.3 *Roles and Responsibilities*

The EHS culture in the workplace is everyone's responsibility. However, certain individuals will be required to accept additional responsibilities based on their role. These roles are summarised in **Section 12.4.3.1** to **12.4.3.7**.

12.4.3.1 *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. Expectations for the role in terms of implementing a Health, Safety, Social and Environmental management system 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 the work scope is conducted in accordance with the Project EHS rules and regulations, work practices 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 by an appointed third-party auditor and recommendations for non-compliances.

12.4.3.2 HSE 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 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.

12.4.3.3 Administrative /Corporate Social Responsibility Department

This Department would be expected to undertake the following roles:

- Manage, review and develop the Social Program to ensure that it fulfils Project requirements, including measures observed in this ESMP, and monitor the implementation;

- Coordinate and evaluate the effectiveness of all program elements;

- Manage the implementation of stakeholder relations and grievance management to ensure that all social-related requirements in this ESMP are implemented;

- Manage the implementation of community development program that are required in this ESMP;

- Manage the implementation of community health program, including coordination with HSE team on occupational health and safety measures associated with management of impact to community health;

- Coordinating with HSE team on implementation of the Project vehicle safety measures associated with management of impact to community safety;

- Coordinating with HR (Human Resources) person to ensure implementation of labour-related measures required in this ESMP;

- Consultation with community and liaise with relevant stakeholders in implementing the required stakeholder and grievance management measures, including liaison with related government bodies as necessary;

- Lead collaboration to establish and implement the Project grievance mechanism during construction phase, and supervise contractor's social performance as required in this ESMP; and

- Manage social monitoring and report the results to the Project Manager.

12.4.3.4 *Contractors' Site Representatives/HSE Department*

Contractors, depending on their workscopes, would be expected to have an HSE team. Contractors' Site Representatives or HSE Department should be assigned clear responsibilities and expectations with respect to implementing the projects EHSS expectations and should be fully responsible for implementing any required expectations which fall under their workscopes. More specifically, they shall:

- Actively promote and implement all Project HSE Plans related with the work they are preforming. Contractor shall make sure that all activities under his/her responsibility shall follow all safety regulation/requirement, coordinating with Sponsor's 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.

12.4.3.5 *Employees*

All employees involved in the Project shall be qualified through training, experience, or knowledge. Non-supervisory personnel employed on the Project shall:

- Familiarise themselves with the concept of the Project EHSS rules and regulations;
- Work in accordance with Project HSE Procedure, safe work practices, and method statements, risk assessments, permits to work and any other instructions that apply to their works;
- Use only tools/equipment and materials, which have been approved for use, and employ them only for the purpose for which they were designed;
- Take an active part in the protection of themselves, fellow workers, property and the environment from accidental losses;
- Immediately report to his respective supervisor or HSE officer/inspector if any potential hazards (relates to unsafe conditions and/or unsafe acts), which could lead to an accident, are found;
- Report promptly to immediate supervisor and HSE officer/inspector if any incidents/near misses as well as injuries, regardless how minor; and
- Shall attend Project safety training and drills programs as required.

12.5 *TRAINING, AWARENESS AND COMPETENCE*

It is expected that the Project would implement a training and awareness program covering environmental, health, safety and social expectations, labour and working conditions and the grievance mechanism of the Project. This program will consist of motivation measures and rewards for compliance and penalties for non compliance.

As a minimum, this should be implemented as an induction for all employees and contractors engaged on the Project construction, with further training to be implemented depending on the level of responsibility for implementing HSE and social expectations and exposure to environmental and safety risks.

The Project should ensure that all personnel responsible for the implementation of this ESMP are competent on the basis of education, training and experience. All personnel shall be provided with environmental and social training appropriate to their scope of activity and level of responsibility.

12.6 *ORGANISATIONAL CAPABILITY*

The overall Project organisational structure is presented below; outlining the structure of PT IPP (responsible for the construction of all Project facilities except the FRSU) and PT FRSU (the FSRU will be constructed by Samsung Heavy Industries in South Korea).

PT IPP (JSP) will own and operate the CCGT Power Plant, the gas pipeline and transfer the transmission line to PLN on COD and PT FSRU (JSR) will own and operate the FSRU asset.

PT IPP will be a self O&M structure with Marubeni taking role of O&M Leader whilst PT IPP and PT FSRU will enter into Time Charter Party (TCP), in which PT FSRU will time charter the FSRU to PT IPP and receive time charter payments from PT IPP in return. **Figure 12-4** presents the overall Project structure and **Figure 12-5** illustrates the organisational structure during construction activities.

During construction the EPC Owners Engineer (yet to be decided) and the FSRU construction supervisors will have the responsibilities for:

- Quality Control;
- HSE;
- Project Management;
- Programme, Controls and Reporting;
- Construction Supervision;

- Engineering and logistics;
- Contracts and administration.

The EPCs and the Sponsors will have suitable resources in place to oversee the ESMP implementation; ensuring construction activities are addressing commitments set out in the ESMP.

This team will be led by the HSSE Manager and consist of H&S supervisors, environmental advisors (including air, noise, biodiversity, water quality etc.) and community relations advisors (who will lead the consultation, grievance management, CSR and LRP activities). The EPCs will also be expected to reflect a similar team structure to support the implementation of the construction management plans.

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The EPC consortium (led by GE) will be responsible for implementation of the ESMP with appropriate HSE and Community Relations resources in place to support the implementation. **Figure 12-6** illustrates the organisational structure of the EPCs led by GE.

During operations the Sponsors will be fully responsible for implementation of the ESMP (JSP for the power plant and JSR for the FRSU). The JSP EHS Manager at the power plant, supported by an environmental/CSR officer, will monitor the implementation of the operational mitigation measures. The chief officer and engineer will oversee the FSRU operational mitigation measures.

Figure 12-4 *Overall Project Organisational Structure*

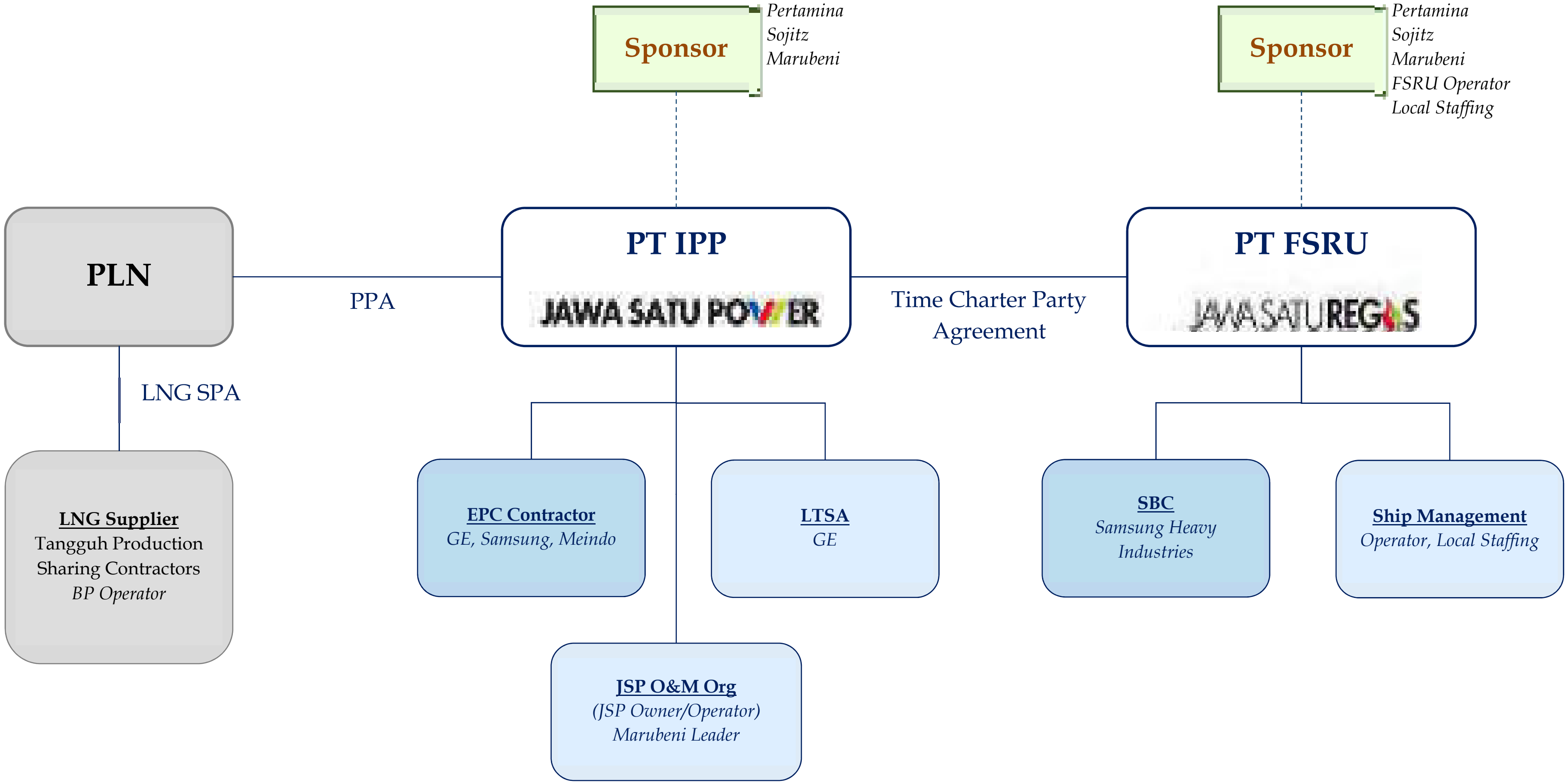

Figure 12-5 *Organisation Structure of Sponsors during Construction*

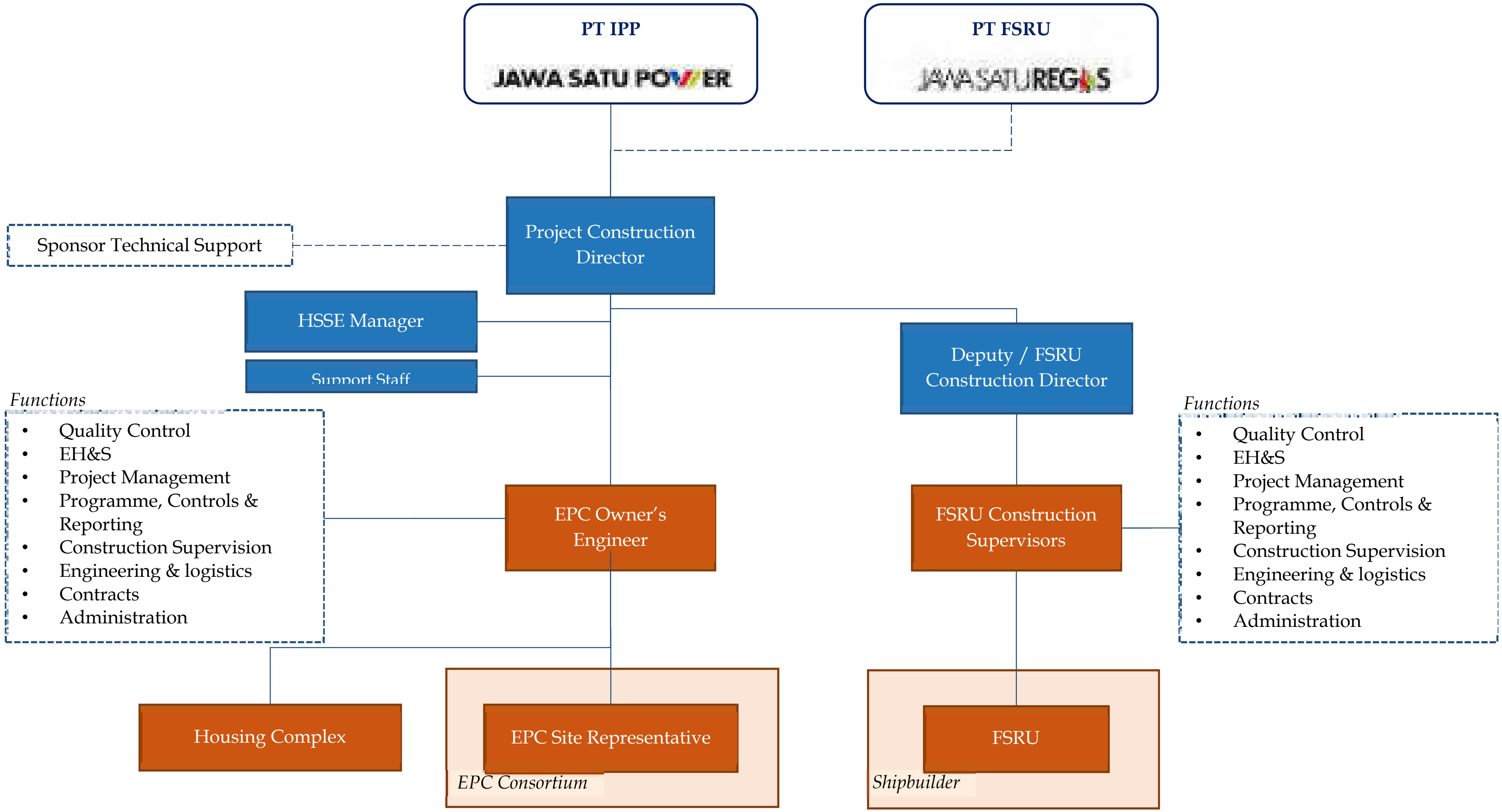

Figure 12-6 EPC Consortium Organisation Structure

12.7 *OUTLINE OF ESMP*

Based on the assessment and discussions regarding design adjustments and mitigations the following plans will be developed (separately or combined) either by the EPCs or JSP:

- Air Quality Management Plan;
- Community Development Plan/Corporate Social Responsibility;
- Change Finds Procedure;
- Biodiversity Action Plan;
- Emergency Response Plan;
- Local Recruitment and Procurement Plan;
- Noise and Vibration Management Plan;
- Oil and Chemical Spill Contingency Management Plan;
- Security Plan;
- Soil and Groundwater Management Plan;
- Stakeholder Engagement Plan;
- Surface Water Management Plan;
- Traffic Management Plan;
- Waste Management Plan (Hazardous and Non Hazardous);
- Occupational Health and Safety Management Plan;
- Community Health and Safety Management Plan;
- Worker Training Plan; and
- Worker Accommodation and Management Plan.

These plans are set out further in the subsequent two (2) sections covering construction and operational impacts. They will be the responsibility of the EPCs and Sponsors to develop, implement and monitor.

12.8 *ENVIRONMENTAL AND SOCIAL MANAGEMENT*

The Project has been required as part of the local regulatory process to develop a *Rencana Pengelolaan Lingkungan hidup (RKL) - Rencana Pemantauan Lingkungan hidup (RPL)* or a monitoring and mitigation plan.

This document sets out how the Project will adhere to the national and local laws and regulation and is provided in **Annex O**. The commitments in this document will be monitored and report on to the MOEF on a quarterly basis.

A management and monitoring plan has been prepared for all phases of the Project and is presented in **Table 12-1** to **Table 12-4**. This includes the tentative parameters to be measured, methods to be utilised, sampling locations, frequency of measurements, detection limits, cost and responsibilities for implementation and supervision.

The Monitoring Plan is presented in **Table 12-5** . This plan should be adopted by the Project and updated regularly. The monitoring components of the various management plans will be refined and finalised during plan development.

Impact monitoring will be required during the life of the Project to verify the predicted levels of residual impacts from the Project and the effectiveness of the various environmental and social management plans or construction and operations.

Table 12-1 Environmental Management and Monitoring during Construction

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
1	Transportation/operation of vehicles (construction, materials/supplies and workforce)	Air Quality	Deterioration of air quality from exhaust emissions from vehicles	• Old vehicles will be replaced with new, more fuel efficient alternatives. • Where feasible high use vehicles will be converted to cleaner fuels. • All vehicles, equipment and machinery will undergo a pre-use inspection prior to use and periodic maintenance inspections.	Appointed EPC Contractor	• Vehicle checklists. • Fuel usage record. • Annual maintenance record.
2	Transportation/operation of vehicles (construction, materials/supplies and workforce)	GHG	Increased GHG Emissions at National and Global Levels	• Optimisation of construction schedule and placement of laydown areas/temporary camp sites to reduce overall traffic movements/distance travelled, thus reducing GHG emissions from transport.	Appointed EPC Contractor	• GHG emission inventory
3	Transportation/operation of vehicles (construction, materials/supplies and workforce)	Terrestrial Biodiversity	Disturbance and displacement of fauna and flora due to the use and movement of heavy machinery and vehicles	• Use of the access road should be restricted to construction vehicles only. Checkpoints should be used to manage access and inspect vehicles for vegetation (including firewood) taken from the Project Area. • All vehicles are to maintain a speed of a maximum of 40km/hr within work sites to reduce the risk of fauna strike. • All land rehabilitation will be undertaken using native indigenous species. The area of landscaping within the Project area shall re-establish habitat values including re-establishing mangrove habitats along the foreshore area and coastal vegetation along the access road, CCGT plant and facilities. • A community program is to be established with adjacent landowners to replant mangrove forest along foreshore areas and re-establish coastal vegetation on non-utilised public land and private land (With consent of the land-owner) within the Javan Coastal Zone EBA between the Muara Gembang – Tanjung Sedary KBA and the Muara Gimanuk KBA. This program will re-establish habitat within the EBA suitable for the endemic bird trigger species.	Appointed EPC Contractor	• Checkpoints in place. • Vehicle entry and inspection record. • Driver training record.
4	Workforce presence	Terrestrial Biodiversity	Direct mortality to fauna and flora from hunting and poaching from the workforce and local residents	• Hunting and poaching will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation. • The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to hunting and poaching, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations.	Appointed EPC Contractor	• Workforce induction program includes anti-poaching and code of conduct. • Evidence of community awareness raising activities. • Worker training record. • Biodiversity Action Plan in place and socialised to workforce.
5	General Land Clearance – all sites	GHG and Climate Change	Increased GHG emissions (National and Global Level)	• Actual land clearing/disturbance will be minimised to the greatest extent possible. Net GHG emissions could also be reduced by revegetation in many areas that will be cleared only for temporary activities such as laydown areas and temporary camps for construction.	Appointed EPC Contractor	• GHG emission inventory

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
6	General construction activities - all sites	Terrestrial Biodiversity	Disturbance and Displacement of Fauna	• Hunting and poaching will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation; • The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to hunting and poaching, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations; • All vehicles are to maintain a speed of a maximum of 40km/hr within work sites to reduce the risk of fauna strike • Clearing of habitat within Natural Habitat areas (mangrove forests) along the coastal zone will be avoided and minimised where possible. No clearing of mangroves is to occur outside of the Project area; • Site level avoidance should be undertaken within the mangrove areas including restricting clearance where feasible, vegetation protection fencing and steepening of road batters. • Clearing vegetation outside of designated areas will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation; • The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to unauthorised clearing of vegetation, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations; • The planned vegetation clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing; • Use of the access road should be restricted to construction vehicles only. Checkpoints should be used to manage access and inspect vehicles for vegetation (including firewood) taken from the Project Area; • All land rehabilitation will be undertaken using native indigenous species. The area of landscaping within the project area shall re-establish habitat values including re-establishing mangrove habitats along the foreshore area and coastal vegetation along the access road, CCGT plant and facilities. Re-establishment of native vegetation will create habitat for Critical Habitat species and improve the habitat values of the Javan Coastal Zone EBA. The area anticipated to be replanted will be approximately 10ha adjacent to the project footprint. The replanting strategy shall be outlined within the Biodiversity Action Plan (BAP) ; • A community program is to be established with adjacent landowners to replant mangrove forest along foreshore areas and re-establish coastal vegetation on non-utilised public land and private land (With consent of the land-owner) within the Javan Coastal Zone EBA between the Muara Gembang – Tanjung Sedary KBA and the Muara Gimanuk KBA. This program will re-establish habitat within the EBA suitable for Critical Habitat species. The area targeted for reestablishment of vegetation is to be 80ha. The program is to be detailed within the BAP; and • A Fauna Shepherding Protocol is be used in the Javan Coastal EBA to ensure that any endemic bird species have vacated the area prior to any clearance work • The use of fencing and hoarding during construction in the Javan Coastal EBA is to be kept to a minimum around Project construction sites.	Appointed EPC Contractor	• Protocol in place and socialised to workers. • Fences in place.
7	General construction activities - all sites	Air Quality	Dust generation - Deterioration of air quality	• Develop and Implement a Dust Management Plan (DMP). The DMP will contain the measures outlined in this document and a plan for implementation. • Regular site inspections will be performed to monitor compliance with the DMP. All inspection results will be recorded and corrective actions taken where mitigation and management measures are not being implemented effectively.	Appointed EPC Contractor	• Inspection records for daily activities. • $PM_{2.5}$, PM_{10} monitoring at sensitive receptors. • Community grievance records

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
				• Daily onsite and offsite inspections will be undertaken to visually assess the dust emissions from earthwork and construction activities, and from vehicles exiting the construction sites. Results from the inspection will be recorded and appropriate measures will be taken to reduce emissions where necessary. • All dust and air quality complaints will be recorded, the cause identified and the appropriate measures taken to reduce emissions in a timely manner. • The frequency of site inspections will be increased when activities with a high potential to produce dust are being carried out and during prolonged dry and windy conditions. • Use of site watering to suppress wind and physical disturbance dust generation. • Only cutting, grinding, or sawing equipment fitted with suitable dust suppression techniques such as water sprays will be used. • All chutes, conveyors and skips will be covered at all times. • Drop heights from conveyors, loading shovels and hoppers will be minimised. • Ensure an adequate water supply on site for effective dust suppression and mitigation.		
8	General construction activities – CCGT Power Plant	Air Quality	Dust generation - Deterioration of air quality	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top cover in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape. • Real time PM_{10} monitoring will be undertaken at two fenceline locations. Monitoring will commence 3-months prior to the earthwork phase commencing. • Wind breaks will be erected around the construction site at least the height of any stockpile on site. • Use of site watering to suppress wind and physical disturbance dust generation. • The construction site will be planned so that machinery and dust causing activities are located away from air sensitive receptors as far as possible. • All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required. • Deliveries of ready-made cement and other fine powders will be delivered in enclosed tankers and stored with suitable emission controls to prevent escape of material and overfilling during delivery. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.	Appointed EPC Contractor	• Site inspection records. • Wind breaks in place. • Sand and aggregates in bunded areas.

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
9	General construction activities – Onshore pipeline	Air Quality	Dust generation - Deterioration of air quality	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top cover in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable. • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.	Appointed EPC Contractor	• Site inspection records.
10	General construction activities - Substation	Air Quality	Dust generation - Deterioration of air quality	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top cover in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape. • All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable. • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.	Appointed EPC Contractor	• Site inspection records.
11	General construction activities – Transmission Line Towers	Air Quality	Dust generation - Deterioration of air quality	• All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Implement a wheel washing system.	Appointed EPC Contractor	• Site inspection records.
12	High noise generating construction activities – General CCGT Construction (Site Preparation, Building Construction, Bulk Earthworks, or similar)	Noise	Temporary and short-term noise disturbance impacts and amenity issues (most affected receptors, nearby community; other affected receptors, broader community).	• CCGT construction work and activities should be carried out during the IFC daytime hours (i.e. 7am to 10pm). Where possible the CCGT construction works and activities should conclude at 6PM daily, to further minimise impacts and provide respite outsiders standard business hours. • Any work that is performed outside these hours (i.e. during the night time period, 10pm to 7am) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (i.e. 45 dBA), at all potentially affected sensitive receptors. Where this is not possible it may be necessary to undertake the night works with agreement from nearby and potentially affected neighbours. • Where works near R2, or any unforeseen activities in close proximity to other receptors, are to occur and these works are anticipated to generate high noise levels of >70 dBA, potential respite periods (e.g. three hours of	Appointed EPC Contractor	• Noise monitoring

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
				work, followed by one hour of respite) should be implemented. Respite should be implemented if it is the preference of the affected receptors and if it is feasible and reasonable, and practicable, to implement during the works. In some circumstances respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure. • Where unforeseen works will occur in close proximity to a receptor and these works are anticipated to generate high levels of noise (e.g. >75 dBA), potential respite periods (e.g. three hours of work, followed by one hour of respite) should be considered. Respite should be implemented if they are the preference of the affected receptors and if they are feasible and reasonable, and practicable, to implement during the works. In some circumstances respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure.		
13	High noise generating construction activities, and vibration – CCGT Piling (Impact Piling, or Similar)	Noise (and vibration)	Temporary and medium-term noise disturbance impacts and amenity issues (most affected receptors, nearby community; other affected receptors, broader community).	• CCGT piling and activities should be carried out during the IFC daytime hours (i.e. 7AM to 6PM). Where possible the CCGT construction works and activities should conclude at 6PM daily, to further minimise impacts and provide respite outsiders standard business hours. Piling activities between 6pm and 10pm will be limited to augering and welding. • Any work that is performed outside these hours (i.e. during the night time period, 10PM to 7AM) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (i.e. 45 dBA), at all potentially affected sensitive receptors. Where this is not possible it may be necessary to undertake the night works with agreement from nearby and potentially affected neighbours. • CCGT piling should be conducted as per the method summarised in Section 3.1 and reproduced in Annex E of this report. • All noise reducing mitigation that is presented Annex C of this report should occur i.e. pre-drilling to ten metres depth, at all piling locations; use of pile caps and cushions, the latter consisting of five layers of high strength multiflex board; and • Installation of the EGI fence to the southwest nearby the local school and housing area. The height and specification should be determined after EPC test piling and noise monitoring. • The work sequence that is presented Annex E should be strictly adhered to and no more than 12 piling rig units should work concurrently unless an alternative work sequence and piling rig layout design/plan is identified that will reduce noise levels, or minimise impacts to those presented in this report. • Where any unforeseen piling works will occur in close proximity to a receptor and these works are anticipated to generate high noise levels >70 dBA, potential respite periods (e.g. three hours of work, followed by one hour of respite) should be implemented. Respite should be implemented if it is the preference of the affected receptors and if it is feasible and reasonable, and practicable, to implement during the works. In some circumstances respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure.	Appointed EPC Contractor	• Noise monitoring
14	High noise generating construction activities, and vibration – All CCGT Works (incl. Piling)	Noise (and vibration)	Temporary and medium-term noise disturbance impacts and amenity issues (most affected receptors, nearby community; other	• During the construction design, appropriate plant, equipment and/or machinery should be selected for each task and efficient work practices adopted to minimise the total construction period and the number of noise sources on the site. The quietest item of plant available should be selected where options that suit the design permit. • During the works, unnecessary noise due to idling diesel engines and fast engine speeds should be avoided when lower speeds are sufficient.	Appointed EPC Contractor	• Noise monitoring

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
			affected receptors, broader community).	• During the works, drivers should be instructed to travel directly to site and avoid any extended periods of engine idling at or near residential areas. • During any night works, any activity that has the potential to generate impulsive noise should be completely avoided. These types of events are particularly annoying, especially at night and have the limited potential to generate sleep disturbance or awakening impacts. • During the works, ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the site. • During the works, ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse. • Implementation of a community grievance mechanism and community consultation should occur.		
15	High noise generating construction activities – General construction road traffic on access roads	Noise	Temporary and medium-term noise disturbance impacts and amenity issues (most affected receptors, nearby community; other affected receptors, broader community).	• Construction road traffic associated with CCGT works should be limited to the IFC daytime hours (i.e. 7AM to 10PM). Any traffic that is required outside these hours (i.e. during the night time period, 10PM to 7AM) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (45 dBA), at all potentially affected sensitive receptors. • During the works, unnecessary noise due to idling diesel engines and fast engine speeds should be avoided when lower speeds are sufficient. • During the works, drivers should be instructed to travel directly to site and avoid any extended periods of engine idling at or near residential areas. • During any night works, any activity that has the potential to generate impulsive noise should be completely avoided. These types of events are particularly annoying, especially at night and have the limited potential to generate sleep disturbance or awakening impacts. • During the works, ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines should be repaired or removed from the site. • During the works, ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse. • Implementation of a community grievance mechanism and community consultation should occur.	Appointed EPC Contractor	• Noise monitoring
16	High noise generating construction activities – All CCGT Works (incl. Piling)	Noise	Temporary and medium-term noise disturbance impacts and amenity issues.	• Regular monitoring of construction (including piling) noise levels will be conducted and an evaluation of compliance provided for. All site noise levels will be measured in the absence of any influential sources not associated with the project. If the measured project noise levels are below the predicted values and comply with the criteria presented in this report, no further mitigation or management measures may be required. If the measured project levels are above the predicted noise levels and/or criteria presented in this report, further mitigation and/or management measures will be considered and implemented, where feasible, reasonable and practical to do so.	Appointed EPC Contractor	• Noise monitoring
17	High noise generating construction activities – Jetty Piling (Impact Piling, or Similar)	Noise	Temporary and short-term noise disturbance impacts and amenity issues.	• Noise modelling of Jetty piling works has identified that unmitigated emissions comply with the most stringent night time project-specific criteria (45 dBA) at the closest and/or potentially most affected receptor	Appointed EPC Contractor	• Nil

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
				(N14) situated within the potential area of influence of these activities, as documented in Section 6.1 of the **Annex E** acoustics assessment report. On this basis, the noise reducing mitigation and management measures that are applicable to CCGT piling works, do not apply to Jetty piling, which can be undertaken a) at any time of day i.e. during the daytime or the night time and b) without implementing the noise reducing measures reproduced in Annex C of the **Annex E** acoustics assessment report.		
18	General construction activities – FSRU + ORF, gas delivery pipeline, transmission line, Cibatu Baru II/Sukatani substation	Noise and vibration	Temporary and short-term noise disturbance impacts and amenity issues.	• Nil	Appointed EPC Contractor	• Nil
19	General construction activities - Seawater Water Intake and Cooling Water Outfall Discharge Pipeline	Noise and vibration	Temporary and short-term noise disturbance impacts and amenity issues.	• Nil	Appointed EPC Contractor	• Nil
20	Earthworks, including vegetation clearance, excavation, grading and levelling	Soil	Exposure of soil causing erosion and loss of top soil.	• All machinery to be used in areas of Natural Habitat and Critical Habitat are to exert a low pressure on the ground surface so as to minimise soil compaction; • All machinery and hand held equipment used must comply with required air and noise emission standards; • Sediment and erosion control measures are to be used in all areas of construction to minimise soil contaminated runoff entering waterways. These measures are to be outlined in a Sediment and Erosion Control Plan; • All disturbed soil surfaces are to be rehabilitated and native flora species are to be planted within areas under the Projects control. These species are to be suitable habitat for bird species listed in the Javan Coastal Zone EBA • Delineation of clearance boundaries to limit the areas to be cleared. • Scheduling clearance activities to avoid extreme weather events such as heavy rainfall, extreme dry and high winds. • Revegetation areas with temporary land use, conducting progressive rehabilitation. • Demarcate routes for movement of heavy vehicles to minimise disturbance of exposed soils and compaction of sub-surface layers. • Reuse topsoil within rehabilitation activities. • Control erosion through diversion drains, sediment fences, and sediment retention basins.	Appointed EPC Contractor	• Site inspection records.
21	Earthworks, including vegetation clearance, excavation, grading and levelling	Soil	Exposure of soil causing erosion and loss of top soil.	• Stockpiles to be separated into topsoil and sub-soil and be located at least 10 m from any surface water source and groundwater well or 50 m from Cilamaya canal; and • Stockpiles are to be located in areas surrounded by natural wind barriers to minimise the potential for wind erosion.	Appointed EPC Contractor	• Site inspection records.

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
22	Earthworks, including vegetation clearance, excavation, grading and levelling	Groundwater	Compaction process impacting groundwater levels and as such local well users and groundwater contamination. Acid Sulphate Soil impacts to groundwater, vegetation, surface water quality and aquatic biota from soil clearing at the Access Road and Jetty coastal areas	• A groundwater Management plan will be developed should an impact to ground water be identified from compaction through the hydrogeological study: This should include: • Conduct groundwater monitoring during the compactions process. For earthworks and excavations in the waterlogged coastal soils where there is the potential for ASS, the following measures are recommended: • Prior to proceeding with any soil disturbance activities, conduct onsite ASS tests at coastal excavation locations; • Where ASS is confirmed to be present implement control measures, such as: – Schedule excavation such that the potential effects on any area disturbed at any one time are limited and managed; – Stockpiling of ASS is only permitted as a short-term activity where removal from site is not possible (e.g. weather) and must be placed on impermeable area with runoff protection, 50 m away from surface water; – Minimise the time that excavations are left open and the presence of temporary spoil piles to reduce the amount of time that ASS is exposed to the air. – No dumping of exposed ASS is permitted onto the surrounding land or into surface waters; – Use of marine, estuarine, brackish or fresh waters is not permitted as a means of diluting and/or neutralising ASS or associated contaminated waters. – Given the fine sediment and waterlogged nature of the potential area of ASS, covering excavated spoil with clean material is not recommended as the material may liquidise, flow and contaminate the surrounding area. • Evaluate treatment and disposal options based on volume of ASS material, considering: – Removal, treatment and disposal offsite; – Neutralisation of ASS materials (e.g. lime application); or – Strategic reburial in anoxic environment. • Monitoring samples of soil and surface water following completion of earthworks/excavation in ASS affected area. • The above mitigation measures should be detailed in an ASS Management Plan that details the steps, measures and strategies that will be used to manage potential impacts of the excavation works that have the potential to disturb ASS materials at the site to reduce the magnitude of the potential impact.	Appointed EPC Contractor	• Groundwater management plan and monitoring (if deemed necessary); • ASS Management Plan; • ASS test results prior to excavation works in coastal areas; • Soil and Surface Water Monitoring; and • Site inspection records.
23	Earthworks, including vegetation clearance, excavation, grading and levelling	Surface Water Quality	Deterioration of surface water quality.	Sponsor shall also inform the EPCs to develop Construction Environment Management Plan and Run-off and Sediment Control Plans prior to the commencement of construction activities to include the following: • Major earthworks activities during construction shall be scheduled during dry season as much as possible. • Topsoil removed during clearing shall be stored in specified areas. Stockpiled earthworks, during and after clearing will be placed as bunds at strategic locations in order to reduce sediment loadings to the storm run-off. • Stockpiles to be separated into topsoil and sub-soil and be located at least 10 m from any surface water source and groundwater well or 50 m from Cilamaya canal; • Open stockpiles of construction materials (e.g. aggregates, sand and fill material) in places which are identified to have a possibility of significant run-off will have measures in place to prevent the washing away of construction materials, soil, silt or debris into any drainage system. • Earthworks to form the final surfaces will be followed up with surface protection and drainage works to prevent erosion caused by rainstorms. Soil erosion caused by wind and rainstorms shall also be reduced by	Appointed EPC Contractor	• CEMP and SCP in place and socialised to workers.

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
				minimising the land clearance area during construction activities, where possible, providing surface protection such as sheet cover. • Temporary traffic areas and access roads, if any, formed during construction will be protected by coarse stone ballast or equivalent. These measures shall prevent soil erosion caused by rainstorms.		
24	Earthworks, including vegetation clearance, excavation, grading and levelling	Terrestrial Biodiversity	Loss of habitat and degradation of habitat due to the construction activities	• No clearing of mangroves is to occur outside of the Project area; • Site level avoidance should be undertaken within the mangrove areas including restricting clearance where feasible, vegetation protection fencing and steepening of road batters. • Clearing vegetation outside of designated areas will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation. • The Project owner shall provide training to staff and workers on all rules, regulations and information concerning restrictions related to unauthorised clearing of vegetation, as well as the punishment that can expected if any staff or worker or other person associated with the Project violates rules and regulations. • The planned vegetation clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing. • All land rehabilitation will be undertaken using native indigenous species. The area of landscaping within the Project area shall re-establish habitat values including re-establishing mangrove habitats along the foreshore area and coastal vegetation along the access road, CCGT plant and facilities. • A community program is to be established with adjacent landowners to replant mangrove forest along foreshore areas and re-establish coastal vegetation on non-utilised public land and private land (With consent of the land-owner) within the Javan Coastal Zone EBA between the Muara Gembang – Tanjung Sedary KBA and the Muara Gimanuk KBA. • Planting of native indigenous flora, including mangroves along the shoreline adjacent to the road and jetty construction sites is to occur to reduce impacts to connectivity along the shoreline. • Appropriate rehabilitation of disturbed areas using native vegetation is to occur to facilitate movement of fauna species, especially within the EBA. It is estimated that approximately 10ha of land adjacent to project components is available for site revegetation. • Existing populations and the introduction of new invasive species into Natural Habitats and Critical Habitats are to be managed. These measures are to be outlined in an *Invasive Species Management Plan* and include measures such as: • The provenance of any fill material brought onto the site is to be checked regarding invasive species contamination; • Vehicle wash down procedures are to be used to reduce the transmission of invasive species into and from the Project area(s); • Control measures are to be utilised in areas of Natural Habitat and Critical Habitat	Appointed EPC Contractor	• Regular (weekly) checks during construction are to occur along all project boundaries to ensure compliance with clearing within marked boundaries; • Records are to be kept and regularly reviewed (3 monthly) for implementation of the workforce training program for fauna/flora awareness; • Records are to be kept and regularly reviewed (3 monthly) of all personnel entering and exiting the project area through checkpoints, including results of all random inspections undertaken for poached flora/fauna; • Monitoring if rehabilitation success/failure is to occur on all replanting sites. Monitoring is to consist of regular inspections (3 monthly) to determine plant establishment. Where plant establishment is determined to have failed, reestablishment is to occur; • A regular social engagement (12 monthly) survey is to occur to gauge the socialisation of conservation measures, including the coastal revegetation program.
25	Earthworks, including vegetation clearance, excavation, grading and levelling	Terrestrial Biodiversity	Emissions (dust, noise, vibration) and discharges (run-off, effluent) disturbance and degradation of habitats	• Measures to control dust are to be utilised to limit generation of dust and hence deposition onto vegetation surrounding construction areas. • All machinery to be used in areas of Natural Habitat and Critical Habitat are to exert a low pressure on the ground surface so as to minimise soil compaction. • All machinery and hand held equipment used must comply with required air and noise emission standards. • Sediment and erosion control measures are to be used in all areas of construction to minimise soil contaminated runoff entering waterways. These measures are to be outlined in a Sediment and Erosion Control Plan.	Appointed EPC Contractor	• Site inspection records.

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
				• All disturbed soil surfaces are to be rehabilitated and native flora species are to be planted within areas under the projects control. These species are to be suitable habitat for bird species listed in the Javan Coastal Zone EBA.		
26	Earthworks, including vegetation clearance, excavation, grading and levelling	Surface water	Reduction of surface water quality	• Stockpiles to be separated into topsoil and sub-soil and be located at least 10 m from any surface water source and groundwater well or 50 m from Cilamaya canal; • Construction of drainage ditches and retention ponds to collect water run-off to reduce flows. • Develop a Construction Sediment and Erosion Management Plan including erosion control measures such as limitation of gradients on earthworks, installation of sediment traps along water drainages including silt fences, and vegetation traps, sediment barriers and geotextile curtains. • Prompt temporary or permanent stabilisation and reinstatement of earthwork areas will be conducted to reduce the amount of exposure time and manage potential for wind/water erosion impacts leading to loss of sediment and potential entry into water courses.	Appointed EPC Contractor	• Site inspection records.
27	Earthworks, including vegetation clearance, excavation, grading and levelling - Critical and Natural habitat	Terrestrial Biodiversity	Emissions (dust, noise, vibration) and discharges (run-off, effluent) disturbance and degradation of habitats	• Habitat biodiversity offsets are unnecessary to achieve a no-net-loss of biodiversity values. Specific measures however to manage Critical habitat species will be required to be outlined within a Biodiversity Action Plan.	Appointed EPC Contractor	Biodiversity Action Plan review.
28	Earthworks, including vegetation clearance, excavation, grading and levelling - Critical and Natural habitat	Terrestrial Biodiversity	Emissions (dust, noise, vibration) and discharges (run-off, effluent) disturbance and degradation of habitats	• All machinery to be used in areas of Natural Habitat and Critical Habitat are to exert a low pressure on the ground surface so as to minimise soil compaction. • All machinery and hand held equipment used must comply with required air and noise emission standards. • Sediment and erosion control measures are to be used in all areas of construction to minimise soil contaminated runoff entering waterways. These measures are to be outlined in a Sediment and Erosion Control Plan. • Hours of operation of the construction site are to be limited to the hours of 7.00am to 10.00pm Monday to Sunday. • All light sources are to be directed away from areas of Natural Habitat and Critical Habitat, where feasible.	Appointed EPC Contractor	• Records are to be kept and regularly reviewed (3 monthly basis) during construction on the application on the implementation of the Sediment And Erosion Control Plan; • Records are to be kept and regularly reviewed (3 monthly basis) during construction on the application on the implementation of the Invasive Species Management Plan. Monitoring is to include inspections of the site on a monthly basis during construction in areas of natural habitat to identify and eradicate any invasive species.
29	Earthworks, including vegetation clearance, excavation, grading and levelling - Critical and Natural habitat	Terrestrial Biodiversity	Introduction of invasive species through increased movement of people, vehicles, machinery, vegetation and soil.	• The use of fencing and hoarding during construction in the Javan Coastal EBA is to be kept to a minimum around Project construction sites Development of an Invasive Species Management Plan to include: • The provenance of any fill material brought onto the site is to be checked regarding invasive species contamination. • Vehicle wash down procedures are to be used to reduce the transmission of invasive species into and from the Project site(s). • Control measures are to be utilised in areas of Natural Habitat and Critical Habitat	Appointed EPC Contractor	• Invasive Species Management Plan in place and socialised to workforce. • Site inspection records. • Planting proliferation and growth assessment.

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
				• All disturbed soil surfaces are to be rehabilitated and native flora species are to be planted within areas under the Projects control. These species are to be suitable habitat for bird species listed in the Javan Coastal Zone EBA.		
30	Fencing	Terrestrial Biodiversity	Fragmentation of habitat, or permanent /temporary severance of wildlife corridors between isolated habitats of importance for biodiversity.	• The use of fencing and hoarding during construction in the Javan Coastal EBA is to be kept to a minimum around project construction sites. • Appropriate rehabilitation of disturbed areas is to occur to facilitate movement of fauna species during operation, especially within the EBA.	Appointed EPC Contractor	• Records are to be kept and regularly reviewed (3 monthly basis) during construction on the application of the fencing and hoarding implementation; • Regular inspections (weekly during construction) during the dry season to determine the level of dust deposition on vegetation surrounding the Project Area. Where excessive dust on vegetation is identified, and rain is not forecast within the next 5 days, vegetation should be washed using a water truck. • Records are to be kept and regularly reviewed (3 monthly basis) on the planting of indigenous flora and fauna on disturbed areas; and • Monitoring if rehabilitation success/failure is to occur on all replanting sites. Monitoring is to consist of regular inspections (3 monthly) to determine plant establishment. Where plant establishment is determined to have failed, reestablishment is to occur.
31	Jetty Construction, Dredging and Pipeline Trenching	Marine Biodiversity	Direct loss and Degradation of Marine Habitats and Water Quality	• Project shall develop a dredging and disposal risk assessment and Dredging Management Plan in accordance with IMO and OSPAR guidelines. • The dredging footprint of the Project to be reduced as far as practicable in order to reduce the direct disturbance to the seabed and indirect effects from turbidity plumes. This includes: • Dredging vessels will be equipped with the appropriate Global Positioning System (GPS) equipment or other navigational aids to ensure dredging will occur at the specified dredge footprint and disposal at the designated soil disposal site; • EPCs' dredgers will maintain adequate clearance between vessel hull and the seabed at all states of the tide and reduce vessel speed to ensure that excessive turbidity is not generated by turbulence from vessel movement or propeller wash. • Records are to be kept and regularly reviewed (weekly) for implementation of the Dredging Management Plan.	Appointed EPC Contractor	• Dredging management plan. • Site inspection records. • Vessel inspection. • TSS monitoring of TSS levels at dredging sites.

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
				• Direct measurement of the TSS periodically at baseline sampling station locations MW9, MW10, MW11 and MW12 to establish actual recorded levels verses modelled.		
32	Vessel presence and movements	Marine Biodiversity	Direct mortality or injury of marine fauna from vessel movements	• Vessels will operate in accordance with standard maritime practices, whereby vessel speeds will be adjusted depending on environmental conditions (e.g., visibility, metocean condition) as required by the captain of the vessel and to avoid any encountered hazards. • Support vessels will not travel greater than six (6) knots within 300 m of a whale or 100 m from a dolphin, if sighted, (i.e. will maintain a caution zone of those distances). • Vessels will approach no closer than 100 m from a whale or 50 m from a dolphin, if sighted (Note this standard does not apply to support vessels engaged in limited/constrained manoeuvrability activities where vessel speed will already be low). • Vessels will not directly approach a marine mammal from in front or behind their path of travel. • Vessels will not exceed a speed limit of five (5) knots within designated boating channels around the jetty or the FSRU. • Vessel bridge crew to maintain visual watch of any hazards (including marine mammals). • Records are to be kept and regularly reviewed (3 monthly) for the mortality or injury of marine fauna from vessel movements.	JSR	• Training records for vessel personnel. • Marine mammal observation forms.
33	Dredging, FSRU mooring/jetty pile driving, construction	Marine Biodiversity	Disturbance and displacement of marine fauna by underwater noise during construction	• Acoustic decoupling (i.e. repositioning or placement on rubber fittings) of loud equipment during piling should be implemented. • Pile driving management measures consistent with JNCC (2010) standard pile driving protocol: – Trained and dedicated MMOs and PAM operatives during pile driving. – Mitigation zone (JNCC recommend a minimum mitigation zone of 500 m, to be determined on a case-by-case basis. The zone may be determined using numerical modelling of the pile driving characteristics proposed for the Project, but in the absence of modelling, a conservative 1 km mitigation zone will be implemented). – 30-minute pre-start observations. – Delay-start procedure (if marine mammal sighted within the mitigation zone). – Soft-start procedure (minimum 20 minutes). – Shut-down procedures if marine mammal sighted within the mitigation zone during pile driving. • Delay-start and shut-down procedures will also be implemented if a marine turtle is sighted within 500 m of the pile driving activity. • Where piling/activity continues into a period of poor visibility/ night-time there is no need for additional mitigation. • Where piling/activity is initiated during times of poor visibility (including night-time conditions, the activity will only be permitted if there have been no sightings of marine mammals within 2 hours prior to low visibility/darkness. Activities then to be kept continuous as much as is possible. Other standard mitigation is also required (with the exception of observation period). • Vessel and Dredger maintenance to be performed as adequate maintenance, including lubrication and repair of winches, generators, propulsion components and other potential sources is an effective measure for noise reduction. • When marine species are observed in the mitigation zone, additional information and corrective actions taken such as a shutdown of the pile driver, duration of the shutdown, behaviour of the animal, and time spent in the mitigation zone will be recorded.	Appointed EPC Contractor	• Documentation on pre-start procedure. • MMOs and PAMs present. • Marine mammal observation forms. • Site inspection records.

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
				• Any incidents that occur during dredging that result in negative impacts on the marine species will be documented and reported to the authorities when required. • Only hydraulic hammer for pile driving is used, not diesel based for the FSRU piles. • Records shall be maintained of all marine species sightings in the area, including date and time, weather conditions, species identification, approximate distance from the pile, direction and heading in relation to the pile driving, and behavioural observations. When marine species are observed in the mitigation zone, additional information and corrective actions taken such as a shutdown of the pile driver, duration of the shutdown, behaviour of the animal, and time spent in the mitigation zone will be recorded. •		
34	FSRU and vessel mobilisation	Marine Biodiversity	Introduction of invasive species from FSRU/vessels brought from outside Indonesian waters (ballast water/hull fouling)	• The FSRU and any contracted vessels coming from outside of Java territorial waters will have vessel hull and niches confirmed to be free of IMS prior to mobilisation to the local waters of the Project area. • All contracted vessels and the FSRU will maintain a current anti-fouling coating, as evidenced by a current Anti-fouling System Certificate under *Annex 1 of the International Convention on the Control of Harmful Anti-Fouling Systems on Ships* or other equivalent records. • The FSRU and all contracted vessels will meet the requirements of the International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004, including: - Ballast water shall be managed in accordance with the provisions set out in the Convention; and - A Ballast Water Management Plan and a ballast water record book will be implemented and maintained on board.	JSR	• Vessel inspection record. • Ballast water management plan in place. • Ballast water discharge record.
35	Hydrotest of offshore pipeline	Marine Water Quality	Reduction of marine water quality	• Chemicals used in hydrotesting will be selected with consideration for their potential ecotoxicity and will use the lowest toxicity practicable for preserving pipeline integrity.	Appointed EPC Contractor	• Chemical inventory for hydrotest water.
36	Hydrotest of onshore equipment	Surface Water Quality	Deterioration of surface water quality.	• For the selection of chemicals for hydrotest water, the Project will select biocides / chemical additives that present a low risk of contamination, in terms of dose concentration, toxicity, biodegradability, bioavailability, and bioaccumulation potential.	Appointed EPC Contractor	• Chemical inventory for hydrotest water.
37	Waste management	Environmental Quality	Generation, handling, treatment and disposal of solid and liquid hazardous and non-hazardous wastes	• Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimise odour nuisance). • Store wastes in closed containers away from direct sunlight, wind and rain and systematically to allow inspection between containers to monitor leaks or spills. • Ensure that liquid waste storage areas have impermeable floors and containment, of capacity to accommodate 110% of the volume of the largest waste container. • All wastes will be disposed of by authorised third- party disposal contractors. • Concrete waste of inert nature will be stored in a laydown area near the concrete batching plant and will be reused where possible. • Any bitumen waste will be stored separately in a lined area to be disposed of by licensed contractors.	Appointed EPC Contractor	• WMP in place and socialised to workers. • Site inspection records.
38	Waste management	Infrastructure	Pressure on existing waste management infrastructure	WMP required detailing: • Waste inventory that details all wastes anticipated by the construction works, the frequency at which they will occur and the timing in the Project programme, is needed.	Appointed EPC Contractor	• WMP in place and socialised to workforce. • Site inspection records.

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
				• Waste disposal sites in the area that are licensed to accept the types of waste the construction phase will create, following the 3Rs ethos (i.e. reduce, reuse and recycle). • Waste storage and segregation. • Waste transfer and transport. • Training to workers. • Waste auditing.		
39	Wastewater discharge and runoff	Surface Water Quality	Deterioration of surface water quality.	• Portable or permanent sanitation facilities serving all workers should be provided at all construction sites e.g. one (1) toilet for every 25 workers up to the first 100, and one for every 50 thereafter) will be provided for the construction workforce. Septic tanks shall be provided to treat the sanitary discharge. • Wastewater collected from canteen kitchens, including that from basins, sinks and floor drains, should be discharged into sanitary sewers via grease traps. The sanitary sewer should then be treated prior to discharge or reuse as greywater. • Surface run-off from bunded areas should pass through oil/water separators prior to discharge to the stormwater system.	Appointed EPC Contractor	• Site inspection records.
40	Wastewater discharge and runoff	Surface Water	Deterioration of surface water quality.	• All surface run-off from the construction areas potential sources of contamination will be minimised and reduced (e.g. by minimising the area of impermeable surfaces) and the peak discharge rate will be reduced (e.g. by using retention ponds and silt screen). • Appropriate surface drainage surrounding the construction areas will be designed and provided where necessary. This includes diversion channels to intercept storm water running-off the cleared areas and prior to large scale land clearance and removal of topsoil, where appropriate. These channels will be protected against erosion such as sandbag, rock armouring or lining as required. • Stormwater management structures such as stormwater ponds will be designed to collect the silt-laden surface runoff and allow the removal of silt by natural settlement, which in turn should reduce sediment loading prior to discharge into receiving environment. • All drainage facilities and sediment control structures will be inspected on a regular basis and maintained to confirm proper and efficient operation at all times and particularly during rainstorms. Deposited silt and grit will be removed regularly. The stormwater drainage system will be periodically inspected for blockage sand cleaned at least once before the monsoon season each year. • Measures will be taken to reduce the ingress of drainage into excavations. If trenches have to be excavated during the wet season or rainy conditions, they will be excavated and backfilled in short sections wherever practicable. Water will pumped out from trenches or foundation excavations will be discharged into storm drains via silt removal facilities. • Personnel will be trained to visually inspect discharged water quality for oil and grease traces (that will be visible on the surface) periodically and take appropriate corrective actions. • A dike wall shall also be constructed around high potential spillage area such as fuel tank. For spillage in other location is considered to be minor so that oil pan and containment devices are necessary to response. Additionally, containment devices are to be provided for storage areas of oil, fuel and chemicals to control contaminated surface runoff. • Control and monitoring systems will be used to alert the crew to leaks or any other potential risks.	Appointed EPC Contractor	• Site inspection records.

Table 12-2 Social Management and Monitoring during Construction

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
1	Land acquisition for pipeline right of way, access road and jetty	Land owners and fish pond cultivators	Land acquisition impacts and lost income from fresh water fisheries activities (shrimp or fish)	• Implement the RP to ensure livelihoods are not impacted • Undertaking consultation with the land owners and users • Support the fishpond owners/ cultivators to re-establish new fish • Prioritisation for Project opportunities	JSP	• Number of resettlement related grievances submitted • Number of land owners and users employed by Project • Number of land owners and users participating in the Project's CSR and LRP program • Evidence of consultation activities and records • Consultation database • Evidence of new fish ponds established • Consultation records with fish pond cultivators
2	Land acquisition for substation, transmission line, pipeline right of way and access road	Land owners, users and sharecroppers	Land acquisition impacts and lost income from paddy fields	• Implement the RP to ensure livelihoods are not impacted • Undertaking consultation with the land owners and users • Prioritisation for Project opportunities	JSP	• Number of resettlement related grievances submitted • Number of land owners and users employed by Project • Number of land owners and users participating in the Project's CSR program Evidence of consultation records • Consultation database
3	FSRU installation and laying of offshore pipelines	Fisher folk in Blanakan and Muara villages	Loss of income due to restrictions and construction activities (perceived and actual)	• Undertake a detailed fish catch survey prior to construction and implement necessary LRP activities is required (follow up during contruction) • Conduct regular socialisation and consultation activities in particular prior to the mangrove clearing and offshore activities to discuss the activities proposed, restricted areas, LRP, compensation process and timeline • Ensure the Project's grievance mechanism is well socialised • Compensation will be on a case by case basis and agreed by both parties involved • Implement a relevant community development of the fishermen's needs • Prioritise employment for interested local fishermen	• Meindo • JSP	• Fish catch survey • Evidence of consultation records Consultation database • Map of fishing activities • Number of grievances submitted • Report on grievance close out • Number of local fishermen participating in CDP activities • Number of local fishermen employed by the Project
4	Project Employment and Procurement of Goods and Services	Local communities residing near Project activities	Managing Community Expectations	• Provide and communicate clear and factual information about the Project's needs • To avoid over committing or promising employment • To have clear stipulation of using local labour in the EPC contracts • To ensure the EPC liaise closely with the local village leaders and local government authorities to agree on the appropriate procedures for recruitment and hiring	• JSP • JSR • Meindo • Samsung • GE	• Evidence of consultation activities and records • Consultation database • Evidence of consultation activities and records • Number of related grievances submitted • Evidence of EPC local content commitments • EPC Local Recruitment Policy

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
5	Access road and onshore pipeline construction activities	Local fish pond cultivators in Cilamaya, Muara and Blanakan	Damage to fishponds due to dust, waste disposal and other construction activities	• Apply noise, dust, and vibration barriers to reduce the level of disturbance • Establish a grievance mechanism • Conduct regular socialisation and consultation activities • Compensation will be on a case by case basis and agreed by both parties involved as per the LRP in the RP • Prioritise employment for interested local fish pond owners	Meindo	• Number of related grievances submitted • Evidence of consultation activities and records • Report on grievance close out • Number of fish pond cultivators employed by Project
6	Construction of the transmission line and substation	Local paddy owners and users along transmission line, substation and Cilamaya	Damage to paddy fields due to dust, waste disposal, flooding and other construction activities	• Apply appropriate flood barriers and dust suppression techniques • Socialise the grievance mechanism • Conduct regular socialisation and consultation activities • Compensation will be on a case by case basis and agreed by both parties involved • Prioritise employment for interested local farmers.	• Samsung • GE	• Number of related grievances submitted • Number of grievance mechanism socialisation activities • Evidence of consultation records • Consultation database • Report on grievance close out • Number of local famers employed by Project
7	Access road construction	Villagers in Cilamaya and Muara	Loss/restricted in access to fields due to access road construction activities	• Socialise the grievance mechanism • Conduct regular socialisation and consultation activities • Discuss with EPC and village head options to allow safe access through the construction works	Meindo	• Number of grievance mechanism socialisation activities • Evidence of consultation records • Consultation database • Evidence of consultation records
8	Presence of non-local workers	Local villages in close proximity to construction activities	Adverse interactions with non-local workers resulting in community resentment, increased use of alcohol, violence, sex workers, environmental contamination/pollution such as poor waste management etc.	• Compulsory medical examinations for Project workers • Training for all workers on the expected workforce behaviours • Conduct inductions and training refreshers on the Project's Code of Conduct • Provision of onsite health care • Implement a grievance mechanism	• JSP • Meindo, • Samsung • GE	• Evidence of medical records • Training materials • Workforce training logs • Induction training materials • Workforce induction logs • Evidence of worker acknowledgement of code of conduct • Onsite health clinic • Number of related grievances submitted
9	Presence of non-local workers	Non local workers	Poor working conditions at site and within accommodation facilities	• All workers will have a contract in place that adheres to Indonesian requirements that cites fair working terms and conditions, salary conditions, contract duration and worker rights. • All accommodation identified for use by construction workers comply with Indonesian, IFC and ILO standards i.e. safe structures, clean, and sanitary conditions, and easy access with separate arrangements for females and males; • Where large number of workers are involved transportation to and from the site is provided to manage congestion impacts; • Are impacts to the environment well managed i.e. proper disposal of wastes and effluents; • All workers have access to clean water for consumption and washing; • Appropriate H&S measures are in place such as access to a first aid kit, fire extinguishers and alarms and security; and	• JSP • Meindo, • Samsung • GE	• Worker contract records • Worker accommodation inspections • Community grievance records • Worker grievance records

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
				• All workers have access to a grievance mechanism.		
10	Project employment	Cilamaya village surrounding the power plant area	Influx resulting in increased pressure on infrastructure and services and creating social discontent	• Establish recruitment and employment plan • Establish a grievance mechanism • The Project to liaise with the local police and healthcare providers to ensure no additional pressure has been placed on them due to Project influx.	Samsung	• Recruitment and Employment Policy and Procedure • Number of local workforce employees • Number of related grievances submitted • Records of police and healthcare providers consultations
11	FSRU installation and laying of offshore pipelines	Local fishing folk from Blanakan and Muara	Health and safety impacts offshore associated with local fishing vessel incidents	• Coordinate with the relevant authorities i.e. to communicate Project shipping activities • Coordinate with Kantor Kesyahbandaran Tanjung Priok and Port Authority Class II in Tanjung Priok (and other key parties) regarding the pipe deployment plan • Ensure clear markings are in place (e.g. buoys and chase vessels) to identify restricted areas • Conduct consultation activities with the fishing groups to discuss restricted areas and H&S risks • Socialise the grievance mechanism • Establish an ERP and safety markers • Undertake formal safety studies	• JSR • Meindo	• Records of consultations • Number of grievance mechanism socialisation activities • Evidence of ERP • Evidence of ERP socialisation • Evidence of safety buoys/markers • EPC risk assessment studies
12	Project construction traffic	Local villages in close proximity to construction activities and residing along transportation routes	Traffic congestion and incidents with community members and other road users	• Consultation with the communities and roadside schools on key Project traffic routes • Traffic safety signs along transportation routes and hot spots • Undertake road improvements • Ensure all Project drivers are trained in safety awareness • Enforce speed limit regulations	• Meindo • Samsung • GE	• Records of consultations • Evidence of traffic safety signage • Evidence of road safety improvements • Safety awareness training materials Records of driver training sessions • Journey plan records
13	Construction of CCGT Power Plant	Cilamaya communities residing around power plant	Community health and safety impacts due to construction activities	• Consultation with the communities on upcoming Project activities • Post safety signs around the entrances • Grievance mechanism should be accessible to all	• Samsung • GE	• Records of consultations • Evidence of safety signage • Number of grievance mechanism socialisation activities • Number of related grievances submitted
14	Construction workforce demobilisation	Local communities residing near Project activities	Construction demobilisation and reduced local incomes	• The Project will inform the community about employment opportunities prior to operations • Where feasible the EPCs will provide local construction worker details to the Sponsors to optimise transfer of workers to the operations phase • The Project's grievance mechanism will be accessible for all communities • The Project will develop relevant community development activities for the impacted communities; coordinating with relevant authorities to prioritise local directly impacted communities to participate	• JSP • Meindo • Samsung • GE	• Construction demobilisation plan and socialisation • Socialisation records for operation employment opportunities • Number of grievance mechanism socialisation activities • Number of related grievances submitted • Community development plan • Consultation records associated with the CDP • Number of locals participating in the CSR activities

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
15	Construction of power plant, access road, jetty and pump house and transmission line and substation as well as offshore pipeline laying	Cultural Heritage (tangible and intangible)	Damage to cultural heritage or disruption to community festival (Nadran)	• Implement a Chance Find Procedure (CFP) in the event that cultural heritage is discovered. • Maintain close coordination with the fishing communities and village authorities (particularly Blanakan) to understand the schedule and agenda of the events and optimise the construction schedule to minimise the impact on the Nadran festival (such as avoiding working nearshore during the festival); • Socialise the offshore pipeline laying schedule to the community and the village authorities so they are well-informed about the potential risks and understand mitigation measures to take should any unexpected events occur during the event; and • Deploy adequate health and safety personnel during the event in a close coordination with security officers such as police and army if needed.	• EPCs	• Evidence of CFP in place • Consultations records of socialisation • Records or community grievances and close out

Table 12-3 Environmental Management and Monitoring during Operation

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
1	Workforce presence	Terrestrial biodiversity	Direct mortality to fauna and flora from hunting and poaching from the workforce and local residents	• A *Fauna Shepherding Protocol* (**Annex J)** is be used in the project area to ensure that any flora and fauna have vacated the area prior to any clearance work.	JSP	• Fencing in place • Records are to be kept and regularly reviewed (3 monthly basis) during construction on the application of the Fauna Shepherding Protocol.
2	CCGT Power Plant	Air Quality	Combustion of natural gas and deterioration of air quality (on Human Health)	• Stack height increase from 60m to 65m; **or** • NO_x emission concentration guaranteed reduction from 51mg/Nm^3 to 40mg/Nm^3. • Two Continuous stack emission monitoring (CEM) will be installed and operated throughout the operational lifetime of the Project to ensure that the NO_x emission concentration from the CCGT does not exceed 51mg/Nm^3 or the reduced guaranteed value of 40mg/Nm^3, whichever is confirmed by the Project; • Annual stack emission testing of NO_x emissions will be undertaken to counter check the performance of the emission monitoring system; • Installation of two continuous ambient NO_2 air quality and meteorological monitoring systems. One monitoring system will be positioned in the area where the maximum short-term ground level concentrations have been predicted based on detailed dispersion modelling. The second monitoring system will be located in an area representative of the true background so a differentiation can be made between background and potential impacts to air quality from the Project. The effectiveness of the monitoring program will be reviewed regularly.	JSP	• CEM records • Annual stack emission monitoring records • Ambient air quality monitoring records
3	CCGT Power Plant					
4	CCGT Power Plant	Air Quality	Deposition of salt (Sodium Chloride (NaCl)) on the surrounding plant and equipment	• It is recommended that all exposed surfaces be coated or painted to reduce corrosion from salt deposition. Regular maintenance of exposed surfaces is also required.	JSP	• Site inspection records.
5	CCGT Power Plant	GHG	Increased GHG Emissions (National and Global Level)	• Cold venting of gas directly to atmosphere will be avoided where possible. If significant quantities are emitted, the Project should consider flaring, as this converts the CH_4 to CO_2 and thereby reduces the net GHG emissions in terms of CO_2-e emissions.	JSP	• GHG Emissions inventory
6	CCGT Power Plant	Terrestrial biodiversity	Degradation of habitat from air emissions and runoff	• Mitigation measures are to be outlined within the Biodiversity Action Plan for the Project site.	JSP	• BAP in place and socialised to workforce.
7	Presence of CCGT, transmission lines, substation and roads	Landscape and Visual	Visual impact of activities and sites	• Landscaping and tree planting will be undertaken to either screen or significantly reduce the visual dominance through filtering. • For viewing locations where a high or un-acceptable level of visual impact may occur, landscape mitigation and screening would reduce these impacts. • Other measures such as colour and textural treatment of visible built structures will also be implemented.	• JSP	• Site inspection records.
8	Presence of non-local workers	Local villages in close proximity to construction activities	Adverse interactions with non-local workers resulting in community resentment, increased use of alcohol, violence, sex workers, environmental contamination/pollution such as poor waste management etc.	• Compulsory medical examinations for Project workers • Training for all workers on the expected workforce behaviours • Conduct inductions and training refreshers on the Project's Code of Conduct • Provision of onsite health care • Implement a grievance mechanism	• JSP • Meindo, • Samsung • GE	• Evidence of medical records • Training materials • Workforce training logs • Induction training materials • Workforce induction logs • Evidence of worker acknowledgement of code of conduct • Onsite health clinic • Number of related grievances submitted

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
9	Presence of non-local workers	Non local workers	Poor working conditions at site and within accommodation facilities	• All workers will have a contract in place that adheres to Indonesian requirements that cites fair working terms and conditions, salary conditions, contract duration and worker rights. • All accommodation identified for use by construction workers comply with Indonesian, IFC and ILO standards i.e. safe structures, clean, and sanitary conditions, and easy access with separate arrangements for females and males; • Where large number of workers are involved transportation to and from the site is provided to manage congestion impacts; • Are impacts to the environment well managed i.e. proper disposal of wastes and effluents; • All workers have access to clean water for consumption and washing; • Appropriate H&S measures are in place such as access to a first aid kit, fire extinguishers and alarms and security; and • All workers have access to a grievance mechanism.	• JSP • Meindo, • Samsung • GE	• Worker contract records • Worker accommodation inspections • Community grievance records • Worker grievance records
10	500 kV Transmission Line	Noise	Not applicable	It is noted that mitigation is limited to items 9) CCGT Power Plant and item 10) Cibatu Baru II/Sukatani Substation and as per the mitigation stated above. To avoid misunderstanding items 11 to 13 i.e. the 500 Kv transmission line noise and vibration, and Cibatu Baru II/Sukatani Substation vibration are listed here to specifically state that there are no further mitigation requirements based on the findings addressed in this impact assessment	-	-
11	500 kV Transmission Line	Vibration				
12	Cibatu Baru II/Sukatani Substation Operations	Vibration				
13	500 kV Transmission Line	Terrestrial Biodiversity	Direct mortality of avifauna along the transmission line due to strike during operation	Biodiversity Action Plan for the Project area to include: • Bird deflectors on the length of the power line. The deflectors will increase line visibility by thickening the appearance of the line for easier detection by avifauna. • Use moveable markers of contrasting colours (e.g. black and white) that protrude above and below the line, and be placed 5-10 m apart. • Removing the thin neutral or earth (shield) wire above the high voltage transmission lines where feasible, and where this is not possible, marking the line to make it more visible. • Minimising the vertical spread of power lines. Having lines in a horizontal plane reduces collision risk. • Habitat manipulation to influence flight activity and bird behaviour, e.g. tree lines under the high voltage lines to increase visibility. • Insulating cables close to poles, at least 70 cm on both sides and around perching areas, and up to at least 140cm. • Hanging insulators under cross arms and poles, provided the distance between a likely perch (mainly the crossarm) and the energised parts (conductors) is at least 70 cm.	JSP	• Site inspection records.
14	Vessel presence and movements	Marine Biodiversity	Direct mortality or injury of marine fauna from vessel movements	• Vessels will operate in accordance with standard maritime practices, whereby vessel speeds will be adjusted depending on environmental conditions (e.g., visibility, metocean condition) as required by the captain of the vessel and to avoid any encountered hazards. • Support vessels will not travel greater than 6 knots within 300m of a whale or 100m from a dolphin, if sighted, (i.e. will maintain a caution zone of those distances). • Vessels will approach no closer than 100m from a whale or 50m from a dolphin, if sighted. (Note this standard does not apply to support vessels engaged in limited/constrained manoeuvrability activities where vessel speed will already be low). Vessels will not directly approach a marine mammal from in front or behind their path of travel. • Vessel bridge crew to maintain visual watch of any hazards (including marine mammals).	• JSP • JSR	• Site inspection records. • Visual observation records.
15	FSRU Operations and	Marine biodiversity	Disturbance and displacement of marine fauna may occur from underwater noise	• The FSRU will be maintained in accordance with an inspection and maintenance schedule and procedure, which will reduce excessive noise	FSRU Operator	• Site inspection records.

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
	LNG Tanker Offloading			levels that may otherwise be produced by defective machinery and equipment.		
16	Seawater intake	Marine biodiversity	Impingement and subsequent entrainment of marine fauna, with can result in injury and mortality effects.	• Installation of mesh screens or equivalent to limit ingress of marine organisms including addressing the size and swimming ability of organisms.	JSP	• Site inspection records.
17	Waste management	Environmental Quality	Generation, handling, treatment and disposal of solid and liquid hazardous and non-hazardous wastes	• An induction regime for Project staff highlighting the waste management system and how wastes are to be managed on site. • Provide bins for the segregation and proper storage wastes to minimise the potential releases to the environment or contamination of other materials. • Segregate hazardous and non-hazardous waste and provide appropriate containers for the type of waste type (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimise odour nuisance). • Hazardous waste store should be segregated to avoid the co-storage of incompatible waste types. • Store wastes in closed containers away from direct sunlight, wind and rain and systematically to allow inspection between containers to monitor leaks or spills. • Ensure that storage areas have impermeable floors and secondary containment, of a capacity to accommodate 110% of the volume of the largest waste container. • Hazardous wastes will be disposed of by authorised third- party disposal contractors.	JSP	• Workforce induction records. • Site inspection records.
18	Waste management	Infrastructure	Pressure on existing waste management infrastructure	• WMP required detailing: • An inventory of the wastes anticipated by the Project. • Identification of the disposal routes the Project plans to use for its waste in the operation phase. • A programme of audit for the waste infrastructure and waste hauliers the Project intends to use. • Site rules for waste management including segregation, storage and packaging requirements for each waste type. • Mapping of waste facilities on site including distribution of waste receptacles at strategic locations aboard the FSRU, along the pipe line route, at the CCGT power station and the substation.	JSP	• WMP in place and socialised to workforce. • Site inspection records.
19	Wastewater discharge and runoff	Surface water	Deterioration of surface water quality.	• All drainage facilities and sediment control structures will be inspected on a regular basis and maintained to confirm proper and efficient operation at all times and particularly during rainstorms. • Deposited silt and grit will be removed regularly. The stormwater drainage system will be periodically inspected for blockage sand cleaned at least once before the monsoon season each year. • Measures will be taken to reduce the ingress of drainage into excavations. If trenches have to be excavated during the wet season or rainy conditions, they will be excavated and backfilled in short sections wherever practicable. Water will pumped out from trenches or foundation excavations will be discharged into storm drains via silt removal facilities. • Personnel will be trained to visually inspect discharged water quality for oil and grease traces (that will be visible on the surface) periodically and take appropriate corrective actions. • Control and monitoring systems will be used to alert the crew to leaks or any other potential risks.	JSP	• Site inspection records.

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
20	Wastewater and process cooling water discharges from the CCGT pipeline	Marine water	Reduction of marine water quality	• Wastewater and cooling water discharge will be conducted below the water surface, to increase dispersion. • Pipeline outlet structure to include a diffuser. • Monitoring of receiving water quality will be undertaken at the discharge location within three (3) months of operations commencing, and annually thereafter.	JSP	• Water monitoring data.
21	Waste water and process cooling water discharges from the FSRU and Vessels	Marine water	Reduction of marine water quality	• Monitoring of receiving water quality will be undertaken at the discharge location within 3 months of operations commencing, and annually thereafter. • Any potential exceedances in discharge standards will be addressed through corrective actions, which may include additional treatment or dilutions prior to discharge.	JSR	• Water monitoring data.
22	Jetty Presence	Marine Water Quality	Disturbance to coastal processes, sedimentation and reduction of water quality	• Conduct a detailed engineering design following Notice to Proceed (NTP) on the Project, which will include a sedimentation study to measure the sedimentation rate. Based on this and monitoring of the condition of the jetty and any sediment build up or localised erosion, corrective actions may be required. • The potential need for maintenance dredging (and associated management/mitigation) will be covered off in the Dredging Management Plan. • Monitoring plan which includes periodic monitoring for sediment accretion or erosion in the area of the jetty.	EPC	• Site inspection records.

Table 12-4 Social Management and Monitoring during Operation

No.	Activity/Aspect	Receptor	Potential Impacts	Mitigation	Mitigation & Implementation Responsibility	Monitoring
1	FSRU operation	Fisher folk in Blanakan and Muara villages	Health and safety of local fishing groups	• Development and socialisation of a marine facilities management plan • Consultation with fishermen on marine safety • Regular patrol to ensure the exclusion zones are clear from any activities prohibited by the law • Establish an ERP and safety markers to identify the exclusion zone areas • Undertake formal safety studies such as HAZOPs • Implement a grievance mechanism	JSR	• Records of consultations • Patrol logs • Evidence of ERP • Evidence of ERP socialisation • Evidence of safety buoys/markers • Operator safety studies • Number of grievance mechanism socialisation activities • Number of related grievances submitted
		Fisher folk in Blanakan and Muara villages	Loss of income due to restrictions and exclusion zone and operations of FSRU	• Monitor fishing incomes and catch based on fish survey results • Conduct regular socialisation and consultation activities • Ensure the Project's grievance mechanism is well socialised • Compensation will be on a case by case basis and agreed by both parties involved	JSR	• Records of consultations • Number of grievance mechanism socialisation activities • Number of related grievances submitted • Evidence of appropriate close out of grievance
2	CCGT Power Plant operation	Cilamaya village surrounding the power plant	Community health and safety in the event of an incident	• Conduct necessary safety studies to e.g. HAZOP to esure appropriate H&S measures are in place • Erect appropriate health and safety signage and limit access to authorised persons only • Conduct suitable training and inspections amongst all workers • Develop a community emergency response plan and socialise it to the relevant communities to ensure that the communities are aware about the safety risk and understand what to do in a case of emergency • Socialise the Project's grievance mechanism to the community to enable them submit grievances.	JSP	• Operator safety studies • Evidence of safety signage • Appropriate access gates in place • Provision of workforce access cards • Induction training materials • Workforce induction logs • Evidence of ERP • Evidence of ERP socialisation • Number of grievance mechanism socialisation activities • Number of related grievances submitted
3	Transmission Line operation	Local villages residing by CCGT and transmission line	Community health and safety resulting from EMF, noise and electrocution	• Conduct regular clearance of the clear zone to ensure the area is safe as required by the regulation; • Conduct regular checking/ maintenance to ensure the safe condition of the tower and the cable; • Ensure appropriate signage is erected at the substation and transmission line to educate the public on the potential dangers and hazards. • Conduct targeted consultations with the permanent household residents directly under the transmission line to discuss H&S mitigations in place; • Implement all H&S measures as specified in the regulations including earthing of buildings that are metal clad and directly below the transmission line; • Develop a community emergency response plan and socialise it to the relevant communities to ensure that the communities are aware about the safety risk and understand what to do in a case of emergency; • Undertake updates of the formal Safety Studies such as Hazard and Operability (HAZOP) Study, Safety Integrity Level (SIL) Study, etc., to make sure process hazards are well controlled; and • Conduct a series of H&S focussed consultation activities with the transmission line communities and schools to discuss the design, H&S management measures and their potential concerns and socialise the project's grievance mechanism to the community to enable them submit grievances.	JSP	• Inspection records of transmission cable • Evidence of ERP • Evidence of ERP socialisation • Number of grievance mechanism socialisation activities • Number of related grievances submitted

Table 12-5 Monitoring Plan during Construction and Operational Phases

Environmental Parameter	Aspect	Monitoring Activities	Frequency	Project Phase	Responsibility	Monitoring Location(s)	Method(s)	Applicable Standards
Air Quality	Exhaust emissions from vehicles	• Vehicle checklists. • Fuel usage record. • Annual maintenance record.	Daily	Construction Operations	EPC Contractors JSP in Operations	N/A	Manual	*IFC EHS General Guidelines* *IFC Performance Standard 1 and 3*
	Dust generation	• On-site and off-site physical inspections and reporting. • PM_{10} monitoring at sensitive receptors. • Community grievance records.	Daily	Construction	EPC Contractor	A minimum of two (2) fenceline monitoring locations upwind and downwind of the site, or at opposite sides of the site selected with regard to sources and receptors.	• Continuous automatic monitoring for duration of construction phase. • Aeroqual AQS1 air quality monitoring systems used during the baseline phase can be used for construction phase monitoring. The units should be serviced and managed in accordance with manufacturers recommendations	*Government Regulation of the Republic of Indonesia Number 41 (1999) regarding Air Pollution Control (PP41/1999)*
	Stack emissions	• Continuous Monitoring Emissions Systems (CEMS) records to measure NOx, O2 and moisture (%) content. • Annual stack emission testing of NOx to confirm and support findings from CEMS,	Continuous	Operation	JSP EHS Manager	In stack	• Continuous stack emission monitoring with CEMS • Annual stack testing	• *International Finance Corporation (IFC) (2007) Environmental, Health and Safety Guidelines for Thermal Power Plantt; and* • *Regulation of the Minister of Environment Number 21 of 2008 Regarding Emission Standard for Stationary Sources from Thermal Power Generation Business and/or activities.*
	Ambient Air quality	• Ambient air quality monitoring • Meteorological monitoring	Continuously	Operation	JSP EHS Manager	A minimum of two offsite monitoring locations selected with regard to the air quality impact assessment results and positioned at sensitive human receptors	• Continuous automatic monitoring for duration of operation phase unless alternative program is developed i.e. local government monitoring network; and • Aeroqual AQS1 air quality monitoring systems used during the baseline phase can be used for operational	• *International Finance Corporation (IFC) (2007) Environmental, Health and Safety Guidelines for Thermal Power Plants; and* • *Government Regulation of the Republic of Indonesia Number 41 (1999) regarding Air Pollution Control (PP41/1999).*

Environmental Parameter	Aspect	Monitoring Activities	Frequency	Project Phase	Responsibility	Monitoring Location(s)	Method(s)	Applicable Standards
							phase monitoring. The units should be serviced and managed in accordance with manufacturers recommendations.	
GHG	Operational GHG emissions	• JSP will prepare an GHG emission inventory to quantify direct emissions from the Project as well as indirect emissions associated with the off-site production of energy • http://www.ghgprotocol.org/. Annual GHG reporting will be made available upon request to appropriate parties	Annually	Operation	JSP EHS Manager	CCGT Power Plant	Evaluation of the following: • Scope 1 Emissions: direct emissions from the CCGT Power Plant facilities within the physical project boundary; and • Scope 2 Emissions: indirect emissions associated with the project's use of energy but occurring outside the project boundary	*International Finance Corporation (IFC) Performance Standards (PS) 3 – Resource Efficiency and Pollution Prevention*
Terrestrial Biodiversity	Flora and Fauna	• Checkpoints in place. • Vehicle entry and inspection record. • Driver training record. • Workforce induction program includes anti-poaching and code of conduct. • Fauna Shepherding protocol in place and socialised to workers. • Fences in place. • Evidence of community awareness raising activities. • Worker training record. • Biodiversity Action Plan developed by JSP and being implemented.	Daily Monthly/As required before tasks following induction	Construction Operations	EPC Contractor and JSP during operations	All construction areas	N/A	*IFC Performance Standard 1 and 6*
	Loss/Degradation of Habitat	• Regular checks during construction are to occur along all project boundaries to ensure compliance with clearing within marked boundaries. • Records are to be kept and regularly reviewed) for implementation of the workforce training program for fauna/flora awareness. • Records are to be kept and regularly reviewed of all personnel entering and exiting the project area through checkpoints, including results of all random inspections undertaken for poached flora/fauna. • Monitoring if rehabilitation success/failure is to occur on all replanting sites. Monitoring is to consist of regular inspections to determine plant establishment. Where plant establishment is determined to have failed, reestablishment is to occur. • A regular social engagement survey is to occur to gauge the socialisation of conservation measures, including the coastal revegetation program.	Weekly Quarterly Annual	Construction	EPC Contractor	All construction areas	N/A	*IFC Performance Standard 1 and 6*
	Fragmentation of habitat, or permanent /temporary	• Records are to be kept and regularly reviewed (three (3) monthly basis) during construction on the application of the fencing and hoarding implementation.	Quarterly	Construction	EPC Contractor	All construction areas	N/A	*IFC Performance Standard 1 and 6*

Environmental Parameter	Aspect	Monitoring Activities	Frequency	Project Phase	Responsibility	Monitoring Location(s)	Method(s)	Applicable Standards
	severance of wildlife corridors	• Regular inspections (weekly during construction) during the dry season to determine the level of dust deposition on vegetation surrounding the Project Area. Where excessive dust on vegetation is identified, and rain is not forecast within the next five (5) days, vegetation should be washed using a water truck. • Records are to be kept and regularly reviewed (three (3) monthly basis) on the planting of indigenous flora and fauna on disturbed areas. • Monitoring if rehabilitation success/failure is to occur on all replanting sites. Monitoring is to consist of regular inspections (three (3) monthly) to determine plant establishment. Where plant establishment is determined to have failed, reestablishment is to occur.						
	Air emissions	• Site inspection records. • Biodiversity Action Plan review. • Records are to be kept and regularly reviewed (three (3) monthly basis) during construction on the application on the implementation of the Sediment and Erosion Control Plan. • Records are to be kept and regularly reviewed (three (3) monthly basis) during construction on the application on the implementation of the Invasive Species Management Plan. Monitoring is to include inspections of the site on a monthly basis during construction in areas of natural habitat to identify and eradicate any invasive species.	Daily Quarterly	Construction Operations	EPC Contractors JSP EHS Manager in Operations	All construction areas	N/A	*IFC Performance Standard 1 and 6*
	Invasive Species	• Invasive Species Management Plan in place and socialised to workforce. • Site inspection records. • Planting proliferation and growth assessment.	As required based on inductions Daily Bi annually	Construction	EPC Contractor	Areas of Natural Habitat	N/A	*IFC Performance Standard 1 and 6*
Noise	General construction noise	• Noise compliance monitoring will be conducted during the construction phase of the project targeting the key noise generating activities. Monitoring will be conducted at locations N-1 to N-5. • Monitoring may also occur at other locations where those receptors are identified to be the closest and/or potentially most affected receptors situated within the potential area of influence of the works and activities being undertaken at the time the monitoring is being conducted. • The noise compliance monitoring will be conducted to measure LAeq, 1 hour noise levels (as per IFC 1.7 Noise) associated with the site, with the site noise level contribution determined in the absence of any influential sources not associated with the project. The frequency e.g. daily, weekly, or monthly etc of the monitoring will be established based on the works and activities occurring throughout the overall construction schedule; however monthly monitoring will occur as a minimum equipment noise level register; • Monitor noise levels after erecting noise barriers and deflectors to make sure the barriers are well designed; and • Ensure sure piling and high noise generating activities are limited to the period between 7am and 10pm only.	Monthly	Construction	EPC Contractor and JSP EHS Manager during operations	• Noise compliance monitoring will be conducted during the construction phase of the project targeting the key noise generating activities. • Monitoring will be conducted at locations N-1 to N-5 as identified in the *Annex A* acoustics assessment, which is where baseline noise levels have been directly measured. • Monitoring may also occur at	• The noise compliance monitoring will be conducted to measure LAeq, one (1) hour noise levels (as per IFC 1.7 Noise) associated with the site, with the site noise level contribution determined in the absence of any influential sources not associated with the Project. • The frequency e.g. daily, weekly, or monthly etc of the monitoring will be established based on the works and activities occurring throughout the	*IFC - Environmental, Health and Safety (EHS) Guidelines - General EHS Guidelines: Environmental Noise Management, Section 1.7 Noise (IFC 1.7 Noise), dated 30 April 2007*

Environmental Parameter	Aspect	Monitoring Activities	Frequency	Project Phase	Responsibility	Monitoring Location(s)	Method(s)	Applicable Standards
	Noise nuisance on sensitive receivers	• Monitor noise levels at sensitive receptors surrounding the power plant and jetty area including housing along the boundary perimeter, school and mosque and main transportation route; and • Number of community grievances submitted related to noise.	Monthly	Construction and Operation	EPC Contractor	other locations where those receptors are identified to be the closest and/or potentially most affected receptors situated within the potential area of influence of the works and activities being undertaken at the time the monitoring is being conducted.	overall construction schedule; however monthly monitoring will occur as a minimum.	
Soil	Erosion and loss of top soil.	• Site inspection records.	Monthly	Construction	EPC Contractor	Maintaining the baseline sampling locations	Primary data collection through observation and recording of soil erosion and surface run-off in nearby river bodies	Neither local Indonesian regulations nor the IFC does not establish limits/standards for soil quality. However, IFC General EHS Guidelines provides a summary of management approaches for land contamination due to anthropogenic releases of hazardous materials, waste or oil.
	Accidental spills and leaks of fuel	Prevention of spills and leaks require vigilant checking on a regular basis. This includes: • Regular maintenance of equipment and facilities • Daily inspection of fuelling equipment, fuel pumps, valves • Install floats inside fuel oil tank to prevent evaporation • Build a bund to surround the gasoline and chemical storage areas and underline with a tank to collect potential spills/leaks • Conducting a systematic check twice a year for faults/cracks of the storage tanks • In case cracks/faults are found in tanks, quickly remove the tank, drain away all fuel oil and send them to specialised service providers for repair.	Daily (unless specified otherwise)	Construction and Operation	EPC Contractor during Construction and JSP EHS Manager during Operation	At and around the location of accidental release	Primary data collection through observation and recording of soil quality	
	Emergency Response to accidental spills and leaks	• Develop a site specific Emergency Response Plan for water and soil clean-up and decontamination. • Should a long-term accidental spill be detected, monitoring of potentially affected flora and fauna/ wildlife should also be set up to minimise the indirect impacts on these receptors.	Before Construction and Operation	Construction and Operation	EPC Contractor during Construction and JSP EHS Manager during Operation	Maintaining the baseline sampling locations	Primary data collection through observation and recording of soil quality	
	Accidental spills on soil	After each accidental release, soil sampling should be taken at and around the location of release. Number of samples depends on the scale of the release and the estimated impacted area. Parameters include: • Metals; • Volatile organic compounds; • Semi volatile compounds; and • Total petroleum hydrocarbon. Depths of samples should be at ground surface and immediately above groundwater table.	Depends on the scale of the release (large spill, more samplings are needed)	Construction and Operation	EPC Contractor during Construction and JSP EHS Manager during Operation	At and around the location of accidental release	Primary data collection through observation and recording of soil quality	

Environmental Parameter	Aspect	Monitoring Activities	Frequency	Project Phase	Responsibility	Monitoring Location(s)	Method(s)	Applicable Standards
Ground Water	Acid Sulphate Soil impacts	• ASS Management Plan; • ASS test results prior to excavation works in coastal areas; • Soil and Surface Water Monitoring; and • Site inspection records. Parameters include: • pH, Chloride, Sulfate and Organic content • other Physical-Chemical characteristics particularly TDS and Potassium Permanganate; and • Microbiological characteristics i.e. Total Coliform and Faecal Coliform	Monthly	Construction	EPC Contractor	Maintaining the baseline sampling locations and additional locations surrounding the proposed nearshore facilities i.e. Jetty and onshore pipelines.	All field tests shall be carried out in accordance to the ASTM standards. This includes: • Acidity/alkalinity (pH) test: ASTM D 1293 • Sulfur trioxide content test : ASTM D 516; • Chloride content test: ASTM D 516; and • Carbonate content test : ASTM D 1888	• *Ministry of Health, Government of Indonesia Regulation No. 32 Year 2017 regarding Environmental-Health Standards and Water-Quality Requirements for Hygiene Sanitation, Swimming Pools, Spas and Public Bath (Appendix I on Water for Sanitary Hygiene Standards) (a new regulation replacing MoH 416/1990)*; and • *Government of Indonesia Regulation No. 101 Year 2014 regarding Hazardous and Toxic Waste Management (Appendix V on Quality Standard of Toxic Characteristic for the Contaminated Soil Management).*
Surface Water	Surface Water quality	• Construction Environment Management Plan in place and socialised to workers; • Sediment Control Plan in place and socialised to workers; • Site inspection records; and • Chemical inventory for hydrotest water. Parameters for Surface Water Quality include: • Physical-Chemical characteristics, particularly BOD5, COD, TSS, Dissolved Oxygen, Nitrite, Mercury, Copper, Zinc, Sulfide; • Microbiological characteristics i.e. Faecal Coliform and Total Coliform; and • Plankton Type Parameters for Sediment Quality include Mercury, Cadmium, Lead and Zinc.	Monthly	Construction and Operation	EPC Contractor during Construction and JSP EHS Manager during Operation	Maintaining the baseline sampling locations	• Sampling method shall be aligned with the *Standard Nasional Indonesia SNI 6.989, 57: 2008* regarding Method for Surface Water Sampling; and • Before samples are taken, information such as sample code, date, and time of sampling will be noted in CoC (Chain of Custody) paper, including parameters that will be analysed.	• *Government of Indonesia Regulation No. 82 Year 2014 regarding Management of Water Quality and Control on Water Pollution* (for Water Quality); and • *Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, 2001* (for Sediment) • *IFC Performance Standard 1* • *IFC EHS General Guidelines*
Marine Biodiversity	Direct loss and degradation of marine habitats and water quality	• Vessel inspection. • Dredging management plan (including the potential need for maintenance dredging (and associated management/mitigation).	Monthly	Construction	EPC Contractor	The Nearshore area surrounding the Jetty area adjusted to the baseline sampling area i.e. the Water Area Around the Jetty and along the offshore pipeline.	Conduct monitoring of TSS parameters in aquatic environment around pipe deployment location	• *Decree of Environmental Ministry No. 51/2004 in Appendix III.* • *IFC EHS Guidelines for Ports, Harbours and Terminals, 2017* • *IFC Performance Standard 1 and 3*
	Direct mortality, injury or disturbance of marine fauna	• Training records for vessel personnel. • Marine mammal observation forms. • Documentation on pre-start procedure. • MMOs and PAMs present. • Marine mammal observation forms. • Site inspection records	Monthly	Construction	EPC Contractor	Maintaining the baseline sampling locations and surrounding the FSRU location, along the offshore pipeline	Marine mammals survey	*IFC Performance Standard 1*

Environmental Parameter	Aspect	Monitoring Activities	Frequency	Project Phase	Responsibility	Monitoring Location(s)	Method(s)	Applicable Standards
						and nearshore facilities.		
	Introduction of invasive species	• Vessel inspection record. • Ballast water management plan in place. • Ballast water discharge record.	Monthly	Installation and Operations	EPC Contractor/JSR during operations	Maintaining the baseline sampling locations and surrounding the FSRU location.	• Marine water and sediment quality and plankton sampling; • The marine water shall be sampled using Van Dorn Sampler/ Niskin Bottle; • Plankton sampling, then analysed in the laboratory to find out the plankton community index (diversity/H', uniformity/S and dominance/D).	*International Convention for the Control and Management of Ships' Ballast Water and Sediments*
	Marine water quality	• Chemical inventory for hydrotest water. • Water monitoring data. • Monitoring for sediment accretion or erosion in the area of the jetty.	One off	Construction	EPC Contractor JSR	Maintaining the baseline sampling locations.		• *Decree of Environmental Ministry No. 51/2004 in Appendix III.* • *ANZECC/ARMANZ 2000.* • *IFC Performance Standard 1 and 3* • *IFC EHS Guidelines for Ports, Harbours and Terminals, 2017*
Waste	Waste generation, disposal and reuse	• A waste management plan will be developed to monitor the implementation and achievement of the Construction Waste Management Plan and Operation Waste Management Plan on site and assess their effectiveness • Site inspection records. • Audit reports and credentials of waste disposal contractors and facilities	One off Daily Quarterly	Construction	EPC Contractor	At all construction waste storage and disposal sites	• Monitor compliance with waste management plan; • Record amount of waste generated in Waste Register based on the type and characteristics including collection & disposal activities by the licensed third-parties; • Visual Inspection of safe waste handling and waste storage for evidence of accidental releaseas and to verify that wastes are properly labelled and stored; • Regular monitoring of groundwater quality in cases of Hazardous Waste on-site storage abd disposal; and • Descriptive data analysis of the recorded waste.	Refer to *Annex F* *IFC Performance Standard 3* *IFC EHS General Guidelines*
	Waste generation, disposal and reuse	• Ensure wastes are being handled, collected, stored and transferred and disposed of in compliance with the relevant local regulations; • Ensure the waste management programme, in particular, the environmental mitigation measures, are being implemented properly and effectively; • Audit waste handling, recycling, and disposal procedures during the operation of the project. • Records of waste reduced, reused and recycled will be reviewed during the audit.	Annual	Operation	JSP EHS Manager	At all designated storage and disposal sites within CCGT Power Plant and Jetty		
Visual	Visual impact of site	• Site inspection records.	Monthly	Construction	EPC contractor	At all sensitive visual receptors i.e.	• Incorporate community input	*Guidelines for Landscape and Visual Impact Assessment*

Environmental Parameter	Aspect	Monitoring Activities	Frequency	Project Phase	Responsibility	Monitoring Location(s)	Method(s)	Applicable Standards
						settlements, residential areas, within the proximity of Project facilities	and communicate with stakeholders about projected plans by means of Public Meetings and Engagements.	*(GLVIA)* *IFC Performance Standard 1*
Socio Economic	Loss of income from land acquisition	• Number of resettlement related grievances submitted • Number of land owners and users employed by Project • Number of land owners and users participating in the Project's CSR and LRP • Evidence of consultation activities and records • Consultation database developed • Evidence of new fish ponds established • Consultation records with fish pond cultivators	Monthly	Construction	JSP Community Relations Manager	Muara Village, Cilamaya Subdistrict, Karawang Regency	• Primary data collection through direct survey to the community of land owners; • Secondary data collection through relevant local authorities; • Stakeholder Engagement; • Grievance Mechanism.	*IFC Performance Standard 1 and 5*
	Loss of income due to fishing exclusion zones	• Evidence of consultation records • Map of fishing activities • Number of grievances submitted • Number of local fishermen participating in the Project	Monthly	Construction Operations	JSP/JSR Community Relations Manager	Fisherman Villages around the FSRU i.e. Belanakan Village of Belanakan subdistrict and Muara Village, Cilamaya Wetan Subdistrict.	• Fish Catch Assessment and Fishing Survey; • Interviews with fishing communities regarding disruption of fishing activities; • Observing fisheries activities around the Exclusion Zones during construction and operational phases; and • Record incidents of fisheries disruption occurred and actions taken	*IFC Performance Standard 1 and 5*
	Local employment	• Evidence of consultation activities and records • Consultation database • Evidence of consultation activities and records • Number of related grievances submitted • Evidence of EPC local content commitments • EPC Local Recruitment Policy	Monthly	Construction	JSP Community Relations Manager and EPC contractors	At 39 villages directly affected by the Project in Karawang Regency, Bekasi Regency and Subang Regency	• Stakeholder Engagement; • Primary data collection in the form of income data of communities affected through surveys and interviews; and • Secondary data from relevant local authorities.	*IFC Performance Standard 1 4*
	Workforce demobilisation	• Construction demobilisation plan and socialisation • Socialisation records for operation employment opportunities	Monthly	Construction	JSP Community Relations Manager and EPC contractors	All Construction area and workforce camps	• Inspection and interview of with workforce; and	*IFC Performance Standard 2*

Environmental Parameter	Aspect	Monitoring Activities	Frequency	Project Phase	Responsibility	Monitoring Location(s)	Method(s)	Applicable Standards
		• Worker grievance mechanism socialisation activities • Number of related grievances submitted • Consultation records associated with the CDP • Number of locals participating in the CDP					• Workers Grievance Mechanism.	
	Damage to lands, crops, fish ponds and equipment	• Number of related grievances submitted • Evidence of consultation activities and records • Report on grievance close out	Monthly	Construction	JSP Community Relations Manager and contractor	All Construction area	• Fish Catch Assessment; • Soil sampling at the Agricultural area at a minimum three (3) locations within two (2) km within the vicinity; • Stakeholder Engagement; and • Community Grievance Mechanism.	*IFC Performance Standard 1*
	Workforce Management	• Worker management plan in place • Worker induction and training logs • Number of related grievances submitted	As required	Construction	EPC contractor	All Construction area and workforce camps	• Inspection and interview of with workforce; and • Workers Grievance Mechanism.	*IFC Performance Standard 1 and 4*
	Workforce Working and Living Conditions	• Worker contract records • Worker accommodation inspections • Community grievance records • Worker grievance records	Monthly	Construction	EPC contractor			*IFC Performance Standard 2*
	Influx	• Recruitment and Employment Policy and Procedure • Number of local workforce employees • Number of related grievances submitted • Records of police and healthcare providers consultations	Quarterly	Construction	EPC contractor	All Construction area	• Stakeholder Engagement; and • Community Grievance mechanism	*IFC Performance Standard 1*
	Cultural Heritage	• Evidence of CFP in place • Socialization records during Nadran	Annually	Construction	EPC contractor	NA	• Stakeholder Engagement; and • Community Grievance mechanism	*IFC Performance Standard 8*
	Community H&S	• Records of consultations • Number of grievance mechanism socialisation activities • Evidence of ERP and socialisation • Evidence of safety buoys/markers • EPC risk assessment studies • Evidence of traffic safety signage • Evidence of road safety improvements • Safety awareness training materials • Records of driver training sessions • Journey plan records • Inspection records of transmission cable	Monthly	Construction Operations	EPC contractor JSP Community Relations Manager	At 39 villages directly affected by the Project in Karawang Regency, Bekasi Regency and Subang Regency	• Stakeholder Engagement; • Secondary data from relevant local authorities e.g. local clinics and hospitals; • Make observations in the field including inspections on the the signages and lights installed • Community Grievance Mechanism	*IFC Performance Standard 1 and 4*

12.9 DEVELOPMENT OF THE ESMS

These management plans will form one element of the Project's environmental and social management system (ESMS). **Figure 12-7** presents the nine (9) elements of the Project's proposed ESMS including this ESIA, SEP and grievance mechanism.

Figure 12-7 Elements of the Environmental and Social Management System

Source: IFC, 2015

The Project has already commenced a number of the element of the ESMS including:

- Identification of the Project's potential environmental and community impacts in the AMDAL and ESIA documents;
- Development of the ESMP Chapter (in this ESIA) and the RKL RPL (Annex O);
- Development and implementation of the SEP (**Annex C**) with the project impacted communities. It will be important for the Project to continue implementation of the SEP prior to, during construction and operations;
- Development, disclosure and implementation of the Project's grievance mechanism as set out in the SEP;

- Ongoing consultation with the Projects land owners, village leaders and local community through formal consultations; and

- Identification and recruitment of personnel to support the implementation of the ESMS.

The Project and its EPCs has drafted the overall ESMP and ESMS for construction will continue to develop the additional management plans as set out in this chapter, continue engaging with its key stakeholders around the project, its impacts and mitigation measures whilst addressing grievances submitted.

During construction activities, the project will undertake monitoring activities as set out in Table 12-5 to oversee the implementation of the Project's environmental and social commitments.

12.9.1 Monitoring and Verification

The ADB's SPS Appendix 1 sets out expectation on monitoring of the Project during construction and operations, specifically its states:

"The borrower/client will monitor and measure the progress of implementation of the EMP. The extent of monitoring activities will be commensurate with the project's risks and impacts. In addition to recording information to track performance, the borrower/client will undertake inspections to verify compliance with the EMP and progress toward the expected outcomes…"The borrower/client will prepare periodic monitoring reports that describe progress with implementation of the EMP and compliance issues and corrective actions, if any. The borrower/client will submit at least semi-annual monitoring reports during construction for projects likely to have significant adverse environmental impacts…"For projects likely to have significant adverse environmental impacts during operation, reporting will continue at the minimum on an annual basis. Such periodic reports will be posted in a location accessible to the public."

In the case of this Project, given it is a Category A for environment, an independent monitor is required. This will be undertaken by an independent Lenders' Environmental and Social Consultant (LESC) with the appropriate environmental and social monitoring qualifications. The role of the LESC will be to review and verify the implementation of the Project's ESMP and related documents and management plans prepared by JSP and its EPCs.

This activity is typically bi annually during construction and annually during operation, for the duration of the project. The monitoring involves a data review period followed by a site visit where interviews are conducted with site managers and workers as well as local communities and government agencies as well as a site walk over (sub station, transmission line, power plant, right of way and jetty and pump house areas). Audits may also be undertaken on a needs basis if required to investigate a specific issue.

JST is responsible for ensuring that all EPC contractors are complying with the applicable H&S and E&S requirements.

Monitoring is a means to verifying the overall effectiveness of the management and mitigation measures contained within the management plans set out in the previous tables. The key objectives to monitoring are to:

- Confirm effectiveness of management and mitigation measures;
- Ensure compliance with Applicable Standards (i.e. national, ADB SPS, IFC Performance Standards, EHS Guidelines, JBIC and NEXI Guidelines and the EP III). For the applicable standards, refer to **Table 12-6**;
- To inform the Sponsors/EPCs of ineffective mitigations allowing an opportunity for adjustment;
- Determine whether environmental and social changes are attributable to Project activities, or as a result of external Project activities; and
- Provide a basis for continual review and improvements to Project design and execution.

Impact monitoring will also be undertaken during the life of the Project to verify the predicted levels of residual impacts from the Project and the effectiveness of the various management plans.

A robust reporting system will provide the Project with the necessary feedback mechanisms to ensure quality and timely implementation of the ESMP.

Reporting will be required for AMDAL compliance (quarterly RKL RPL reporting) to the MOEF as well as the Lenders' compliance activities discussed previously. This will typically be associated with Lender audits and the implementation not only of the ESMPs but the follow on Equator Principle Action Plan (EPAP) or Environmental and Social Action Plan (ESAP) developed by the Lenders' environmental and social advisors following the first monitoring audit prior to financial close.

Reporting will provide a mechanism to ensure that the measures proposed in the RKL RPL and the ESMP are well implemented.

Prior to the commencement of the construction activities, the Sponsors will finalise the format and frequency for reporting on the status and progress of environmental and social monitoring. The EPCs will be required to provide relevant EHS and community data to the Sponsors in a timely manner to enable the Sponsors to conduct the necessary reporting.

Table 12-6 Applicable Standards for Monitoring Activities

Receptor	Applicable Standards
Soil	Neither local Indonesian regulations nor the IFC does not establish standards for soil quality standards.
Groundwater	• *Ministry of Health, Government of Indonesia Regulation No. 32 Year 2017 regarding Environmental-Health Standards and Water-Quality Requirements for Hygiene Sanitation, Swimming Pools, Spas and Public Bath (Appendix I on Water for Sanitary Hygiene Standards) (a new regulation replacing MoH 416/1990);* and • *Government of Indonesia Regulation No. 101 Year 2014 regarding Hazardous and Toxic Waste Management (Appendix V on Quality Standard of Toxic Characteristic for the Contaminated Soil Management).*
Surface water	• *Government of Indonesia Regulation No. 82 Year 2014 regarding Management of Water Quality and Control on Water Pollution*
Air Quality	• *IFC Guideline for Thermal Power Plant (2008) Table 7 - Typical Air Emission Monitoring Parameters / Frequency for Thermal Power Plants* • *Ministry of Environment Regulation No. 21 of 2008 on Quality Standard of Immobile Source Emission for Business and/or Thermal Power Plant Activity for the emission stack* for Thermal Power Plant • *Peraturan Menteri Negara Lingkungan Hidup Nomor 13 Tahun 2009 Tentang Baku Mutu Emisi Sumber Tidak Bergerak Bagi Usaha Dan/Atau Kegiatan Minyak Dan Gas Bumi* for Generators; • *MARPOL 73/78 Annex VI - Regulations for the Prevention of Air Pollution from Ships* for the Vessel Operation*;* • *Keputusan Menteri Negara Lingkungan Hidup No. 13 Tahun 1995 Tentang : Baku Mutu Emisi Sumber Tidak Bergerak* for stationary sources; and • *Peraturan Menteri Lingkungan Hidup dan Kehutanan No. P.20/ MENLHK/ SETJEN/ KUM.1/3/ 2017 tentang Baku Mutu Emisi Gas Buang Kendaraan Bermotor Tipe Baru Kategori M, N, dan kategori O)* for the Land Transportations/Vehicles.
Noise	• *IFC - Environmental, Health and Safety (EHS) Guidelines - General EHS Guidelines: Environmental Noise Management, Section 1.7 Noise (IFC 1.7 Noise), dated 30 April 2007*
EMF	• *Standard Nasional Indonesia (SNI) 04-6950-2003 regarding the High Voltage Transmission (SUTT) and Extra High Voltage Transmission (SUTET) – Electromagnetic Fields Standards*; and • *International Commission on Non-Ionising Radiation Protection (ICNIRP)*
Marine Water Quality	• *Decree of Environmental Ministry No. 51/2004 in Appendix III*
Marine Sediment Quality	• *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMANZ 2000).*

12.10 BUDGET

The implementation responsibility and estimated budgets for each required management plan (where available) are provided in **Table 12-7**. The management plans to be implemented during construction by the EPCs will be established before implementation of each management plan; whereby commitments have been made in to adhere to the Applicable Standards and mitigations set out in this ESIA. As such **Table 12-7** only sets out additional costs to be incurred by JSP.

The below estimates include budgets for resources and equipment to implement the ESMP as well as conduct training, environmental and social monitoring, analysis and reporting.

Table 12-7 ESMP Implementation Responsibilities and Estimated Costs

No.	Management Plan	Responsible Party	Estimated Budget (USD)
Environment			
1	Air Quality Management Plan	EPCs	Under EPCs' Contract
2	Biodiversity Action Plan	JSP	~$30,000
3	Chance Finds Procedure	EPCs	Under EPCs' Contract
4	Acoustics and Vibration Plan	EPCs	Under EPCs' Contract
5	Oil & Chemical Spill Contingency Plan	EPCs	Under EPCs' Contract
6	Vehicle Management & Maintenance Plan	EPCs	Under EPCs' Contract
7	Soil & Groundwater Management Plan	EPCs	Under EPCs' Contract
8	Surface Water Management Plan	EPCs	Under EPCs' Contract
9	Traffic Management Plan	EPCs	Under EPCs' Contract
10	Waste Management Plan	EPCs	Under EPCs' Contract
Social			
11	Local Recruitment & Hiring Plan	EPCs & JSP (Operations)	Under EPCs' Contract
12	Stakeholder Engagement Plan	JSP	~500,000
13	Land Acquisition and Resettlement Plan	JSP	~25,000,000
14	Grievance Management and Compensation	EPCs	Under EPCs' Contract
15	Livelihood Restoration Plan	JSP	~625,000
Health and Safety			
16	Emergency Response Plan	EPCs & JSP (operations)	Under EPCs' Contract
17	Community H&S Plan	EPCs & JSP (operations)	Under EPCs' Contract
18	Occupational H&S Management Plan	EPCs & JSP (operations)	Under EPCs' Contract
19	Security Plan	EPCs & JSP (operations)	Under EPCs' Contract
20	Worker Training Plan	EPCs & JSP (operations)	Under EPCs' Contract
21	Worker Accommodation & Management Plan	EPCs & JSP (operations)	Under EPCs' Contract
Data Management and Reporting			
22	Environmental and Social Management System	JSP	~250,000
23	Environmental and Social Monitoring Plan	JSP	~2,000,000
	TOTAL (JSP)	**JSP**	**~283,750,000**

Note: Estimates for JSP for 25 years

- JSP operational costs will be confirmed prior to FC

12.11 UPDATING OF ESMP

This ESMP will be updated, revised and reviewed internally on regular basis to ensure the management plans remain relevant and are effectively mitigating the risks set out in this ESIA.

The ESMP will be monitored and reviewed on a bi annual basis. Furthermore, in the event of an unforeseen impact and design change with respect to the Project Standards (including the Indonesian Government, ADB and IFC requirements), the ESMP would be updated as necessary.

13 REFERENCE AND BIBLIOGRAPHY

(Bakosurtanal, 2009) Peta Mangroves Indonesia. Pusat Survey Sumberdaya Alam Laut. Badan Koordinasi Survey dan Pemetaan Nasional. Bakosurtanal, Indonesian Geospatial Information Agency, Jakarta (2009)
Online at:
http://www.big.go.id/assets/download/BUKU%2040%20TAHUN%20BAKOSURTANAL.pdf. Accessed on 6th February 2018.

(*CDIAC, 2018*) Carbon Dioxide Information Analysis Centre – Fossil Fuel Emissions.
Online at:
http://cdiac.ess-dive.lbl.gov/trends/emis/meth_reg.html. Accessed on Data retrieved 22nd of February 2018.

(*EU, 2008*) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe.
Online at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0050&from=EN. Accessed on 1st of February 2018.

(Ellison, 2003) Ellision, J. Climate change and sea level rise impacts on mangrove ecosystems (2003)
Online at:
https://www.researchgate.net/publication/228596763_Climate_change_and_sea_level_rise_impacts_on_mangrove_ecosystems. Accessed on 6th of February 2018.

(ERM, 2018a) PLTGU Jawa 1 Independent Power Project - Integrated Environmental and Social Impact Assessment (ESIA) Scoping Report (in Draft).

(ERM, 2018b) Laporan Analisis Mengenai Dampak Linkungan (ANDAL) - Pembangunan Pembangkit Listrik Tenaga Gas Uap (PLTGU) Kapasitas 1.760 MW, Jaringan Transmisi, Pipa Gas, Pipa Air Pendingin, Rumah Pompa, Jetty, serta Fasilitas Terapung dan Unit Regasifikasi Secara Terintegrasi di Kabupaten Karawang dan Kabupaten Bekasi, Provinsi Jawa Barat (in Draft), 2018.

(ERM, 2018c) PLTGU Jawa 1 Independent Power Project - Integrated Environmental and Social Impact Assessment (ESIA) - Additional Baseline Surveys for ESIA, January 2018.

(ERM, 2018d) PLTGU Jawa 1 Independent Power Project - Final Stakeholder Engagement Plan (SEP) (2018)

(ERM, 2015) The ERM Impact Assessment Standard (2015)

(GE, 2018) EPC Workshop conducted at MCC Marubeni Indonesia on 14th of February 2018

(GE, 2017) Data Request received by e-mail on 7th of February 2018.

(Hidayat et al., 2017) Hidayat,T., Kusmana,C.,Tiryana, T. Species composition and structure of secondary mangrove forest in Rawa Timur, Central Java, Indonesia (2017).
Online at: http://www.bioflux.com.ro/docs/2017.675-686.pdf. Accessed on 6th February 2018

(IEE,2016) Initial Environmental Examination Report (2016).

(IFC, 2017a) World Bank Group (WBG) International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines Thermal Power Plants (2008 and 2017 (in Draft))
Online at:
http://www.ifc.org/wps/wcm/connect/dfb6a60048855a21852cd76a6515bb18/FINAL_Thermal%2BPower.pdf?MOD=AJPERES&id=1323162579734. Accessed on 6th February 2018.

(IFC, 2017b) World Bank Group (WBG) International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines for Liquefied Natural Gas (LNG) Facilities (2017)
Online at:
http://www.ifc.org/wps/wcm/connect/edb102c5-ca61-4561-8b8e-8124fa2060af/20170406-FINAL+LNG+EHS+Guideline_April+2017.pdf?MOD=AJPERES. Accessed on 6th February 2018.

(IFC, 2017c) World Bank Group (WBG) International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines for Ports, Harbours and Terminal (2017)
Online at:
https://www.ifc.org/wps/wcm/connect/d2f2cf88-ce22-4a48-86fc-45ee3b8e9e45/20170201-FINAL_EHS+Guidelines+for+Ports+Harbors+and+Terminals.pdf?MOD=AJPERES. Accessed on 10th July 2018.

(*IFC, 2015*) World Bank Group (WBG) International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines for Offshore Oil and Gas Development (2015).
Online at:
http://www.ifc.org/wps/wcm/connect/f3a7f38048cb251ea609b76bcf395ce1/FINAL_Jun+2015_Offshore+Oil+and+Gas_EHS+Guideline.pdf?MOD=AJPERES. Accessed on 6th February 2018.

(*IFC,2012*) International Finance Corporation (IFC) Performance Standard 2 – Labour and Working Conditions (2012)
Online at:
http://www.ifc.org/wps/wcm/connect/2408320049a78e5db7f4f7a8c6a8312a/PS2_English_2012.pdf?MOD=AJPERES. Accessed on 15th February 2018.

(*IFC, 2007a*) World Bank Group (WBG) International Finance Corporation (IFC) General Environmental, Health, and Safety (EHS) Guidelines (2007).
Online at:
http://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES. Accessed on 6th February 2018.

(IFC, 2007b) World Bank Group (WBG) International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines for Construction and Decommissioning (2007).
Online at:
https://www.ifc.org/wps/wcm/connect/3aa0bc8048855992837cd36a6515bb18/4%2BConstruction%2Band%2BDecommissioning.pdf?MOD=AJPERES . Accessed on 6th February 2018.

(*IFC, 2007c*) World Bank Group (WBG) International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines for Electric Power Transmission and Distribution (2007).
Online at:
http://www.ifc.org/wps/wcm/connect/66b56e00488657eeb36af36a6515bb18/Final%2B-%2BElectric%2BTransmission%2Band%2BDistribution.pdf?MOD=AJPERES&id=1323162154847. Accessed on 6th February 2018.

(*IFC, 2007d*) World Bank Group (WBG) International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines for Shipping (2007).
Online at:
https://www.ifc.org/wps/wcm/connect/d52b768048855520b58cf76a6515bb18/Final%2B-%2BShipping.pdf?MOD=AJPERES&id=1323152475418. Accessed on 6th February 2018.

(IFPRI, 2017) International Food Policy Research Institute: The impact of global climate change on the Indonesian economy (2017).
Online at:
http://www.ifpri.org/publication/impact-global-climate-change-indonesian-economy. Accessed on 6th February 2018.

(Institute for Global Environmental Strategies, 2017) IGES List of Grid Emission Factors.
Online at:
https://pub.iges.or.jp/pub/iges-list-grid-emission-factors. Accessed on 6th of March 2018.

(JBIC, 2017) JBIC Guidelines for Confirmation of Environmental and Social Considerations (2017).
Online at:
https://www.jica.go.jp/english/publications/jbic_archive/environmental_guidelines/index.html. Accessed on 6th February 2018.

(JSP, 2018b) Jawa-1 Project CCGT Power Plant Construction Contract: Major Equipment List for Waste water Treatment System (2018)

(Mahakarya, 2015a) Offshore Survey for LNG Floating Storage & Regasification Unit (FSRU) Site at Cilamaya (2015).

(Mahakarya, 2015b) Geotechnical Survey for the Proposed Pipeline Route & FSRU Location (2015).

(MOEF, 2018) Kementerian Lingkungan Hidup dan Keehutanan Republik Indonesia. Peta Hasil Overlay Lokasi IPP PLTGU Jawa-1 dengan Lampiran SK Penetapan (SK.3287/MenHK-PKTL/KUH/PLA.s/7/2016) Kelompok Hutan Ciasem-Pamanukan di Kecamatan Cilamaya Wetan Kabupaten Karawang Provisin Jawa Barat (2018)

(Marubeni, 2017) IPP Jawa 1 Project: Offshore 20 inch Pipeline Installation Methodology (2017)

(Marubeni, 2016a) IPP Jawa 1 Project: Construction Methodology at ROW (Onshore Pipelines, Transportation Road For First 4.7km) (2016).

(Marubeni, 2016b) Supporting Facilities for FSRU Jawa-1: 20 Inch Pipelaying Analysis With Shallow Laying Barge Kalinda (2016).

(Marubeni, 2016c) Supporting Facilities for FSRU Jawa-1: On Bottom Stability Design Report (2016).

(Meindo, 2018) EPC Workshop conducted at ERM Indonesia on 12th of February 2018

(NEA, 2017) National Environment Agency: Climate of Indonesia (20170. Online at: http://www.nea.gov.sg/weather-climate/climate/climate-of-cities-in-asia/climate-of-indonesia. Accessed on 6th February 2018.

(NRL. 2008) Electric and Magnetic Fields and Your Health: Information on electric and magnetic fields associated with transmission lines, distribution lines and electrical equipment (2008)
Online at:
http://www.who.int/peh-emf/project/mapnatreps/nznrl_emfbooklet2008.pdf. Accessed on 6th February 2018.

(Pöyry, 2018a) Schedule 26 – Boundaries of Temporary Areas Drawing (2018)

(Pöyry, 2016a) Cilamaya Flood Study (2016).

(Pöyry, 2016b) Bathymetric Survey and Seawater Data Collection Report (2016).

(Pöyry, 2016c) 500kV Transmission Line Study For PLTGU Jawa 1 Combined Cycle IPP Project (2016).

(Pöyry, 2015) Report of Hydrological Analysis for Feasibility Study, Gas based Combined Cycle Power Plant Project at Cilamaya, West Java – Indonesia (2015).

(RKL RPL, 2014) Laporan Pelaksanaan RKL RPL Lapangan Migas di Blok PHE-ONWJ Semester I Tahun (2014).

(Samsung, 2018a) Data Request received by e-mail on 7th and 8th of February 2018.

(Samsung, 2018b) Manpower Schedule – 500kV Transmission Line (2018)

(Samsung, 2018c) EPC Workshop conducted at MCC Marubeni Indonesia on 14th of February 2018

(Samsung, 2017) Construction Methodology(Conceptual) for New Storm-water Drainage Line (2017)

(*SKG Cilamaya, 2017*) Regulatory Environmental Monitoring (RKL and RPL) Semester 1, 2017 completed for SKG Cilamaya (2017)

(SKG Cilamaya, 2016) Environmental Monitoring (RKL and RPL) Semester 2, 2016 completed for SKG Cilamaya (2016)

(SLHD, 2008) Status Lingkungan Hidup Tahun 2008: Badan Pengendalian Lingkungan Hidup Daerah Provinsi Jawa Barat (2008)
Online at:
http://dlh.jabarprov.go.id/index.php/layanan/dokumen/kegiatan/slhd/tahun-2008/32-bab-7-pesisir-dan-laut/file.
Accessed on 6th February 2018.

(*Soilens, 2015*) Soil Investigation at the proposed Power Plant area for 800 to 100 MW CCGT power Plant at Cilamaya, West Java (2015).

(Tigenco, 2016) Geotechnical Investigation of the Jawa 1 CCGT Power Plant IPP Project, Cilamaya, West Java (2016).

(UNFCC, 2010) Indonesia Second National Communication Under The United Nations Framework Convention on Climate Change (UNFCCC) (2010).
Online at:

http://unfccc.int/resource/docs/natc/indonc2.pdf. Accessed on 6th February 2018.

(United States Nuclear Regulatory Commission, 1999) Environmental Standard Review Plan. Office of Nuclear Reactor Regulation.
Online at:
https://www.nirs.org/wp-content/uploads/nukerelapse/levy/exhe6bacchus.pdf.
Accessed on 9th of March 2018.

(WHO, 2000) World Health Organisation (WHO) Air Quality Guidelines for Europe, 2nd edition (2000). Online at:
http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf.
Accessed on 1st February 2018.

(*World Bank Country Adaptation Profile, 2016*) Climate Change Knowledge Portal For Development Practitioners and Policy Makers
Online at:
http://sdwebx.worldbank.org/climateportal/index.cfm?page=climate_country_adaptation. Accessed on 20th Febraury 2018.

(*Worley Parsons, 2011*) Greenhouse Gas Emissions Study of Australian CSG to LNG, April 2011. Report prepared for APPEA.
Online at:
http://www.abc.net.au/cm/lb/4421188/data/greenhouse-gas-emissions-study-of-australian-csg-to-lng-data.pdf. Accessed on 22nd of February 2018.

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