PAPUA LNG PROJECT

UPSTREAM ENVIRONMENTAL IMPACT STATEMENT

VOLUME 1: MAIN REPORT

Chapter 3: Impact Assessment Process and Methods

TOTAL E&P PNG LIMITED

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3. Impact Assessment Process and Method

This chapter describes the impact assessment process and methods used to characterize and assess the environmental and social impacts of the Papua LNG Project (the Project). The assessment of the Project's potential impacts is intended both to satisfy PNG regulatory requirements for the preparation of an environmental impact statement (EIS) under the *Environment Act 2000*, which is necessary to obtain an environment permit for the Project, and to align with International Finance Corporation (IFC) performance standards and guidelines, and TOTAL general specifications. These requirements are described in detail in Chapter 2.

IFC performance standards and guidelines require a comprehensive, full-scale environmental and social impact assessment (ESIA) for greenfield projects and for projects that are likely to generate significant adverse environmental and social risks and impacts. This chapter describes the main stages in the ESIA process, including the impact assessment methods used in this report (Section 3.1), the approaches used to assess impacts associated with potential major hazards/unplanned events (Section 3.1.4.5), and cumulative impacts (Section 3.1.4.6). Section 3.2 outlines the adaptive impact assessment and management process as the Project design evolves from FEED into detailed design and execution.

3.1 ESIA Process Overview

Figure 3.1 shows the main stages of the ESIA process that have been implemented to prepare this EIS, which are:

- Screening of environmental and social values, and potential impacts, at a high level.
- Scoping and defining the Project area of influence (PAOI) and study area. This includes an analysis of alternatives.
- Characterizing the baseline environmental and social setting.
- Impact assessment, including identifying potential Project impacts, determining mitigation measures, and assessing the significance of residual impacts. The impact assessment includes evaluating potential cumulative impacts.
- Reporting of the ESIA process (this report) to align with PNG regulatory requirements and IFC standards, including definition of the Project's proposed environmental and social management framework implemented to manage, monitor and report on the Project's performance in the future (Chapter 19).

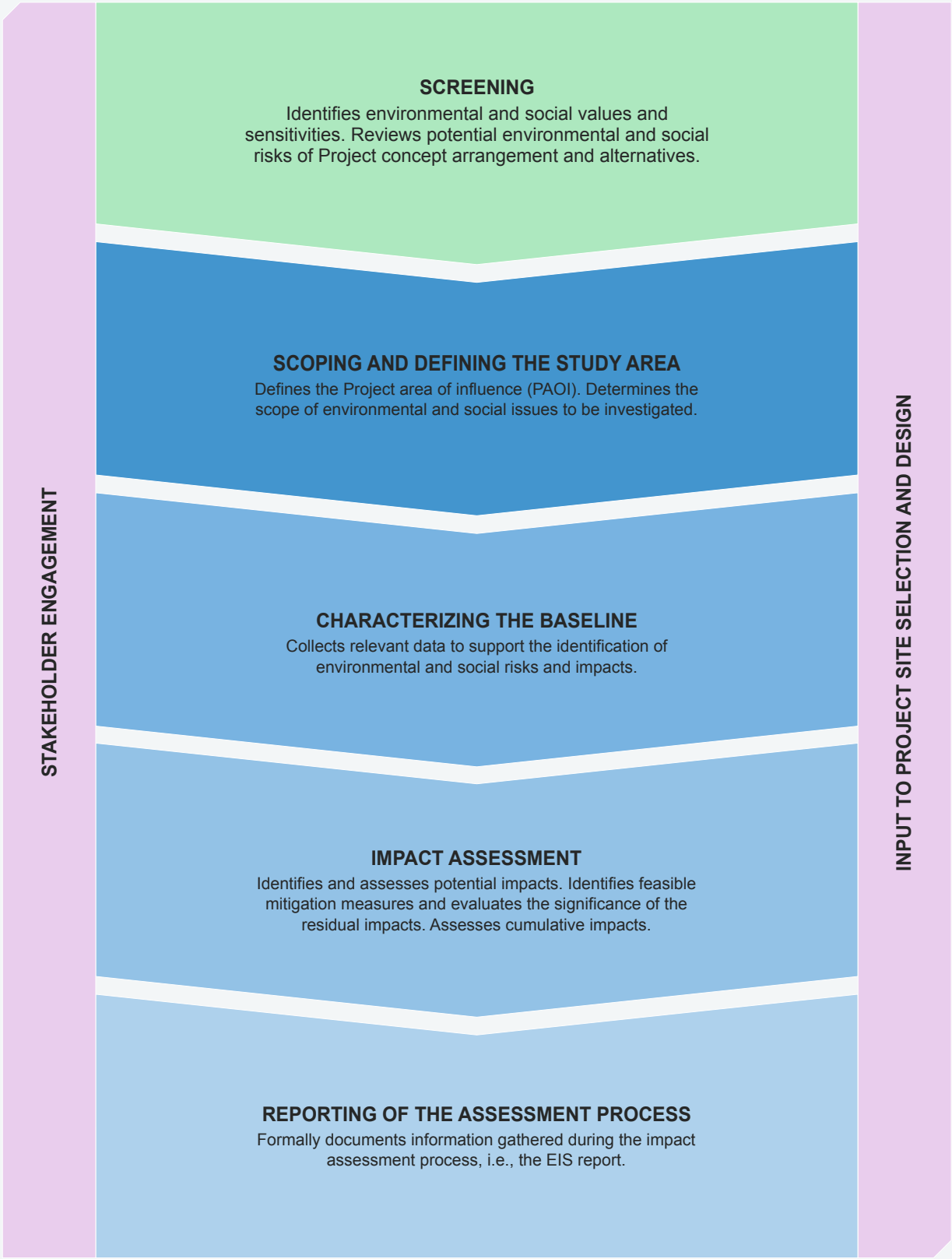
As illustrated in Figure 3.1, stakeholder engagement is necessary throughout the ESIA process, as is ongoing communication with Project design engineers, to allow meaningful exchange of information on potential impacts and proposed mitigation to take place during the ESIA process. Chapter 6 discusses the stakeholder engagement process for ESIA and as an ongoing process for the Project.

Project-specific activities undertaken in the main stages of the ESIA process are described in the following sections.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PROCESS

Papua LNG Project | Environmental Impact Statement

FIGURE 3.1



EIS Environmental impact statement

3.1.1 Screening

Identifying potential environmental and social values, sensitivities and constraints, and screening potential impacts is an essential initial stage in the ESIA process. Between 2014 and 2015, TEP PNG undertook a comprehensive societal and environmental screening study of the Project's early conceptual design, including alternative site locations for key process and infrastructure components.

The screening study involved:

- A desktop study, including a bibliographic review of available information, such as published scientific, social, legal and government agency data, relevant to the Project design and site alternatives.
- A field reconnaissance survey to verify or update the findings of the desktop study through on-site observations and preliminary stakeholder engagement. TEP PNG Project personnel and leading environmental and social specialists completed this field survey.

The screening study identified at a high level the Project area's key environmental and social values, and sensitivities and constraints in relation to the initial Project design and alternative sites for key facilities. This study informed TEP PNG decisions on the siting of the central processing facility (CPF) and the alignment of the export pipeline corridor, including the final kilometers of the onshore approach to Orokolo Bay. Chapter 5 describes alternatives for the CPF site and export pipeline corridor.

The information collected during the screening phase contributed to the identification of key environmental and societal values at risk of adverse impacts from Project development. This information was used to scope and plan the subsequent detailed baseline studies for the Project impact assessment.

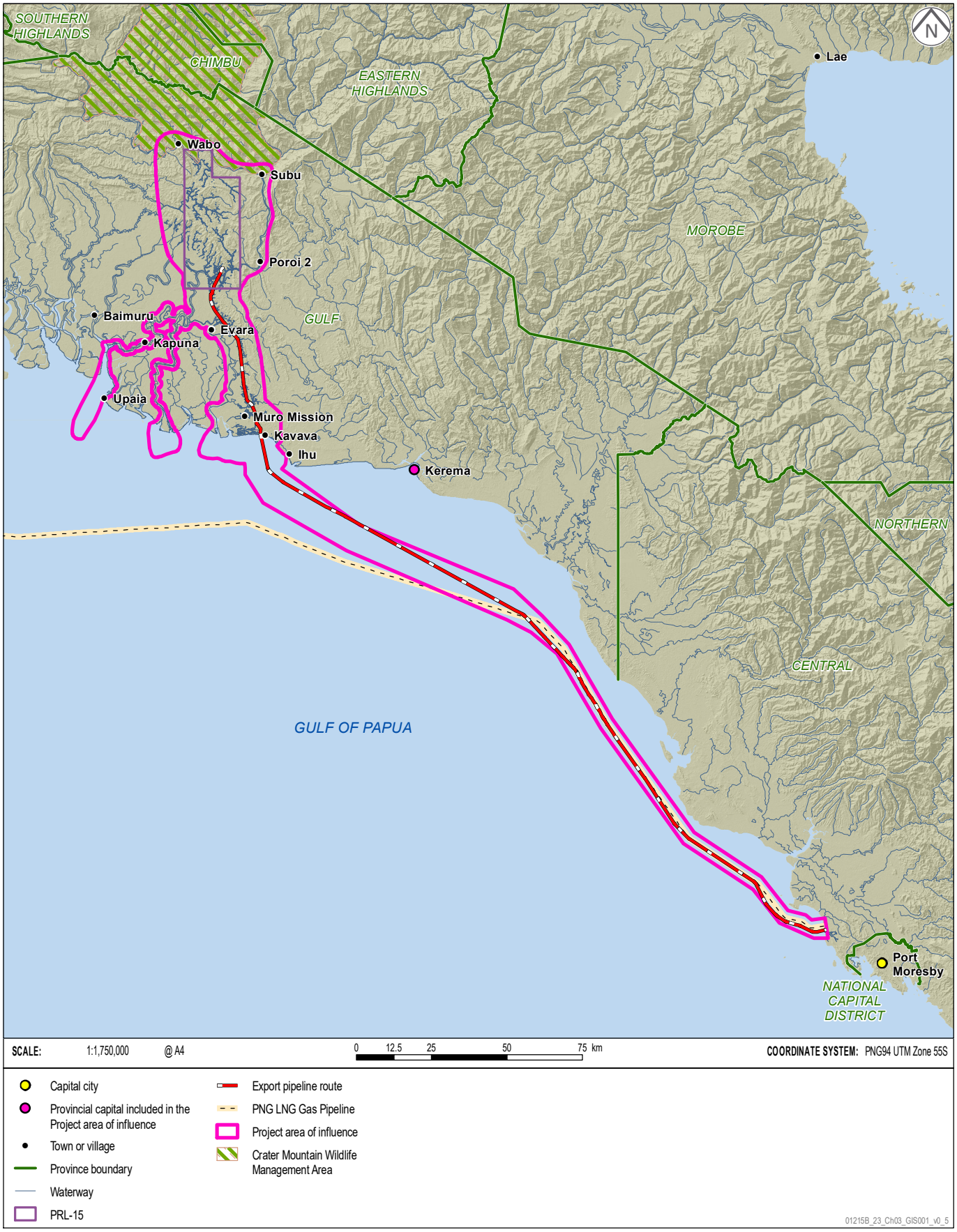
3.1.2 Scoping and Defining the Study Area

The focus of the scoping phase was to identify the potential environmental and social issues to be investigated during the Project impact assessment and to establish the terms of reference for that process.

A fundamental element in the scoping phase was to define the extent of the impact assessment study area. In this regard, the EIS has been guided by the IFC Performance Standard 1 (IFC PS1) (IFC, 2012) definition of the 'project area of influence' (PAOI), which is the area that is likely to be affected by the Project, by its activities and by facilities that are directly owned, operated or managed by the upstream Project. This definition includes direct, indirect (or induced), predictable but unplanned, and cumulative impacts arising from the Project.

The PAOI definition considered environmental and social criteria, such as terrain features, land and vegetation type, and the affected communities' occupation and use of the land and natural resources, and the potential impacts to these values arising from Project development. Figure 3.2 shows the PAOI that was used to guide the ESBS. Although not shown in the figure, the PAOI also includes the marine transport route between Caution Bay and the upstream riverways route to PRL-15, Project associated developments and activities such as quarries, logistical wharfs/terminals not operated by the Project, and considers the potential for induced in-migration (and associated implications). As depicted, the PAOI considers potential social and environmental impacts of the Project's logistics transport routes in the Purari delta, the upstream gasfield development and CPF within PRL-15 and the export pipeline corridor.

FIGURE 3.2


SOUTHERN HIGHLANDS
CHIMBU
EASTERN HIGHLANDS
Lae
N
Wabo
Subu
MOROBE
Poroi 2
Baimuru
Evara
GULF
Kapuna
Upaia
Muro Mission
Kavava
Ihu
Kerema
NORTHERN
CENTRAL
GULF OF PAPUA
Port Moresby
NATIONAL CAPITAL DISTRICT
SCALE: 1:1,750,000 @ A4
0 12.5 25 50 75 km
COORDINATE SYSTEM: PNG94 UTM Zone 55S
Capital city
Provincial capital included in the Project area of influence
Town or village
Province boundary
Waterway
PRL-15
Export pipeline route
PNG LNG Gas Pipeline
Project area of influence
Crater Mountain Wildlife Management Area
01215B_23_Ch03_GIS001_v0_5

The PAOI, as defined, is conceptual and remains dynamic, as greater definition of or changes to the Project design may alter the PAOI. For example, as the Project definition is refined and alternative sites are eliminated from consideration in the design basis, the spatial extent of the PAOI may decrease.

The PAOI was used to define the study areas for each impact assessment discipline. Secondary data sources and the characteristics specific to the discipline were used to inform study area selection and to appropriately characterize the area most likely to be affected by the Project. The study area for all disciplines either correlated with or was in the PAOI. The PAOI is referred to in the baseline environmental and social chapters of this report (i.e., Chapters 7 to 10) as appropriate.

The scoping phase of the impact assessment provided the information to:

- Prepare the Environmental Inception Report (EIR) (ERIAS Group, 2016[1]) used to obtain the Conservation and Environment Protection Authority's (CEPA's) approval to undertake the proposed environmental and social baseline studies as part of the formal EIS process. Section 2.2 describes the regulatory requirements of the EIS environmental permitting in detail.
- Design, plan and undertake the detailed environmental and social baseline studies, including the data collection method, e.g., using desktop study reviews and field surveys. Part 23 of Volume 2 collates the detailed method for each discipline study.

3.1.3 Characterizing the Baseline

The baseline data collection stage characterized the existing values and conditions of the receiving physical, biological, and social environments of the Project area, thus the risks and impacts identified and assessed were based on recent environmental and social baseline data at an appropriate level of detail.

The main objectives of the baseline characterization phase were to:

- Describe the existing environmental and social conditions in the Project area using desktop studies and field surveys.
- Provide information and data to comprehensively identify and support the assessment of potential Project-related impacts.
- Identify pre-existing sensitivities and values, including potentially sensitive receptors, Project-affected persons and Project-affected communities, in the Project area that may constrain or that require consideration in Project development.
- Inform Project design at an early stage.

The baseline characterization field survey program was undertaken over 13 months from January 2016 to February 2017 when 12 surveys campaigns were completed. Twenty-two technical baseline studies and one additional report that collates the field survey scope and methods, which are presented in Volume 2 of the EIS, were completed to establish existing conditions and characterize the environmental and social settings of the Project area (Table 3.1).

1 The EIR was updated and submitted to CEPA in July 2019 (see Chapter 1).

Table 3.1 – Baseline Reports and Associated Part Number

ESBS Discipline	Report Name	Report Author	Vol. 2
Geology, terrain and soils	Upstream Geology, Terrain and Soils Baseline Report	SLR Consulting Australia Pty Ltd	Part 1
Hydrology and meteorology	Upstream Hydrology and Meteorology Baseline Report	BMT WBM Pty Ltd	Part 2
Surface water and sediment quality	Upstream Surface Water and Sediment Quality Baseline Report	BMT WBM Pty Ltd	Part 3
Groundwater	Upstream Groundwater Baseline Report	SLR Consulting Australia Pty Ltd	Part 4
Freshwater and estuarine	Upstream Freshwater and Estuarine Biodiversity Baseline Report	BMT WBM Pty Ltd	Part 5
Terrestrial biodiversity	Upstream Terrestrial Biodiversity Baseline Report	ERIAS Group	Part 6
Deforestation	Upstream Deforestation Baseline Report	Booyong Forest Science PNG Pty Ltd	Part 7
Vegetation regeneration	Upstream Vegetation Regeneration Baseline Report	Booyong Forest Science PNG Pty Ltd	Part 8
Seabed and coastal geomorphology	Seabed and Coastal Geomorphology Baseline Report	BMT WBM Pty Ltd	Part 9
Physical oceanography	Physical Oceanography Baseline Report	BMT WBM Pty Ltd	Part 10
Marine water and sediment quality	Marine Water and Sediment Quality Baseline Report	BMT WBM Pty Ltd	Part 11
Marine biodiversity	Marine Biodiversity Baseline Report	BMT WBM Pty Ltd	Part 12
Marine fisheries and resources	Marine Fisheries and Resources Baseline Report	ERIAS Group	Part 13
Community and demographics	Upstream Community and Demographics Baseline Report	SIA & Development	Part 14
Governance and economics	Upstream Governance and Economics Baseline Report	SIA & Development	Part 15
Community health	Upstream Community Health Baseline Report	NewFields Companies, LLC	Part 16
Cultural heritage and archaeology	Upstream Cultural Heritage and Archaeology Baseline Report	Dr Robert Skelly in collaboration with Social Research Institute	Part 17
Land and natural resources	Upstream Land and Natural Resources Baseline Report	Booyong Forest Science PNG Pty Ltd	Part 18
Air quality	Upstream Air Quality Baseline Report	SLR Consulting Australia Pty Ltd	Part 19
Noise	Upstream Noise Baseline Report	SLR Consulting Australia Pty Ltd	Part 20
Visual amenity	Upstream Landscape and Visual Amenity Baseline Report	SLR Consulting Australia Pty Ltd	Part 21
Marine and river traffic and transport	Marine and River Traffic and Transport Baseline Report	EnviroGulf Consulting	Part 22
All (except hydrology and meteorology, physical oceanography, air quality and visual amenity)	Field Survey Scope and Methods Documents	As above	Part 23

Extensive community consultation and stakeholder engagement occurred during the baseline studies to alert Project-affected communities about the conduct of baseline surveys and as part of

the social and cultural heritage surveys themselves. Chapter 6 describes stakeholder engagement activities for the EIS.

3.1.4 Impact Assessment Methods

3.1.4.1 Identification of Potential Impacts

The identification of potentially significant impacts arising from proposed Project-related activities includes:

- Identifying the potential impact resulting from the Project.
- Predicting and analyzing the resulting changes to the environmental and social values identified in the baseline characterization phase.

The impact identification process systematically considered all the Project's spatial components and the timing of changes that may have an impact on the environment or that present potential hazards, taking into account the existing environment, as characterized during the baseline studies. This assessment identified only the potential impacts of credible scenarios and considered all Project development phases (i.e., construction (including early works), operations and decommissioning) for the Project described in Chapter 4.

The assessment has addressed the impacts associated with the export pipeline route, TEP PNG, however, is seeking approval for a 4-km-wide pipeline construction corridor, i.e., 2 km either side of the pipeline route centerline to allow for minor tactical realignments to avoid yet unknown environmental and social sensitivities (e.g., chance finds) that may be encountered during preconstruction surveys, and during construction, and also to achieve optimal design constructability. The baseline environmental and social studies include this corridor as it is within the PAOI.

3.1.4.2 Assessing Potential Impacts

The following impact assessment methods have been applied in this EIS:

- Compliance standard assessment for predicted impacts where appropriate quantitative criteria and guidelines exist against which to evaluate risk, e.g., air quality, noise, water quality.
- Significance assessment for expected impacts where quantitative assessment criteria do not exist.
- Assessment of unplanned, accidental or abnormal impacts.

The sections below present the impact assessment methods, with discipline-specific approaches presented in applicable sections of the impact assessment chapters (Chapters 11 to 16) of this report.

Compliance Standard Assessment Method

Impacts associated with Project activities, such as air quality emissions, surface water in waterbodies receiving wastewater discharges and ambient noise levels, can be readily evaluated by a quantitative assessment and comparison with objective, quantitative criteria, guidelines or standards. This approach has been adopted for the assessment of predicted Project-derived emissions where such values or thresholds exist. Predicted Project-derived emissions have been modeled considering the implementation of technically and commercially feasible mitigation measures and the results evaluated by comparison with relevant established PNG, International

Finance Corporation, World Health Organization or other international or good industry practice criteria, guidelines or standards (see EIS Volume 3 Technical Studies).

Significance Assessment Method

The significance assessment method was adopted where a qualitative assessment was required. This method allows the most suitable and practicable mitigation measures to be developed, as it focuses on credible impacts with a likelihood of occurring and impacts of particular concern to stakeholders. Residual impacts have been assessed by considering both the magnitude of the impact after the successful application of impact avoidance or management measures (Section 3.1.4.3) and the sensitivity of the value being impacted. While the definitions of the various magnitude and sensitivity categories are, to some degree, subjective, the use of a matrix provides an element of transparency that may otherwise be absent from qualitative impact assessments.

Magnitude of Impact

The criteria used to define the magnitude of an impact reflect the size and nature of the change based on several elements:

- Impact nature: whether the change from the existing condition due to the impact is positive or negative.
- Impact type: the direct, indirect, induced and cumulative effects of the impact, where:
  - Direct impacts: impacts that result from primary planned interactions between a planned Project activity and environmental, social and cultural heritage receptors, e.g., a Project will have discharges resulting in increased river turbidity.
  - Indirect impacts: impacts that are subsequent to the primary planned interactions between the Project and its environmental, social and cultural heritage receptors, e.g., a Project will have discharges resulting in increased river turbidity with subsequent impact on health of fish species and economic livelihood of fishing dependent villagers.
  - Induced impacts: successive impacts that have no direct relationship to a planned Project activity, but may nonetheless result from flow on activities associated with the Project, e.g., in-migration, increased hunting.
- Severity: the scale or degree of positive or negative change from the existing condition due to the impact.
- Geographical extent: the spatial extent of the impact where this is defined as site (which may be localized to all, parts or a part of the site), local, regional or widespread (e.g., provincial, national or trans-boundary).
- Duration: the timescale of the effect, such as short, medium or long term (i.e., effectively permanent), and whether the impact is reversible or irreversible.

Magnitude has been categorized as very high, high, medium, low, minimal and positive (where applicable) (Table 3.2) and the discipline-specific magnitudes are defined in applicable sections of the impact assessment chapters (Chapters 11 to 16) of this report.

Sensitivity of Value

The criteria used to define the sensitivity of a value has been determined based on a range of factors:

- Formal status, which may be assigned by statutory or regulatory authorities or by appropriately recognized national or international organizations. This can involve legislation, regulations or international conventions or other mechanisms that attribute a particular status to a value.
- Rarity or uniqueness in and beyond the immediate area of interest, i.e., its vulnerability, and the capacity for the value to be replaced.
- Capacity to adapt to change without adverse effects on the value's inherent attributes, i.e., its resilience.
- Importance to local communities and society, and its iconic or symbolic importance to cultural value systems.

Sensitivity has been ranked as very high, high, medium, low or minimal (Table 3.2) and the discipline-specific sensitivities are defined in applicable sections of the impact assessment chapters (Chapters 11 to 16) of this report.

Impact Significance

The significance of an impact on a value is determined by combining the likely magnitude of the impact on that value with its sensitivity via a matrix based on discipline-defined criteria. This approach is shown in Table 3.2.

Table 3.2 – Significance Assessment Matrix

Magnitude of Impact	Sensitivity of Value				
	Very High	**High**	**Medium**	**Low**	**Minimal**
Very High	Severe	Major	Major	Moderate	Moderate
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Minor
Low	Moderate	Moderate	Minor	Minor	Negligible
Minimal	Minor	Minor	Negligible	Negligible	Negligible
Positive	Positive	Positive	Positive	Positive	Positive

The magnitude of an impact is assessed after the application of mitigation and management measures (see Section 3.1.4.3) such as, avoidance and minimization that are expected to change the impact's severity, geographical extent or duration. The magnitude of an impact is combined with the value's sensitivity, which generally remains unaltered unless proposed actions or activities reduce the susceptibility of that value to adverse effects. This approach assesses the significance of the residual impacts, i.e., the credible impacts associated with project development, assuming that embedded design controls (Section 3.1.4.3) and mitigation and management measures are effectively applied. The result is a significance rating for the residual impact.

In this EIS, an initial assessment of potential impacts has been undertaken without consideration of the embedded design controls and mitigation measures for the social and cultural heritage disciplines in addition to the residual impact assessment (Chapters 13 and 14).

3.1.4.3 Impact Mitigation

A basic step in an impact assessment process is identifying measures that a project will take to mitigate its impacts.

Mitigation measures have been applied to potential impacts by implementing the mitigation hierarchy in accordance with relevant PNG legislative requirements and in accordance with IFC Performance Standard 1 (IFC, 2012):

> To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.

The hierarchy establishes the preferential order for applying management measures to most effectively reduce the magnitude of an impact, considering good international industry practice, and potentially the sensitivity of a receptor, as far as practicable. In some instances, mitigation can be incorporated into the Project design (i.e., built-in mitigation) to avoid or reduce the negative impacts, or to enhance the positive impacts.

Chapter 4 identifies the embedded design controls built-in to the Project design to address the potential impacts of the Project, e.g., location that has avoided sensitive environmental or social receptors, bunding for hazardous material storage tanks or drainage networks to manage hydrocarbon-contaminated water. Mitigation and management measures to further avoid and minimize the impacts are then identified, as needed, in each impact assessment chapter (Chapters 11 to 16). In some cases this also includes measures to enhance or optimize potential benefits of the Project.

This Project's impact assessment process has therefore involved identifying where significant impacts could occur and then working with the Project design team to identify and develop technically and commercially feasible means of mitigating the impacts to levels that are deemed acceptable.

3.1.4.4 Residual Impacts

The significance assessment method assesses residual impacts considering the implementation of the embedded design controls and the mitigation and management measures (see Section 3.1.4.3) via a significance matrix using the magnitude of the predicted impact and the sensitivity of the environmental or social value being impacted (Table 3.2). Residual impacts with a significance rating of moderate or above are considered significant. This provides a focus for Project resources and planning, although Project management plans (Chapter 19, Environmental and Social Management, Monitoring and Reporting) will address all potential impacts and identified mitigations measures.

Where significant impacts remain, additional opportunities for mitigation will be explored during the FEED Project phase. Additional requirements related to offsetting or compensation (see Chapter 19, Environmental and Social Management, Monitoring and Reporting) will be designed where appropriate, and in consultation with relevant communities, stakeholders and government agencies, as required.

Residual impacts will be managed through adaptive management once the Project moves into construction and operations.

3.1.4.5 Assessment of Major Hazards

Total identified and assessed major hazards associated with accidental, upset or abnormal events (also referred to as unplanned impacts) in a social and environmental aspects and impacts identification (SENVID) study and hazard identification (HAZID) studies.

The purpose of the SENVID was to identify, at an early stage, the aspects that can potentially impact the environment or society including major hazards. The SENVID examined all Project phases to identify the components and activities that may cause environmental and social harm

due to major accidental, upset or abnormal events. .The HAZID followed a similar approach to the SENVID, but focused on upstream operations. Measures (also called actions) to prevent, control or mitigate unplanned impacts were also identified.

The assessment of major hazards or risks associated with accidental, upset or abnormal events is discussed further in Chapter 18.

3.1.4.6 Assessing Cumulative Impacts

Cumulative impacts are due to the successive, incremental accrual or combined effects of a project, its activities or its facilities, when considered in the broader context of the region and combined with other existing, planned and reasonably anticipated future developments, other human activities and natural environmental stressors.

The assessment of cumulative impacts in this EIS is guided by the Good Practice Handbook for Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC, 2013). Under this guidance, priority for assessing and managing cumulative impacts is limited to those impacts generally recognized as important due to scientific concerns or concerns of Project-affected communities. Thus, this assessment considers only those cumulative impacts identified as important.

The current environmental and social baseline in the Project area includes impacts and disturbances of past and present anthropogenic activities that have changed, in places, the original natural conditions to the present-day conditions. The cumulative impacts assessment (Chapter 17) considers current and potential, reasonably-defined, developments that could act together with the proposed Project to impact on common receptors.

3.1.5 Reporting of the Assessment

The impact assessment process concludes with the reporting of the environmental and social findings and outcomes of the assessment, including stakeholder inputs. These findings are included in the main report (i.e., chapters) of this EIS, which is supported by the specialist technical reports (i.e., Volumes 2 and 3 of the EIS).

3.2 Project Evolution and Adaptive Management

Figure 3.1 shows that, from the start of the impact assessment process, the EIS Study Team collaborated with the Project design team and considered environmental and social sensitivities and risks in Project planning and design. These interactions informed decisions on the optimal siting of key Project facilities and infrastructure to avoid or minimize potential impacts on environmental and social values that were identified in the initial screening and later detailed baseline surveys, including the concerns of Project-affected communities noted during stakeholder engagements.

As with any complex development project, refining the Project design is an ongoing process that will evolve from front-end engineering and design through to detailed design. The final, as-built, Project design will be refined through tactical on-site adjustments during construction. The Project has a management of change process to manage and track such design amendments, which is also intended to assess potential consequences with respect to environmental and social impacts. Major changes, if they occur, will be communicated to CEPA and other relevant authorities, and appropriate actions in terms of regulatory requirements will be determined in conjunction with CEPA and those other authorities.

To accommodate potential late changes in the design process beyond the term of this report, the EIS Study Team has applied a conservative approach in the assessment of likely residual impacts to develop appropriate mitigation measures that address any uncertainties.

The management of change process will be incorporated into the Project management system, and the implementation and success of mitigation will be monitored and adapted as part of the Project's environmental and social management planning, which is described in Chapter 19 (Environmental and Social Management, Monitoring and Reporting).

3.3 References

ERIAS Group, 2016. Papua LNG Project: Environmental Inception Report. Version 5. Report prepared by ERIAS Group for Prepared by Total E&P PNG Limited, Port Moresby.

IFC. 2012. Performance Standard 1. Assessment and Management of Environmental and Social Risks and Impacts. International Finance Corporation, World Bank Group, Washington, D.C.

IFC. 2013. Good Practice Handbook for Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets. International Finance Corporation, World Bank Group, Washington, D.C.