PNG BIOMASS

SOCIAL IMPACT ASSESSMENT

SUMMARY REPORT

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VERSION 1.4

PRODUCED BY

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SIMP
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ERIAS GROUP

Acronyms

ADB	Asian Development Bank
AEL	Aligned Energy Limited
ANZ	Australia and New Zealand Banking Group
ARI	Acute Respiratory Infection
BDMt	Bone Dry Metric Tonnes
BPNG	Bank of Papua New Guinea
CA	Community Affairs
CCRI	Cocoa and Coconut Research Institute
CEPA	Conservation and Environment Protection Authority
CFP	Chance Finds Protocol
CH_4	Methane
CHMP	Cultural Heritage Management Plan
CHSSMP	Community Health, Safety and Security Management Plan
CIA	Cumulative Impact assessment
CLO	Community Liaison Officer
CO_2	Carbon Dioxide
DEC	Department of Environment and Conservation
EA	Environmental Assessment
EHA	Environmental Health Area
EHS	Environment Health and Safety
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
FEED	Front End Engineering and Design
FID	Final Investment Decision
FIP	Forestry Industry Participant
FPIC	Free Prior and Informed Consent
FRP	Full Resettlement Programme
FRV	Full Replacement Values
FSC	Forest Stewardship Council
FSV	Family and Sexual Violence

GBV	Gender-Based Violence
GHG	Greenhouse Gases
GIS	Geographical Information System
GM	Grievance Mechanism
GN	Guidance Note
GPS	Global Positioning System
GRI	Global Reporting Initiative
GW	Gigawatt
HC	Health Centre
HFO	Heavy Fuel Oil
HIA	Health Impact Assessment
HIV	Human Immunodeficiency Virus
HR	Human Rights
HRAP	Human Rights Action Plan
HRIA	Human Rights Impact Assessment
HSFO	High Sulphur Fuel Oil
IAIA	International Association for Impact Assessment
ICP	Informed Consultation and Participation
IFC	International Finance Corporation
ILG	Incorporated Land Groups
IMMP	In-Migration Management Plan
IPA	Investment Promotion Authority
IPIECA	International Petroleum Industry Environmental Conservation Association
IPP	Independent Power Producer
IRC	Internal Revenue Commission
IRENA	International Renewable Energy Agency
LA	Landowner Association
LAP	Land Acquisition Plan
LLG	Local Level Government
LNG	Liquefied Natural Gas
LSFO	Low Sulphur Fuel Oil
LULUCF	Land Use, Land-use Change and Forestry
MCA	Multiple Correspondence Analysis
MMJV	Morobe Mining Joint Ventures
MOU	Memorandum Of Understanding
MVB	Markham Valley Biomass
MW	Megawatt

MWe	Megawatt electrical
NA	Not Available
NCC	National Cultural Commission
NCCDMP	National Climate Compatible Development Management Policy
NCD	Non-communicable diseases
NDOH	National Department of Health
NEC	National Executive Council
NEFC	National Economic and Fiscal Commission
NFB	National Forest Board
NFS	National Forest Service
NGO	Non-governmental Organisation
NMAG	National Museum and Art Gallery
NSPT	National Strategic Plan Taskforce
OSL	Oil Search Limited
PACs	Potentially Affected Communities
PAPs	Project Affected Persons
PCA	Principal Component Analysis
PIIM	Project-Induced In-Migration
PM	Particulate Matter
PMV	People Moving Vehicle
PNG	Papua New Guinea
PNGDSP	PNG Development Strategic Plan 2010-2030
PNGFA	PNG Forest Authority
POME	Palm Oil Mill Effluent
PPA	Power Purchase Agreement
PPL	PNG Power Limited
PSA	Project Study Area
PV	Solar Power
RIT	Resettlement Implementation Team
RTAs	Road and Traffic Accidents
SABL	Special Agricultural Business Leases
SDG	Sustainable Development Goals
SDH	Social Determinants of Health
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SMLI	Social Mapping and Landowner Identification
STI	Sexually Transmitted Infections

TB	Tuberculosis
TCN	Third Country Nationals
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
UNPFII	UN Permanent Forum on Indigenous Issues
UPNG	University of Papua New Guinea
US	United States
VLC	Village Liaison Committee
VLO	Village Liaison Officer
VRD	Vector-related Diseases
WASH	Water, Sanitation and Hygiene
WBG	World Bank Group
WDCs	Ward Development Committees
WHO	World Health Organization

Introduction

A. Publication statement

This *Social Impact Assessment Summary Report* (SIA Summary) forms part of the PNG Biomass environmental and social impact assessment containing the consolidated results of a social impact study and assessment of potential impacts (SIA Study) undertaken by an independent contractor (SIMP Pty Ltd). The SIA Study includes further detail on the background, assessment of potential impacts, and recommendations for mitigating any unavoidable impacts. In the following sections, "SIA Summary" will refer specifically to the present document; "SIA Study" will refer specifically to the independent contractor (SIMP Pty Ltd) SIA study and assessment; and "SIA" will be used as generic term for the social impact assessment process.

SIA Study

The SIA Study was conducted under the lead of principal investigator Dr Laurence Goldman, supported by a team of expert researchers and specialists with long-term experience and involvement with PNG communities, development projects, and field research (Table 1). The SIA Study team was mixed in gender and nationality and utilised graduates from PNG tertiary institutions to conduct questionnaire surveys.

Table 1: SIA Study experts

Expert name	Area of study expertise	SIA Study contributions
Laurence Goldman (PhD, MA, BSc)	Social impact assessment, PNG	SIA principal investigator Survey questionnaire Social issues Resettlement
John Brooksbank (BSc)	Social sectors, social impact assessment	Education, transport, governance, economic benefit analysis Stakeholder identification Social service infrastructure
Joe Crouch (BA Hon) Kenneth Miamba (BA)	Cultural heritage	NMAG liaison Cultural heritage site records, fossils, GPS points Sacred site status, values, aesthetics Ecosystem services: cultural
Helen Johnson (PhD, BA)	Gender, human rights, impact assessment	Plant, tree and ground material use by women Animal products Environmental values Gender, focus group research Ecosystem services: provisioning and cultural

Expert name	Area of study expertise	SIA Study contributions
Michael Bourke (PhD, MAg, BAgrSci) Matthew Kanua (MSc, BA) Mike Lowe (PhD, BA)	Agricultural impact assessment	Cash crops, incomes and markets Subsistence practices and land use Food, fuel, fishing surveys Forest use and animal husbandry Subsistence and livelihood thresholds, assimilative capacity, resilience and opportunities Ecosystem services: provisioning and regulating Resettlement, Full Replacement Values (FRV) schedules
Gary Krieger (MD, MPH, DABT, DTM&H)	Health impact assessment, community health programs	Health infrastructure and stakeholders Health surveys, sanitation, water use Ecosystem services: regulating
Mike Lowe (PhD, BA)	Social (land, household surveys, water)	GIS mapping Water access Ecosystem services survey – hunting, animal products, etc. (provisioning, regulating & cultural)
Krista Nash (BSc)	Survey questionnaires	Survey team management and lead
Nicholas Wari David Kombra Kelly Luis Helen Kuman Ruth Baiga Sedester Elecor Darusilla Meira Celine Figa	Household, ecosystems, health & village surveys	Students from UPNG, University of Technology, and Lae Technical College (all graduates), responsible for undertaking the SIA questionnaire surveys in villages

SIA Report

The SIA Summary was compiled and edited under the lead of Dr Tim Siegenbeek van Heukelom, supported by a team of independent expert reviewers and specialists (Table 2).

Table 2: SIA Report experts

Expert name	Area of expertise	SIA Report contributions
Tim Siegenbeek van Heukelom (PhD, MA, LLM, LLB)	Social impact assessment	SIA Report principal writer and editor
Michael Jones (MAppSc, BSc)	Environmental and social impact investigations	Reviewer and editor
Kerry Connor (PhD)	International Social Performance Standards	Independent expert review
Stephen Midgley (MFor, BSc)	Forestry, international development	Independent expert review
Peter Stevens (PhD)	Soil scientist, development assistance	Independent expert review

B. Introduction

This Social Impact Assessment (SIA) Summary Report consolidates the findings of a SIA Study for the proposed PNG Biomass Markham Valley Project ('the Project') in the Markham Valley in Morobe Province, Papua New Guinea (PNG). Oil Search Limited (OSL), through its wholly-owned subsidiary Markham Valley Biomass Limited (MVB), is the sole developer of the Project which is a long-term biomass energy initiative.

The Project's main objective is to enhance energy security in PNG by increasing power generation capacity and contribute to the well-being of local communities, create opportunities for future generations, and contribute to energy independence for PNG – without compromising the environment. For PNG, this renewable energy project will establish the country's first biomass steam-cycle plant and demonstrate the country's commitment to implementing renewable energy targets.

The SIA supplements the Project's Environmental Assessment (EA) submission to PNG's Conservation and Environment Protection Authority (CEPA). The Project is classified by CEPA as a Level 2 activity under the PNG Environment (Prescribed Activities) Regulation 2002 (sub-category 10.2) for which an EA is required (supported by an Environmental Management Plan). The SIA identifies and evaluates the likely extent and significance of the Project's potential impacts on identified social receptors according to defined assessment criteria. It also reports the significance of the residual impacts following mitigation measures. The SIA guides development of the Project's Environmental and Social Management Plan (ESMP) that, along with the individual management plans, set out the detailed mitigation and management measures and commitments the Project will implement to address the identified impacts.

The purpose of this SIA Report is to assess the Project's alignment with PNG's national requirements as well as the international principles for social impact assessment (i.e., principally the Equator Principles, the International Finance Corporation's Performance Standards on Environmental and Social Sustainability (2012), and the Forest Stewardship Council's National Forest Management Standards for PNG (2010)). An SIA Study was commissioned in order to analyse the social consequences of the Project's development, and to propose ways in which the Project could ameliorate negative or unintended outcomes, implement good social and sustainability practices to improve project performance, and bring about a more ecologically, socio-culturally and economically sustainable and equitable environment. The outcomes of the SIA Study are captured and independently reviewed in this SIA Report.

The studies undertaken to prepare the SIA Report assist communities and stakeholders to identify development goals that will build local capacity, promote community opportunities, and maximise positive development outcomes.

The structure and approach taken in this SIA Summary follows standard international practice for assessing and managing the social impacts of projects (Vanclay, et al. 2015). The objective of this SIA Summary is primarily to provide a user-friendly and concise report more widely accessible by external audiences including non-social practitioners and project hosts.

1. Project Summary

1.1. Proponent

Oil Search Limited (Oil Search/OSL), through its wholly-owned subsidiary Markham Valley Biomass Limited ('the proponent'), proposes to develop the PNG Biomass Markham Valley Power Project ('the Project') in Morobe Province, Papua New Guinea (PNG).

Oil Search is an oil and gas exploration and development company that has been operating in PNG since 1929. The Company is the country's largest oil and gas producer and has interests in all of the nation's producing oil and gas fields. While biomass-to-energy is a new business sector for Oil Search, it has a long history of developing large-scale greenfield projects in PNG, with extensive in-country experience. In 2015, the Company made an estimated US$466 million contribution to PNG's socio-economic development.

1.2. Description

Electricity access and service is widely acknowledged as one of PNG's key infrastructural challenges. The Project will address the need for electricity in the Lae region through environmentally sustainable and socially beneficial power generation.

The Project is a response to a call from PNG Power Ltd (PPL) for an Independent Power Producer (IPP) to generate 30 to 40 MW of power near Lae, and reflects the requirements of a 25-year Power Purchase Agreement (PPA) that was executed with PPL on 15 December 2015. The Project will address, at least partially, the current incapacity of the Ramu grid to provide reliable power, and the PNG Government's long-term objective of increasing the availability of reliable and sustainable power supply at a reasonable cost. Power generated by the Project will provide reliable baseload power to households, industries and resource projects on the Ramu grid, which runs from Lae and Madang in the east to Mt Hagen and Mendi in the west.

The Project has three related components: (1) establishment of up to 16,000 ha of eucalypt plantations to provide biomass (wood) that will be used to fuel a power plant; (2) development of nurseries, power plant, and ancillary infrastructure; and (3) connection of the power generation infrastructure to the nearby 132 KV power line Erap switching-station (which feeds into the Ramu grid) to service industrial and domestic customers in the Morobe, Madang, and Eastern Highlands provinces. Development of plantations and infrastructure will be staged over several years and are subject to the findings of the environmental assessment, government approvals, and landowner negotiations regarding land rental and participation.

1.3. Purpose and objectives

Oil Search's vision for the Project is to provide Papua New Guinea with clean, sustainable and cost-effective energy from a domestically operated world-class biomass power station. As the wholly-owned subsidiary implementer, the mission of MVB is to power Papua New Guinea and empower its citizens through the safe, reliable and sustainable operation of the Project.

This vision and mission clearly define both economic and social drivers for the Project, which are reflected in the Project's primary objective of improving the wellbeing of Papua New Guineans by enhancing energy security in PNG in harmony with communities and the environment. In doing so, the Project sets out to actively involve local landholders in the development of biomass plantations, create opportunities for future generations, and provide a long-term sustainable source of safe, renewable and reliable power – without compromising the environment. In addition, MVB supports the

PNG Government in meeting its targets set out in their Medium Term Development Plan (see section 3.4) by endeavouring to ensure the Project meets relevant international sustainability criteria and certifications.

1.4. Site and project area

Site selection

Aligned Energy Limited (AEL), as initial Project proponent, assessed (renewable) power options to determine appropriate solutions for PNG. By 2009 AEL determined that a biomass power project could offer PNG environmental, electrical access, employment and social benefits and avoid heavy fuel-oil or diesel power generation. Project planning therefore progressed to an initial country-wide feasibility study in 2010 which included detailed geographic information system (GIS) data mapping and field studies, and assessment of potential Project areas based on the following criteria:

- Relatively flat land available for plantations which was not cleared native forests and was under-utilised.
- The need for more than 10 MW of baseload power generation.
- Adequate rainfall to support biomass production.
- Appropriate soil types for large-scale biomass (wood) plantations.
- A nearby power grid and market, which required power in a three to five year time frame.
- Water sources for a biomass boiler and steam turbine generator power plant.

The GIS mapping collected extensive data on land use, population distribution, rainfall and soils to develop high yield biomass suitability maps. Field studies were conducted in seven regions over an area of 2,500 km^2 and focused on soil analysis, remediation and program design for large-scale pilot testing. The conclusion of these studies (which cost more than US$1 million) was that areas located in the Markham Valley close to sections of the Ramu grid were considered to be most suitable for further investigation.

From 2010 to 2015, AEL (the Project proponent at that time) completed further feasibility and conceptual development studies to select the optimum Project location and development concept. These studies included consideration of environmentally, socially and economically feasible geographical locations for the plantations and power plant.

The Markham Valley was selected as the site for the Project following extensive surveys across PNG which found the area to be highly suitable for biomass power generation due to its rainfall and proximity to existing infrastructure. Initially both biomass export projects and local generation were considered as possible project options. It was clear from 2012 that the Ramu grid suffered from a lack of reliable generation and the ability to provide power to new industries in Lae. The need for power generation for the Ramu grid was subsequently confirmed in late 2012 when PPL called for closed tenders for an IPP for Ramu grid, initially for 36-40 MW, and then subsequently amended to 30 MW of power.

Selection of the Markham Valley in general, and in particular the Project area and power plant site, is based on a number of key factors including the following:

- The proposed plantation area is largely under-utilised, degraded anthropogenic grassland (which does not represent cleared native forest), along with some introduced rain trees. The

rain trees also provide an initial source of biomass to fuel the power station during the first phase of plantation development.

- The proposed plantation area is characterised by relatively flat or low relief topography, good soil and adequate rainfall, all of which are preferred for plantation development (although the potential for some water stress due to the sandy nature of the soils is acknowledged and will be a specific focus of plantation development).
- A 132 kV transmission line (the Ramu grid) already exists along the length of the Markham Valley. This existing infrastructure will simplify the connection of the power plant to the regional electricity grid.
- The Project area has a low population density and a small number of clans and land groups, with landowners in the area being generally supportive of the Project. Markham Valley Biomass has entered into Memoranda of Understanding (MOU) and Land Use Agreements with landowners for the plantation trial and pilot studies.
- The Project area is close to a major port and engineering facilities. The Port of Lae is the largest cargo port in PNG (PNG Ports, 2016) and has the required facilities for Project supply, construction and operation. Lae itself is the main industrial city in PNG and has many of the required support services such as logistics and transport.
- There is easy access to the Highlands Highway and sealed roads between the power plant site and Lae. Road routes to, and within, the Project area currently exist (although these will require upgrading).
- The preferred power plant site is close to major hubs for electricity demand, including Lae and Morobe Mining Joint Ventures' existing and new developments (the Hidden Valley Mine is currently operational and connected from Erap by a 132 kV transmission line; the Wafi-Golpu Project (a proposed underground copper mine) is another major development in the final stages of planning).
- In terms of specific characteristics, the preferred power plant site:
    - Has 50 ha of flat land available to build 2 x 15 MW units and a fenced area for the Project nursery and central facilities.
    - Is composed of grassland (and introduced rain trees) that was previously used for grazing cattle.
    - Will provide adequate foundations to deal with seismic and other geotechnical factors.
    - Is appropriately located in terms of distance and direction from Lae Nadzab Airport and associated flight paths.
    - Is close to suitable water sources (either groundwater or the Markham River), thereby avoiding the need for lengthy pipelines for cooling water and nursery water supplies.
- Additional land areas suitable for plantations are located in the vicinity of the Project area, if there is an opportunity to expand the Project and power plant capacity at a later date.

Project area

The Project area is located within the Markham Valley, about 50 km west-northwest of the provincial capital Lae in Morobe Province. The Project area consists of two areas within the Markham Valley that have been demarcated as areas of interest, denoted Area A and Area B (Figure 1). These two areas represent no more than sequential areas of interest in which the project is concentrating its

negotiation and stakeholder liaison efforts. Areas A and B comprise the locations where initial and subsequent negotiations for plantation land will be conducted, and thus do not represent a fixed 'project footprint' as might be the case in a petroleum or mining project.

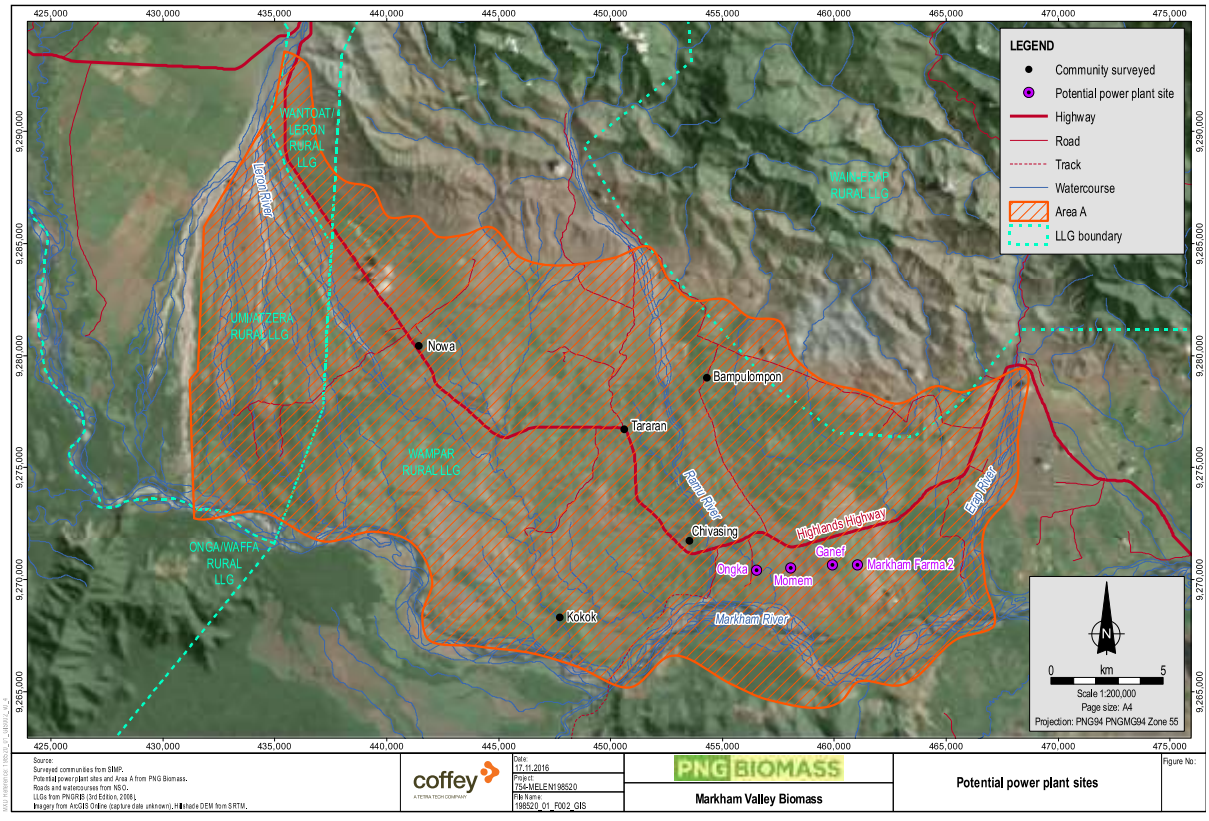
Area A is in Wampar Rural LLG in Huon Gulf District, and partially in Umi Adzera Rural LLG in Markham District (which also encompasses Area B).

Project study area

In accordance with the scale of the Project and the above considerations, the SIA has operated with a Project Study Area (PSA) approach. The PSA encompasses both the IFC 'area of influence' (IFC, 2012) and the 'ecosystem service project area' (Landsberg, et al. 2011) – the area relevant to the assessment of project impact and dependence of potentially affected communities on priority ecosystem services.

For the purposes of the SIA, the PSA is represented by those communities (within the Huon District) in Area A[1] that opted for trial plantations, have existing MOU agreements, have received ongoing stakeholder engagement, and are within the social landscape restricted to the Wampar LLG. Area B is not part of the current project description and hence has not been subject to either EIA or SIA.

Figure 1: Project area map



[1]The western boundary of the Area A polygon extends past the Leron River and into the Markham District.

1.5. Size and design

Components

The Project consists of two distinct components: 1) the establishment of up to 16,000 ha of sustainably managed eucalypt plantations; and 2) the construction of a biomass-fuelled power plant consisting of two 15 MW units, with the preferred power plant site being located in the southeast of the Project area.

Plantations

Plantation development will be supported by road upgrades and/or construction, and a development of a large plant nursery. Plantations will be harvested every 7 to 9 years to provide about 175,300 BDMt p.a. (bone dry metric tonnes of biomass (wood) per year).

Power plant

Construction of the power plant and related infrastructure, and development of the plantations, will take place over several years.

The combustion of dry biomass will generate steam from water sourced from bores or the Markham River. This steam will drive steam turbine generators, thereby generating electricity that will be transferred directly to the nearby high voltage Ramu grid transmission system, which runs from Lae and Madang in the east to Mt Hagen and Mendi in the west. The power will be distributed, and provide reliable baseload power, to major industries, households and rural communities.

Biomass

Biomass is renewable plant material that has been grown using energy from the sun. It includes wood, and other cellulosic plant fibres. Wood is favoured as a biomass fuel due to its low ash content and a relatively constant heating value. Unlike wind and solar power, wood chip biomass electricity generation is not intermittent but is a reliable base load power source.

Biomass power production is a renewable technology that is currently witnessing a substantial uptake, given global pressures on environmental performance and sustainable practices, carbon constraints and corporations' desire to enhance their social licence to operate. Biomass power is the only renewable power source that is storable, transportable and dispatchable on demand.

Biomass power generation is a widely used power source around the world, and biomass power plants are operational in more than 40 countries. Worldwide biomass power capacity is increasing, with an estimated 93 GW (93,000 MW) installed by the end of 2014 (REN21 2015).

1.6. Impacts and benefits overview

Impacts

Potential impacts and benefits as a result of the implementation of the Project have been considered in three assessments: Social Impact Assessment, Environmental Assessment, and Economic Impact Assessment.

The Project will have impacts associated with conversion of a modified grassland environment into broad scale tree plantations. This will impact the biophysical environment due primarily to the change in vegetation, and will generate both positive and negative social impacts, particularly relating to resource use by local communities and 'provisioning' ecosystem services. These impacts will relate

primarily to resource use by local communities and ecosystem services rather than biodiversity conservation. Changes to the local socio-economic context have the potential to impact income levels.

Benefits

Oil Search expects the Project to generate considerable benefits and opportunities for PNG and its citizens during the Project life. By providing reliable power that is sustainable and with few adverse impacts, the Project is a key driver for the growth and the well-being of the people in the Project's impact area. The Project will have large and long-lasting positive benefits in an area which is not presently benefitting directly from a resource project.

The main benefits include providing competitively priced, sustainable and reliable power capable of supporting everyday needs and creating employment and local business opportunities for PNG citizens. In particular, the Project's emission of carbon dioxide (CO_2) to the atmosphere is significantly lower than if the same amount of power was generated by HFO or other fossil fuels.

The Project will promote significant social advancement in the Markham Valley region, primarily via sizeable ongoing employment and landowner business development opportunities (e.g., plantations and support services businesses). The Project will also support education of young people with the objective of introducing them to more specifically qualified jobs in agriculture, forestry, engineering and business, and it will implement a Community Partnerships and Sponsorships program which will target specific community needs.

Benefits associated with the Project include sustainable financial income streams for landowners and substantial new local employment and business development opportunities, as well as increased power supply for the region.

Competitive energy

The energy produced by the Project will be stable, competitively priced and not affected by oscillations in oil prices. Under the PPA, the power produced will have a fixed price over the life of the Project, with a significant component in Kina, which will mitigate risks of fuel price and currency rate fluctuations for PPL.

Energy independence

The Project will generate domestic power to support the country's own community infrastructure (schools, medical and business) and to drive and underpin industrial development in the Morobe and Madang provinces. Domestic production of biomass power also ensures a long-term reduction in the exposure to power prices associated with increasing imported diesel and heavy fuel oil costs, and lower payments overseas for liquid fuels.

Employment opportunities

The Project will create significant local employment opportunities for PNG citizens in the Markham Valley. An independent economic study estimates that the power plant and the 16,000 ha associated plantations will provide over 500 direct jobs for Papua New Guineans and many more additional indirect jobs in a region that has traditionally faced significant unemployment for youth and women. There is no other power project in the country which can sustain this number of jobs for Papua New Guineans in local communities.

Landholder engagement

An important element of the Project is that the landowners obtain additional benefits from the land which is leased to the Project. For example, intercropping, where subsistence and cash crops are planted between the rows of plantation trees, is proving to be a significant economic activity and a local income generator.

In addition to this cash cropping benefit, landowners also benefit from land rental, employment and local business development – such as the community nurseries – where landowners are paid for plant production. The Project is also looking at the most effective way to integrate the grazing of cattle between mature plantation trees.

Climate and sustainability leadership

The Project will enhance PNG's international environmental reputation and demonstrates PNG leadership in climate adaptation and renewable energy. MVB works closely with the PNG Climate Change Development Authority to assist the country in meeting its international climate change goals and commitments. The Project has very low net CO_2 emissions and is many times cleaner than coal or other thermal generation based on oil or diesel. It will save over 100,000 tonnes of CO_2 (carbon dioxide) emissions a year, compared to the use of diesel and fuel oil for power generation.

Electrifying PNG

The Project makes a significant contribution by contributing additional generation capacity to enable the PNG Government's electrification goal of increasing its consumer base of electricity to 70% by 2030 (see section 3.4).

Carbon offsets

Carbon offsets are a measure of the sustainable and renewable credentials of a project. The proponent intends to quantify the project's potential carbon offsets for biomass and forestry; monitor, verify and report carbon benefits; and sell carbon offsets in the voluntary carbon market. The Project is expected to displace fossil fuel generation of more than 5 million tonnes of CO_2 emissions over its operating life.

1.7. Timeframe

Key dates for Project activity milestones are listed in Table 3.

Table 3: Key dates for activity milestones

Date	Activity milestones
2010 – 2011	Initial PNG-wide feasibility study for biomass power
Q3 2011	Markham Valley selected as preferred site
Q1 2012	Initial landowner agreements, trial plantation established, services agreement with PNG Forestry Research Institute in Lae
Q2 2012	MOU with PNG Power Limited (PPL) to conduct feasibility study
Q4 2012	PPL opens competitive tender process

Date	Activity milestones
Q4 2015	Power Purchase Agreement (PPA) signed with PPL
Q3 2016	Front End Engineering and Design (FEED) commenced
2017	Design and final costing
Q1 2017	Submission of Environmental Assessment (EA) report and Environmental Management Plan (EMP) to CEPA
Q3 2017	Environment permit issued by CEPA
Q4 2017	Final Investment Decision (FID); 3,000 ha plantation operational
2017 – 2019	Plantation and nursery expansion
2018 – 2019	Construction power plant
Q3 2019	Commissioning power plant (first 15 MW unit)
2019 – 2020	Operations to grid
2019 – 2021	16,000 ha plantations operational
Q1 2020 – Q3 2022	Engineering, procurement and construction second 15 MW power plant unit

In parallel with the environmental and social studies, ongoing landowner negotiations and consultation with PPL will be pursued, as well as consultation with other stakeholders. The outcomes of these discussions, as well as the final investment decision on the Project, may result in changes to the proposed development schedule.

In accordance with the *Forestry Act 1991*, prior to commencement of harvesting the proponent will register machinery for wood chipping and will apply for a Forest Clearing Authority, as well as the various other regulatory requirements specified under that Act. Other statutory approvals will also be obtained prior to construction of the power plant or commencement of harvesting.

The Project timetable does not include proposed dates for decommissioning or closure, since it is expected that both the power plant and the plantations will continue to operate well beyond the initial Project lifespan of 25 years.

1.8. Additional service demands

Water

Total water required for use in the power plant is conservatively estimated to be about 160 t/h (0.044 m3/s), and this is likely to be extracted from water bores to be constructed at the power plant site or next to the Markham River. Three 50% power plant capacity submersible raw water pumps may also be installed to allow raw water to be pumped from the Markham River to the pre-treatment plant as an alternative water supply.

Emissions/discharges

- Steam and gaseous emissions, primarily from the power plant stacks.
- Ash (two types) generated by combustion of biomass. ‘Fly ash’ may be incorporated within plantation area soils to enhance soil properties or sold to local industries as an input for concrete production, while ‘bottom ash’ can be used in road construction.
- Wastewater discharges from the power plant, which will be treated before release to ensure that IFC discharge guideline values for thermal power plants (IFC, 2008) are met. This treated wastewater will either be used for irrigation or discharged to a man-made drainage line that reports to the Markham River.

Power

The power plant’s proposed configuration will feature two 18 MWe steam turbine boilers (of which 3 MWe will power the module, with the remaining 15 MWe output to the grid).

1.9. Ancillary activities

The Project requires the following ancillary infrastructure and activities:

- Equipment and material for the Project will be imported through the Port of Lae, which is unlikely to create a major stress or congestion on the existing port facilities. It is likely that a bonded area will be established at the power plant site, whereby imported equipment and materials will go directly from the port for inspection and clearance.
- Existing roads, primarily the Highlands Highway, will be used to transport equipment and material from the Port of Lae to the 41 mile marker (power plant site) via tractors and modular trailers. Power plant construction is expected to involve a total of about 400 truck movements for containers and about 30 truck movements for bulk materials.
- Wastewater from the construction workforce during working hours will be treated via an on-site septic system or package plant that will be sized to accommodate a total of about 500 people.
- The power plant site will be serviced by standard telecommunications equipment to allow telephone communications with outside third parties, with a dedicated voice communications link to the PPL control centre and provision for two separate fibre optic voice and data connections to off-site offices.
- Approximately 200 L of diesel fuel will be used daily by the mobile fuel handling equipment, with the diesel fuel being transported to site by truck and pumped to a 30 m3 diesel storage tank. Chemicals will be transported to site in drums (also by truck) and stored in separate locations or directly transferred to tanks for use.

1.10. Regional development context

In Morobe Province there are presently two large resource projects either operating or proposed. Mining is underway at the Hidden Valley gold mine (open pit, gold/silver mine located in the mountainous Wau/Bulolo area to the south east of Lae). In 2015 the Hidden Valley mine employed 2,157 people, consisting of 1,289 employees and 868 contractors. Mining further stages will extend the current mine life by seven years and require an initial capital investment of approximately US$180 million. Working with local community, ward, LLG and District organisations, Hidden Valley has invested over K20 million in community and regional development since 2010 in health, water supply and sanitation, education, agriculture/aquaculture, community infrastructure and community capacity building programmes.

Morobe Mining Joint Ventures is looking to develop a large gold/copper mine discovery at Wafi-Golpu, approximately 80 km from Lae. The Wafi-Golpu exploration activity has 104 employees and 53 contractors but if the mine is developed there will be regional-wide economic ramifications as it would be one of the largest gold and copper mines in the world.

1.11. Project scenarios and alternatives

It is important to distinguish between project scenarios (i.e., With-Project and Without-Project) and project alternatives. Comparing the merits of various tree species in small-scale tree farming in the Markham Valley is an example of a project alternative.

Consideration and analysis of project alternatives (for components such as routes, infrastructure, finance, project type, etc.) in addition to a 'Without-Project' scenario are now standard requirements of SIA reports (IFC, 2003; UNEP, 2002; Esteves, Franks, and Vanclay 2012).

> "Task 14: Actively contribute to the design and evaluation of project alternatives including no go and other options. … Where the SIA has identified that the project will cause serious harm to a community which cannot be mitigated or will lead to community conflict, they have a duty of care to inform the project proponent and request that the project's feasibility be re-assessed and/or the project be redesigned or cancelled" (Vanclay et al. 2015, 50)

This section will consider the two project scenarios (i.e., With-Project and Without-Project) and for the With-Project scenarios discuss and assess a number of project alternatives.

1.11.1. With-Project scenario

Conventional generation alternatives in a With-Project scenario have different types of social impacts. The main factors affecting both the local population and the wider PNG population include:

1. The relative level of social improvement from positive microeconomic impacts (employment, improved cash cropping, improvements in health and education, and access to transport, electricity and communication).
2. Community social benefits (or losses) from improved (or degraded) environmental conditions.
3. Macroeconomic benefits which provide indirect social benefits to all Papua New Guineans including diversity in land use and commodity diversification.
4. Cost and reliability issues for the supply of power generation to the State Utility (PNG Power Limited), including a consideration of Papua New Guinea's pioneering commitment to the Paris Accords.[2]
5. Support of, and compliance with, key Papua New Guinea National Policy objectives.
6. Country reputation factors including the ability of the Project to attract Green Fund and multilateral financing agencies and to enhance and promote Papua New Guinea as a location where future renewable finance or support can be effectively directed to promote employment and sustainability goals.

[2] On 29 March 2016, Papua New Guinea became the first country to formally submit the final version of its national climate action plan (called a "Nationally Determined Contribution," or NDC) under the Paris Agreement.

The alternatives that are considered and compared are:

1. Alternative non-renewable power generation options (including comparison of emissions from different power generation options).
2. Alternative renewable power generation options.
3. Alternative biomass energy options.
4. Alternative biomass sources / land use options for the available marginally utilised land.

Alternative power generation options

Coal
Coal as a generation option has a high capital cost when deployed at scale of less than 100 MW, and the heavy metal contamination issues associated with coal ash are well documented (Environmental Health and Engineering 2011; Markandya and Wilkinson 2007). Particulate emissions are also potentially especially problematic when coal generation occurs near population centres such as Lae. While coal is a low cost fuel in large power plants with low cost access to quality coal deposits, it cannot be safely deployed at low costs for the Ramu Grid. There are no nearby sources of coal which can be secured at low costs, and the logistics costs for coal supply to a port on the Ramu Grid are formidable.

Gas
The Ramu Grid has no nearby gas resources, with the nearest gas located approximately 500 km to the west, and there is at the moment no transmission line which could transmit any power from these gas fields. As a consequence, any near term power generation using gas at Lae would require an LNG import facility. Scoping economics indicate that such a terminal would not provide power at a competitive price at average generation levels below 100 MW.

High-Sulphur Fuel Oil (HSFO)
High-Sulphur Fuel Oil (HSFO) has traditionally been among the lowest cost options for developing countries for power generation, as the health impacts have traditionally not been properly considered as part of the cost of HSFO. The sulphur component in high sulphur fuel oil has extensively documented negative health effects on any nearby populations due to harmful particulate matter (PM), and high levels of SO_2 and SO_3 which cause respiratory conditions and seriously degrade surrounding air sheds (Oeder, et al. 2015; Markandya and Wilkinson 2007). The import of HSFO (more than 0.35% sulphur) is therefore prohibited in Papua New Guinea.

Diesel / Low-Sulphur Fuel Oil (LSFO)
Diesel generation has the one advantage in Papua New Guinea of rapid deployment, but the cost of generation is highly exposed to the oil price. High oil prices and resulting high diesel fuel prices resulted in a severe financial strain on the State power utility in the period 2010-2013. Diesel/LSFO is the best option for providing system backup, and not for continuous generation, due to the high cost of fuel.

Large Hydro
Large hydro power projects (> 30 MW) have a substantial ecological and environmental footprint. Apart from loss of habitat and various plant and animal species, displacement of human population is another major consequence. One of the greatest challenges with the development of hydropower is ensuring that the design and construction of hydropower projects is truly sustainable.

The experience of the Ramu-1 power project, which was 60% complete when it collapsed during construction due to geotechnical instabilities, and which after two months of dry weather by August 2015 had suffered a five metre drop in the water level at a dam that supplies power to a third of the country, highlights the potential risks with large hydro in Papua New Guinea (EMTV 2015). Small run of river plants are not exposed to these major geotechnical risks, but large hydro projects in PNG are vulnerable as the geotechnical problems are extremely difficult to foresee, regardless of sampling and design. If the dry spell had continued, PNG Power would have needed to shut off power generation on the Ramu Grid.

Small Hydro

The approved Least Cost Development Plan for the Ramu Grid includes two small hydro projects (Baiune and Baime) which will complement the other sources of generation on the Ramu Grid by providing a portfolio of smaller generation units distributed around the grid.

To date, diesel and hydropower have been PNG's two default generation options. The ANZ *Powering PNG into the Asian Century* study (Port Jackson Partners 2015) has noted that meeting PNG's power projections would require the construction and operation of over 1,300 MW of hydro and diesel capacity over 15 years. At current costs and assuming the current mix (i.e., 55 per cent hydro) stays constant, this will cost over US$15 billion.

The conventional generation alternatives to the Project's proposed biomass generation have been ranked and evaluated on the basis of the previously set out six key criteria. The comparison in Table 4 indicates that biomass is a highly ranked option for power generation on the Ramu grid.

Table 4: SIA assessment criteria for conventional project alternatives

	Coal	Gas (LNG terminal)	Heavy Fuel Oil	Diesel / Low Sulphur Fuel Oil	Large Hydro (> 30 MW)	Small Hydro (<30 MW)	Biomass
1. Level of social improvement by positive microeconomic impacts	Minimal to negative	Minimal to negative	Minimal to Negative	Minimal to negative	Minimal to negative	Minimal to negative	Positive
2. Community social benefits from improved environmental conditions	Negative	Positive	Negative	Negative	Negative	Positive	Positive
3. Macroeconomic benefits which provide indirect social benefits to all Papua New Guineans	Minimal to negative	Minimal to negative	Highly Negative	Negative	Minimal to negative	Minimal to negative	Positive
4. Cost and reliability issues for the supply of power generation to the State Utility	Positive	Positive	Positive	Negative	Minimal to negative	Positive	Positive
5. Support of and compliance with key Papua New Guinea National Policy objectives	Highly Negative	Minimal to negative	Highly Negative	Minimal to negative	Minimal to negative	Positive	Positive
6. Country reputation factors and improved access to green finance	Highly Negative	Negative	Negative	Negative	Negative	Positive	Positive

Alternative renewable power generation options

The analysis of alternatives in the context of the proposed woodchip biomass production includes consideration of the various available renewable energy resource options, other biomass alternatives, facility location and route options. Various alternatives to biomass energy are available and include hydroelectric power generation, solar power, wind power, and tidal power. Table 5 provides a high-level overview of such alternatives, most of which are inappropriate for or inapplicable in the project area.

Table 5: Assessment of alternative renewable energy options for the Ramu grid

Energy type	Positives	Negatives	Applicability for the Ramu Grid
Hydroelectric Power Generation	• Clean, renewable, sustainable (if no vegetation submerged in dam creation and no landowners are displaced or disenfranchised) • Decreased use of fossil fuels, atmospheric pollutants and GHG emissions • Increased energy security	• High upfront financial costs • Seismic activity and geotechnical risks affect cost and time to deploy economically • High maintenance costs • Siltation and debris management in water flows • Can trigger physical resettlement • Can trigger vector borne disease	• Not land based • Ramu II Hydro proposed 180 W station on the Ramu River is too large for the PPL market and forecasts for the Ramu grid • Micro-hydro is preferred as it allows gradual addition of smaller power generation units (10-15 MW)
Solar Power (PV)	• Clean, renewable, sustainable • Decreased dependence on fossil fuel based sources • Can be large in scale • Could use flat landscape	• Large scale units require high upfront costs • High rainfall areas not suitable • Landscape aesthetic issues • Require expensive diesel backup for those frequent days when there was rain or insufficient insolation	• Home-based units already in operation as off-grid • Economic on-grid deployment would require large scale installation which is unlikely to match forecast demand in the short term. A solar farm of 15+ MW could potentially assist the grid in the three to five year time frame as it would assist in load following during the day (loads drop at night)
Solar Power (PV) and batteries	• Stores solar energy	• More expensive than a biomass / PV / hydro portfolio solution for varying loads	• None. The technology is not economic
Wind Power	• Requires no fossil fuels and emits no pollution	• Landscape and visual issues • Noise • Impacts on fauna and flora • Electromagnetic interference • Wind turbines are costly, operating parameters between 4–25 metres per second after which shut-down – leads to erratic and variable supply	• Not applicable in climatic conditions for the Lae area and the Ramu Grid
Tidal power	Not applicable	Not applicable	Not applicable

Alternative biomass energy options

The term biomass, in an energy context, has become a catchall for various ways of deriving energy from organisms or from their remains. Indirectly, biomass derived energy is ultimately solar energy, since most biomass energy sources are plant materials, and plants need sunlight to grow. Biomass energy sources can range from dedicated energy crops (herbaceous or short rotation woody crops e.g., coppice silviculture), to agricultural crops (though these have fallen out of favour due to the question of competition with food production), agricultural crop residues, forestry residues, aquatic crops (e.g. algae, kelp), municipal and animal wastes.

There are competing uses for biomass resources because of their economic and environmental value. Biomass can be used to generate power, heat, steam, and for producing transportation fuels. Woody biomass has been used as a primary energy source in many rural areas in developing nations, where it is mainly used for cooking and heating; it is still the main fuel in PNG for 95 per cent of the rural population. Unlike fossil fuels, biomass fuels are renewable. On a larger scale, biomass based power plant initiatives have lower atmospheric emission profiles than fossil fuel based systems, and can provide a viable 'green' alternative to the burning of non-renewable fossil fuels for energy.

The project proponent has compared short-rotation biomass with oil palm and biodiesel thereby indicating the greener (e.g., CO_2 emissions reduction) benefits of the proposal (Table 6).

Table 6: Land use comparisons and optional biomass sources

	Short-term rotation crop	Oil Palm	Jatropha/Biodiesel
Time to first harvest	2 years	2-4 years first harvest; 5-8 years full maturity	1-2 years, 6 years maturity
Replanting cycle	6 years	20 years	20+ years
Trees per hectare	1,500	156	2,200
Harvests per year	Continuous (over the project area)	1-2 years	Continuous
Landowner benefits (rental / crop share / Landowner company business)	High	Medium, but only high quality soil areas are planted. Low rainfall in the Biomass Project Area means low landowner revenue	Low
Soil requirements	Marginal, can be undulating	Flat, good drainage, soil, high rainfall	Needs good soils, low yield in marginal soils
Reputation and diversity benefit	High	Low	Low
CO2 emissions reduction	High	Minimal	Low
Waste products streams/chemical issues	None	POME (palm oil mill effluent) - can be used for power if digesters cover pond	Requires acid, methanol, etc., to make biodiesel, chemical waste stream

Cash crop residues, livestock waste or native forest resources (logging and wood processing) are not considered viable options due to the quantities that would be required, and sustainability issues for native forest resources.

Similarly, urban resources in the form of municipal solid waste, particularly the biogenic fraction, are resources that can be converted to electricity, heat, gaseous and liquid fuels through thermo-chemical (incineration, pyrolysis, and gasification), and bio-chemical (anaerobic digestion and fermentation) conversion processes. However, Lae does not currently present as a viable source for such biomass.

1.11.2. The 'Without-Project' scenario

In a Without-Project scenario, the status quo is projected to continue into the near future and it is unlikely social welfare will change dramatically in a 5 to 10 year period. The direct and indirect economic and social benefits that would have been accrued by the farmers and their employees due to the Project would be foregone.

There would similarly be either (i) a deficit in projected power capacity to Lae, escalating energy supply issues as the population grows; or (ii) a higher cost scenario for power provision as higher cost generation alternatives would be deployed (diesel / LSFO are the only quick deployment options which would reasonably be expected to be utilised).

Continued dependence on imported fossil fuels for energy would occur into the near and mid future until other renewable alternative energy supplies are established. The presently unused grassland areas would be given over to more cattle farming (unlikely), used for oil palm or other less environmentally and socially beneficial agriculture (possibly) or simply left unused (highly likely).

Local landowner cash incomes and employment would remain stable and dependent on potential mine-related developments in the region. It is unlikely the project villages would experience the kind of accelerated and incremental changes development projects, even of this scale, tend to deliver. Mine developments and expansion will likely have to source power internally or await Government initiatives such as the Ramu II hydroelectric scheme.

There is no evidence the overwhelming majority of landowners desire or embrace a 'Without-Project' scenario. The SIA finds that the level of cash and non-cash benefits to the local landowners and employees will be welcomed by the PSA communities; will positively impact disposable cash incomes; and will most likely be associated with increased social and economic development for some villages.

The cost of a without-project scenario is very much one of lost opportunity to harness surplus labour and land to development related agendas in a manner that would be a catalyst for iterative projects elsewhere in the country.

2. Methodology

2.1. SIA goals

The overarching goal of the SIA is to identify and assess the intended and unintended social consequences and social change processes, both positive and negative, of the Project and to propose methods to be used to monitor and manage the Project. An overall aim of the Project is to encourage a more sustainable and equitable biophysical and human environment. In addition, the proponent aims to ensure implementation of the Project is in accordance with PNG's regulatory requirements, international standards and principles, and Oil Search's environmental and sustainability policies – which are all discussed in Chapter 3.

The objectives of the SIA are to:

- Provide social and economic baseline data on project impact communities, utilising extensive Household, Village, Ecosystems and Health Questionnaires that incorporate both quantitative and qualitative questions.
- Provide the following sectoral and related analyses: Provincial administration and governance, Community Consultation and Participation, Agriculture and Land, Health, Gender, Human Rights, Cultural Heritage and Archaeology, and Ecosystem Services.
- Utilise the questionnaires and sectoral profiles to constitute a knowledge base for informed and responsible project planning, management and monitoring, and evaluation
- Locate, describe and register all existing archaeological, sacred and heritage sites within the Project area and assess the heritage value of any sites for the project-affected people.
- Identify major opportunities for, and risks to, sustainable development programs; provide recommendations for risk mitigation and optimisation of local participation in development plans.
- Assess the extent, type, nature and scope of project impacts throughout the project's construction and operation phases.
- Provide an informed basis for stakeholder engagement on indigenous community wealth creation, wellbeing and future prospects through forward SIA monitoring and management.

2.2. SIA context

This report discusses the social issues and impacts associated with the Project, predominantly referring to the Project area within the Markham Valley and the Project surrounds. Where appropriate, the discussion also addresses aspects relevant to the Project on a regional, national and international scale as there are broader social and political characteristics of the project host country that impinge on and shape SIA projections and characterisations of risk.

The statistical findings from the Household Surveys are inevitably compromised by a number of factors. Interpretation of responses can be an inexact science. Frequently, respondents wish to project a particular definition of their situation as a strategy to gain further benefits. In some cases, findings reflect expectations or perceived imbalances in benefit streams. The nature of these various limitations is acknowledged and discussed within this report.

Interventions such as resource developments create socially constructed (or induced) risks both to the bio-physical and social-cultural environments. SIA studies are oriented towards understanding and defining what those risks are, how best they can be managed and mitigated, and how such

findings (based on timely and reliable statistical data) can become a policy tool for resource management and stakeholders to engage in development planning.

2.3. SIA background

The Project proponent has previously undertaken a range of SIA related reports, as summarised in Table 7.

Table 7: Social and Environmental studies related to the Project

Date	Extent	Type	Commissioning	Author	Comments
April 2013	Area A PNG Biomass Project	Draft Social Mapping & Landowner Identification	Oil Search & Aligned Energy	Dorke de Gedare	Draft report which appears unfinished
January 2013	PNG Biomass Project	Draft EIR	Oil Search & Aligned Energy	EcoCare Engineering Ltd	Rapid Assessment Report
May 2016	PNG Biomass Project	Draft EIR	Oil Search & Aligned Energy	ERIAS Group	Draft Report

2.4. SIA methods

There are two predominant strands of debate concerning how SIAs are best constructed and presented. The first thread relates to whether Health Impact Assessments (HIA) and/or Human Rights Impact Assessments (HRIA) should be stand-alone undertakings or incorporated within wider social risk evaluations. The second thread concerns an increasing trend to overlay social analyses with assessment models and matrices derived largely from environmental science.

This SIA has taken the view that both HIA and HRIA relate directly to human landscapes and behaviour and as such are better informed, illuminated and assessed within studies that capture and reflect social risks (see Vanclay 2003).This approach in essence focuses on predicting the consequences of proposed policies, programs or projects.

2.4.1. Baseline research

The following research tools and methodologies were used for baseline research:

- Review of all published social scientific literature, and secondary and primary data from and about the affected area. This included existing ethnographic literature on the project impact cultures, reference to data found in the key social mapping and socio-economic impact studies (See Table 8 Social and Environmental studies related to the PNG Biomass Project), patrol reports and Oil Search community affairs corporate knowledge resources.
- Review of early historical writings and previous archaeological documents and consultation with previous researchers in the region to create a site predictive model for the study area. This involved:
    - Creating a list of sites already known for the study area.
    - Creating a list of site types for the study area.
    - Identifying where sites and site types are likely to be, based on cultural and environmental (locational) characteristics.

    - Identifying the physical characteristics of each site type (i.e. describe their archaeological characteristics), so that they can be recognised on the ground.
- Inspect and collate sectoral data from:
    - The PNG NMAG site register.
    - PNG agencies such as the Departments of Education, Health, and Lands.
    - NGOs and mining developers (e.g., Wafi-Golpu Joint Venture) in Morobe Province.
- Review of all relevant legislative regimes including the Environment Act, Forestry Act, and National Cultural Property Act, etc.
- Consultation and peer review by other researchers associated with the region, including: Dr Hartmut A Holzknecht, Professor Bettina Beer, Doris Bacalzo, Tobias Schwörer, Juliane Neuhaus, Professor Hans Fischer, and Dr Garrick Hitchcock.

2.4.2. Field investigations

The following research tools and methodologies were used for field investigations:

- **Baseline Data**: Household, Village, Health, Ecosystems, Cultural Heritage, Water Source, Infrastructure and Gender questionnaires throughout the PSA.
- **Cultural Heritage Data**: Cultural heritage site and ground surveys to establish GPS centroids and include, where possible, site extent polygons delimiting site areas. 'Site' is defined as a discrete archaeological site where an object ('artefact') or feature or set of artefacts/features were separated by ≥15 m of culturally sterile ground from its nearest neighbouring archaeological site. Sites were recorded on standard site survey forms approved by NMAG and registered in the National Site File of cultural heritage sites along with site photography. No excavation or artefact collection was conducted, only surface examination.
- **Household Expenditure**: Surveys of the prices of fresh food in three key fresh food markets (Lae, Forty and Forty-one Mile markets) to:
    - Assess income and expenditure activities, and local price baselines prior to construction to gauge project induced inflation.
    - Provide data necessary to generate Full Replacement Values (FRV) for anticipated Resettlement Action Plans and Resettlement Policy Framework documents, and economic displacement compensation schedules.
- **Key Informants**: interviews and discussions (structured/unstructured, random individual/focussed selective group) concerning significant sites, prioritising areas for clearance survey, and general socio-cultural conditions and issues.

The above processes enabled researchers to triangulate experience, direct observation, and varied databases to analyse community development issues and impacts.

2.4.3. Data collection and methods of prediction

The following practices and methods were used for data collection and prediction:

- Quantitative and mathematical models including predictive modelling for archaeological data, Principal Component Analysis (PCA), and Multiple Correspondence Analysis (MCA).
- Case study analogues with respect to social impact prediction and referencing existing resource developments including copper and gold mining projects in adjacent environs (taking into account differences in the nature of the projects).
- Best estimate professional judgments.
- Household questionnaires were used for collection of detailed and varied socio-demographic data pertaining to livelihoods, population, perceptions and social change. The sampling strategy utilised in the household questionnaires follows international standards based on methodologically sound techniques that are grounded in statistical theory (United Nations 2005).

The following options were among those considered with respect to conduct of the SIA questionnaires across the PSA:

- Area sampling: Selection of geographical area units that comprise the sampling frame (and may include selection of area segments, defined as mapped sub-divisions of administrative area).
- Compact cluster: Sampling in which next-to-last stage is a geographically-defined unit such as census enumeration areas or units.
- Non-probability sampling: Quota, judgmental, purposive, convenience, random walk sampling.
- Probability sampling: Selection methodology whereby each population unit (person, household, etc.) has a known, non-zero chance of inclusion in the sample.

To date it remains unknown which landowners and communities will eventually participate in the project, from which areas, and how they will distribute economic benefits. Scoping confirmed that the villages in the region were fairly homogeneous and the ethnic group social structure egalitarian in nature: it lacked class or other stratification, and exposure to and experience of development projects was evenly distributed across the study area. For this reason the sample design was *self-weighting*, i.e., all cases were assigned the same survey weight/selected with the same probability.

The *target population/coverage universe* consisted of those communities in the immediate vicinity of the Project's proposed power plant and some outlying villages to act as control samples. The selection of villages was constrained by whether stakeholder engagement and Free, Prior and Informed Consent (FPIC) processes had been carried out, the choice of an initial 'area of interest' defined by the project as Area A, and by the plantation trial locales from which representative views and reactions could be documented. These conditions in total violated the requirements for probability sampling because of loose criteria in defining the target population that the questionnaires intended to cover.

Probability sampling must be used at each stage of the sample selection process in order for the methodological requirements to be met. The requirements for probability sampling are (1) that each element must have a known mathematical chance of being selected; (2) that chance must be greater than zero; and (3) it must be numerically calculable to allow inference that the selection is representative of the total population.

Non-probability sampling presents cost and convenience benefits and may involve (1) judgmental

criteria (expert opinion on candidate villages); (2) random walks (entails either selecting every n^{th} household or screening each one along the path of travel); and/or (3) convenience samples (accessible and known to be cooperative). In the context of the prevailing project's social circumstances *non-probability* and *convenience sampling* were utilized.

Sample size determination depends, critically, on the degree of precision wanted for the indicators. The more precise or reliable the questionnaire estimates, the bigger the sample size must be, and possibly by orders of magnitude. Conventionally, stratification of the population to be surveyed prior to sample selection is a commonly used technique. But this assumes some heterogeneity when the geographically-defined cluster (i.e., implicit stratification) was already known to be internally homogeneous. The objective for the questionnaires was a village sample size of 30% of known households.

2.4.4. Impact assessment

The SIA utilises the recommended approach of the United Nations Environment Programme (UNEP) and IFC to summarise impact assessments by way of a matrix (Table 8). The following caveat is provided: this is a hybrid process (cf Salcito, et al. 2013), multi-factorial in nature and always partially subjective. In all cases the simple visual presentation should not hide the complexity of the assessments in the sector analyses.

This approach to impact assessment, however, does not infer that each assessor has necessarily relied upon or engaged with the same criteria to reach a rating attribution. For example, the resilience of a sacred site to change is of a very different order to that of a human susceptible to gender-nuanced behaviours. Therefore, the relative judgments of each assessor allow for intrusion of criteria such as stakeholder concern, perception, adverse consequence, reversibility, adaptability to change, resilience, etc. Similarly, behind each assessment lies a multitude of interrogative processes entered into by each assessor. The impact assessment matrix uses the following criteria:

- **Nature: Direct, Indirect, Cumulative** (cf IFC, 2013)

  Nature indicates whether the identified change has a causal proximity in time and space to the intervention (direct), or causal distance (indirect). The cumulative effects of an activity/intervention may be either: (a) additive—incremental accumulation; or (b) synergistic—produced by the interaction or combination of effects in the past, present and reasonably foreseeable future. Cumulative impacts are the successive, incremental and/or combined impacts of one or more activities on society. They may aggregate linearly, exponentially or reach 'tipping points' after which major changes in environmental, social and economic systems may follow' (Franks, et al. 2010).

- **Duration: Construction, Operation, Closure / Short, Medium, Long-term**

  Duration indicates selected periods that reflect the defined project phases.[3] Construction (18 months), Operation (> 25 years) and Closure (2 years). In without-project scenarios, these periods are replaced by a short (1–5 years), medium (5–10 years) and long-term (10–25 years) gauge.

3 In some sector impact descriptions the phase of Front End Engineering & Design (FEED) has been included. Whilst it is recognised that much of this phase will be desktop work, the triggering of such work in conjunction with minimal field investigations can result in some population shifts and consequential risks for heritage places etc.

- **Extent: Local, Regional or National**

  Extent indicates the geographical and/or social localities (villages, etc.) where the impacts will be experienced.

- **Magnitude: High, Medium or Low**

  Magnitude carries the nuance of severity, size and reversibility of change. In gauging social impacts these assessments are often indistinguishable from each other. In the SIA values are assigned to this parameter according to whether the impact has reached a threshold where it will require immediate mitigation (high), minimal intervention (medium) or no management (low).

- **Likelihood: Likely, Possible, Unlikely, Rare / Certain, Uncertain, Probable**

  Likelihood reflects predictive considerations concerning impact occurrence prior to avoidance, mitigation, and management measures. For residual impact predictions after avoidance, mitigation, and management measures terms such as certain, uncertain and probable are also used with their conventional connotations.

- **Manageability: High, Medium or Low**

  Manageability indicates the degree or level to which adverse consequences can be avoided or mitigated in size, scope or duration. It refers to asking the question if impact will happen regardless or will happen on a lesser scale if appropriate mitigations are put in place. Manageability is based on the recognition that minimising impacts of some activity entails managing the social consequence of those activities. Where an adverse social consequence can be completely avoided then it receives a 'high' manageability rating.

- **Valence: Positive, Negative**

  Valence indicates whether the impact will promote or progress, degrade or detract from the wellbeing of communities or constituencies; 'valence' is understood as the 'value of an outcome' which is generalised here as either positive or negative in nature.

Table 8: Blank template of impact assessment matrix

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Impacts are assessed through highlighting the relevant criteria in the impact assessment matrix, as demonstrated in the example provided in Table 9.

Table 9: Example usage of impact assessment matrix

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Other matrix options often utilise the same criteria to produce a risk quadrant outcome which could optically hide decision-making criteria such as locale, phase, valence, etc. In this respect, the chosen representation of the impact assessment matrix has the advantage of transparently, explicitly and visually displaying the critical assessments. In addition to application of the assessment matrix, indicative mitigation measures and residual impact assessments are provided as appropriate.

The assessments presented in Chapter 5 are without taking into account mitigation and management measures. Mitigation measures and the consequent residual impacts are being presented in Chapter 6.

2.5. Free, Prior and Informed Consent

Development projects and operations can have devastating impacts on indigenous peoples and local communities, undermining their ability to sustain themselves physically and culturally. The right to Free, Prior and Informed Consent (FPIC) has therefore emerged as the desired standard to be applied in protecting and promoting their rights in the developmental process.

FPIC is one of the key principles of international human rights law to protect indigenous peoples from destruction of their lives, cultures and livelihoods. Historically FPIC was coined to protect the rights and lives of indigenous peoples, however today also non-indigenous, project-affected communities are generally considered to have the same rights. They are believed to have the right to consultation and negotiation in decision-making processes that affect them in ways that are consistent with the principles underlying the right to FPIC (Hill, Serena, and Simon 2010). FPIC is therefore increasingly considered to be “a right for local communities to protect themselves from significant impact on the resources and territories for which they can make a justified claim of long and established use” (Forest Stewardship Council (FSC) 2012).

The IFC Performance Standards as well as the FSC Standards set out how to obtain and ensure FPIC of indigenous peoples and/or local communities before commencing operations. Performance Standard 7 describes the trigger mechanism that requires projects to obtain FPIC of indigenous peoples. The FPIC trigger requires three conditions to be met. First ‘Indigenous Peoples’ need to be identified as part of the Project Affected Communities, secondly these identified ‘Indigenous Peoples’ need to be adversely impacted by the Project; and thirdly the circumstance of the adverse impact needs to fall into one of the following categories: 1) land and natural resources; 2) relocation; or 3) critical cultural heritage.

In particular the identification of ‘Indigenous Peoples’ can be a complicated task for project proponents, requiring them to make a well-informed judgment based on the local or national context in the identification of these rights holders, their rights, and hence the applicability of FPIC. A detailed discussion about the identification of indigenous peoples and the applicability of FPIC to the Project is provided in Chapter 3 and details of the Project’s FPIC activities and plans are provided in Chapter 7.

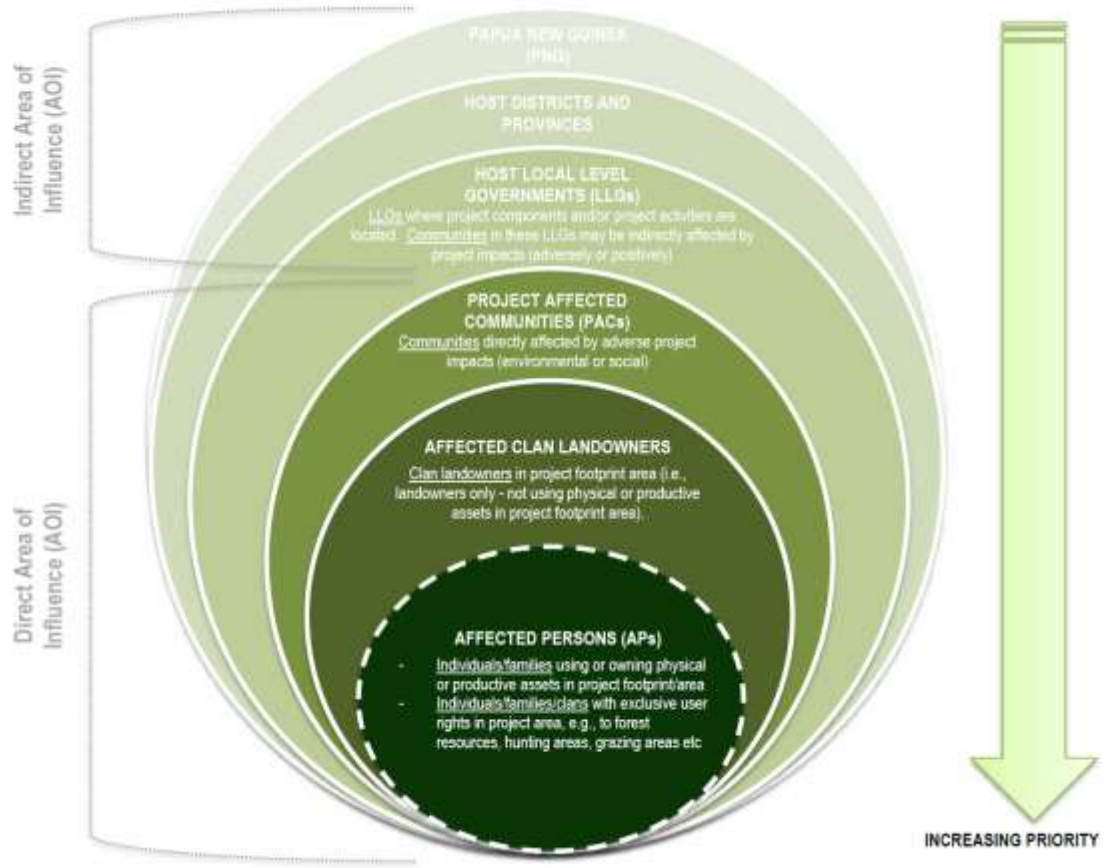
2.6. SIA stakeholder engagement

The proponent has set out to develop the Project through public participation and has initiated consultation with relevant landowner groups. This participatory process is focussed on engaging local communities in culturally appropriate ways to build trust and to identify issues relevant to Project planning and implementation. This process endeavours to ensure that the Project’s socio-economic and environmental objectives are met; adverse effects on local communities, resources and the environment will be minimised; and benefits (including employment opportunities and sustainable development) will be maximised.

The Project has produced a Stakeholder Engagement Plan in 2016 as well as Communications Plan in 2017. The Stakeholder Engagement Plan defines stakeholders in groups of direct and indirect areas of influence (Figure 2).

The IFC/FSC guidelines describe stakeholder engagement as an ongoing process that involves, to varying degrees: (a) stakeholder identification, (b) engagement principles and methods, (c) disclosure of information, and (d) a grievance mechanism. Importantly, the nature, frequency and level of effort of stakeholder engagement should evolve and adapt to be commensurate with risks and adverse impacts and the phases of development.[4] FPIC compliance ensures that consultation with potentially affected communities and stakeholders.

Figure 2: Stakeholder mapping areas of influence



In 2013, a preliminary Social Mapping and Landowner Identification (SMLI) study was conducted for the Project. The SMLI identified the communities likely to be affected by Project activities, with a focus on the establishment of tree plantations.

The main stakeholder groups that the Project interacts with are listed in Table 10 with comments on the nature of the relationship between the Project and the stakeholder.

The extent of communication with stakeholders to ensure appropriate engagement and information on the Project varies depending on each stakeholder group and will be consistent with the requirements of FPIC.

[4] No grievance mechanism was established for the Project at the pre-feed phase. Community issues and feedback, however, were being captured in the community affairs database.

Table 10: Identified Stakeholders

Description	Comment
Affected Landowners	
Traditional landowners of land required for plantations and other Project facilities	Interaction in the field will consist of community visits. Field studies will engage communities during the EA/EMP/RAP development and preparation process. These interactions will be recorded in the CA database. A group of community/village liaison officers (CLOs/VLOs) from key local villages will be recruited as more local communities are affected by Project activities. These CLOs will be responsible for the two-way transmission of information regarding Project progress details and community concerns.
Landowners of surrounding communities in the Markham Valley	
Neighbouring communities in the Project area who may be related to affected landowners.	Non-directly affected landowners will be engaged similarly to directly affected landowners.
Wampar and Umi Atzera Local Level Governments (LLGs)	
The local level authorities within whose boundaries Area A is located.	As a result of regular extension visits to the Huon Gulf District, a good relationship exists between Project field staff and the councillors of the directly affected wards. Regular meetings with the LLGs, ward councillors and staff of district level administration will continue.
Morobe Provincial Government	
Provider of community services, promoter of sustainable rural development.	The Provincial Governor has supported the Project in written communication to other stakeholders (including PNG Power). Presentations have been made to the provincial heads and Project engagement with the provincial lands administration staff will expand as Project development progresses.
National Government Departments, Agencies and Statutory Bodies	
Regulatory bodies whose regulations the Project or associated landowner representative entities have to comply with.	A number of national regulatory departments and agencies are required to be informed of Project progress, especially in regard to formal submissions, e.g., CEPA on environmental matters. These agencies will be informed on an ongoing basis at appropriate stages of Project development.
National and International Non-governmental Organisations	
Organisations that Markham Valley Biomass may cooperate with and who will be kept informed of Project progress.	The Project may interact with a number of NGOs with regard to improving the health and livelihoods of the communities associated with the Project.
International and Development Agencies	
Agencies that may provide specific assistance to the Project, such as Forest Stewardship Council (FSC),	Markham Valley Biomass currently maintains relationships with selected international and development agencies to keep them informed of the Project's progress and this will continue throughout

Description	Comment
International Finance Corporation (IFC) and International Renewable Energy Agency (IRENA).	Project development. For example, the Project will comply with FSC guidelines with assistance from FSC representatives in PNG.
PNG Corporations and Businesses	
Local companies that the Project is working with in some manner.	Markham Valley Biomass currently maintains relationships with selected PNG corporations, and this will continue throughout Project development. For example, an MOU has been signed with South Pacific Brewery (SP) in regard to the promotion of growing cassava in the Markham Valley for use in beer production and to promote associated social and economic development in the area.
Media Organisations	
Mainstream and digital media that the Project will keep informed of development progress and the achievement of any notable, newsworthy milestones.	The Project has received little media attention as activities during the feasibility stages have been of a trial nature.

Specific communication mechanisms that have been used to date include:

- Maintaining Village Liaison Committees, which currently consist of 14 representatives of 7 clans from Area A and are convened on a monthly basis. Details of discussion topics at these meetings are recorded and minutes circulated for sign-off by the Leadership Group.
- Running town hall meetings, which are currently held on a quarterly basis.
- Participating in local market days, which are irregularly used as an opportunity to further raise local community awareness about the Project.
- Having a stand at the annual Morobe Show to present information on the Project and distribute 'Tok Save' information leaflets.
- Having a stall at the Trukai Agricultural Field Day held annually at the Trukai Erap Estate.
- Having regular meetings with LLGs, ward councillors and staff of district level administration, provincial government personnel, and national government agencies and statutory authorities.
- Maintaining relationships with various private companies and non-government organisations to keep them informed of the Project's process.
- Maintaining a website and Facebook page, and issuing press releases to various media outlets during operations.

These mechanisms will be reviewed and modified as the Project further develops and matures to ensure that transparent, open and pro-active communication and cooperation between Markham Valley Biomass and stakeholders is maintained.

3. Legal Framework

Oil Search is committed to operating the Project in accordance with PNG's legislative requirements, to adhere to applicable international principles, and to meet its own corporate environmental and social sustainability principles.

This chapter describes the key socio-economic legislation and agreements that are relevant to the Project, along with international standards and principles that the Project has adopted. For a comprehensive overview and discussion of the environmental legislative frameworks applicable to the Project, see the separate Environmental Assessment report (ERIAS Group 2017).

While minor aspects of other acts and principles will be relevant to the Project, these have only been listed rather than specifically discussed as they do not relate directly to project approvals or require specific action.

3.1. National legislation

Adherence to legislation, standards, principles and guidelines by the Project follows a hierarchical approach:

- Applicable acts, regulations and standards of Papua New Guinea;
- International standards, principles and guidelines;
- Corporate sustainability principles.

In the absence of PNG standards, or where additional assessment is warranted alongside the use of PNG standards, internationally recognised standards and guidelines will be applied including, for example, those developed by the World Health Organization (WHO) and the International Finance Corporation (IFC).

Table 11 lists all the national and international legislation, policies, and standards applicable and referenced in the SIA report.

Table 11: Applicable national and international legislation, policies, standards, and guidance

Jurisdiction	Type	Legislation/Policy	Authority / author
National	Legislation	Environment Act 2000	Conservation and Environment Protection Authority
National	Legislation	Business Groups Incorporation Act (1974)	Registrar of Business Groups, Investment Promotion Authority
National	Legislation	Lands Group Incorporation Act (1974)	Registrar of Land Groups, Department of Lands & Physical Planning
National	Legislation	Oil and Gas Act (1998/2000)	Department of Petroleum and Energy
National	Legislation	Forestry Act (1991)	Papua New Guinea Forest Authority

Jurisdiction	Type	Legislation/Policy	Authority / author
National	Standards	FSC National Forest Management Standards for Papua New Guinea (2010)	PNG FSC National Working Group
National	Legislation	Land Registration (Customary Land) (Amendment) Act 2009	Department of Lands & Physical Planning
National	Legislation	Associations Incorporation Act 1966	Investment Promotion Authority
National	Legislation	Companies Act (1997)	Investment Promotion Authority
National	Legislation	The National Museum and Art Gallery Act (1992)	The National Museum and Art Gallery
National	Legislation	The National Cultural Property (Preservation) Act (1965)	The National Museum and Art Gallery
National	Legislation	National Cultural Commission Act (1994)	National Cultural Commission
National	Legislation	Conservation Areas Act (1978)	Conservation and Environment Protection Authority
National	Legislation	War Surplus Material Act (1952)	
National	Legislation	Cemeteries Act (1955)	
National	Legislation	Criminal Code Act (1974)	Department of Justice
International	Guidance	International Principles for Social Impact Assessment	IAIA, Vanclay (2003
International	Guidance	Social Impact Assessment: Guidance for assessing and managing the social impacts of projects	IAIA, Vanclay, et al. (2015
International	Guidance	Cumulative Impact assessment & Management: Guidance for the Private sector in Emerging Markets. Good Practice Guide	IFC (2013)
International	Guidance	Good Practice Note: Addressing the Social Dimensions of Private Sector Projects	IFC (2003)
International	Guidance	Guide to Human Rights Impact Assessment & Management	IFC (2010)
International	Standards	Performance Standards and Guidance Notes on Environmental and Social Sustainability	IFC (2012)
International	Procedure	Procedure for Environmental and Social Review of Projects	IFC (2013)

Jurisdiction	Type	Legislation/Policy	Authority / author
International	Guidance	Global Reporting Initiative (GRI), Framework and Guideline	GRI (2016)
International	Guidance	Good Practice Manual: Doing Better Business Through Effective Public Consultation and Disclosure	IFC (1998)
International	Guidance	Guidelines for the Implementation of the Right to Free, Prior and Informed Consent	FSC (2012)
International	Guidance	Natural Resource Charter (2nd edition)	NRGI (2014)
International	Guidance	Voluntary Principles on Security and Human Rights	2012
International	Guidance	The Equator Principles: A financial industry benchmark for determining, assessing and managing environmental and social risk in projects.	2013
International	Guidance	Environmental, Health, and Safety (EHS) Guidelines	World Bank Group (2007)
International	Guidance	Principals for Responsible Investment. An investor initiative in partnership with UNEP Finance Initiative and the UN Global Compact.	PRI (2008)

3.2. National legislation

The Environment Act 2002

The Conservation and Environment Protection Authority (CEPA) is PNG's stewarding agency for the *Environment Act 2000*. This makes CEPA (previously the Department of Environment and Conservation (DEC)) the national government agency responsible for environmental impact regulation (which includes socio-economic impact assessment).

The *Environment Act 2000* classifies development activities within a three-level range based on the activity's expected impact on the environment. Activities with the most significant impact on the environment are classified as Level 3, and involve matters of national importance or may result in serious environmental harm. Level 2 activities are of a more moderate environmental impact and further classified into Category A and Category B activities. Activities not prescribed as Level 2 or Level 3 are defined as Level 1. Which activities are specifically prescribed to these respective levels is defined in the *Environment (Prescribed Activities) Regulation 2002*.

The *Environment (Prescribed Activities) Regulation 2002* outlines a range of activity categories, of which the Project falls within the scope of *Sub-Category 10: Energy production***.**

> Sub-Category 10: Energy production:
>
> **10.2: Operation of fuel burning power stations with a capacity of more than 5 MW, but not including emergency generators.**

Based on these activities, CEPA has classified the Project as a level 2 project which does not require the proponent to conduct an Environmental Impact Statement (EIS) under the Environment Act. CEPA did request the Project's to conduct an Environmental Assessment (EA) and Environmental Management Plan (EMP), the SIA supplements the submission of the EA by providing full documentation on all environmental and social issues as well as relevant mitigation measures.

The Forestry Act 1991

In PNG, 97 per cent of land is customarily owned. The harvesting and utilisation of forest resources is guided by the *Forestry Act 1991* which provides four means of securing forest resources from resource owners: Forest Management Agreement, Timber Right Purchase Agreement, Timber Authority, and Forest Clearing Authority.

The PNG Forest Authority (PNGFA) is responsible for identifying areas of forest suitable for logging, estimating the timber resource and annual allowable cut for these areas, awarding logging concessions and monitoring operations. From the mid-1990s onward, PNGFA has put a strong emphasis on identifying customary landowners to ensure they form Incorporated Land Groups (ILG) for logging concessions – which are generally awarded for periods of 50 years and as Forest Management Agreements.

These Forest Management Agreements entail the purchase of forest resources from resource owners by the PNGFA. In turn, the PNGFA then sells purchase rights or timber permits to developers through signed consent that provides legal authority to developers to carry out logging in that particular forest area. The signed consent prescribes the scope of development including a logging plan, environment management plan, and infrastructure development plan and a benefits agreement strategy.

The National Forest Board (NFB) is empowered to manage the affairs of the PNGFA. The NFB comprises representatives from environment and conservation, trade and industry, finance and planning, forest industries association, and non-government organisations for environment, social and development issues, and includes the Managing Director and Directors from the National Forest Service.

The PNG National Forest Service (NFS) is the implementing agency of the National Forest Board. NFS is involved in supervision, monitoring and control over the forest resource development and utilisation. The NFS oversees administration and enforces forest policy as approved by the National Executive Council (NEC). The NFS acts as the State agency in international negotiations and agreements about forestry matters.

The Project falls within the purview of the *Forestry Act 1991*, which requires the proponent to register as a *Forestry Industry Participant* (FIP) prior to commencement of harvesting. In addition, the Project will need to apply for a *Forest Clearing Authority*, register its machinery for wood chipping, and apply for a forestry license.

FSC National Forest Management Standards for Papua New Guinea (2010)

The Forest Stewardship Council (FSC) is an independent, not for profit, non-governmental organisation established to support environmentally appropriate, socially beneficial, and economically viable management of the world's forests. Its *FSC Principles and Criteria for Forest Stewardship* (2015) sets the indicators and verifiers by which forest operations in PNG might be judged. More specifically relevant to PNG are the *FSC National Forest Management Standards for Papua New*

Guinea (2010) which are presently (i.e., over the course of 2016 and 2017) underdoing a revision, with updated guidelines excepted to come into force by January 2018.

Section 4.4.1 of the FSC Standards for PNG stipulate the circumstances under which socio-economic impacts are evaluated and socio-economic impact assessments must be undertaken. Medium and large scale operations require a socio-economic impact assessment to be conducted, in the latter case by an independent qualified contractor. These requirements underscore the commissioning of an SIA for the Project.

The National Museum and Art Gallery Act (1992)

The *National Museum and Art Gallery Act (1992)* was enacted to make the National Museum and Art Gallery **(**NMAG) responsible for the preservation of PNG's cultural heritage, including the management, documentation and preservation of archaeological sites and relics, and the implementation and enforcement of various pre-existing and subsequent legislative instruments. Section 4(1)(vi) of the Act empowers NMAG to maintain the national register of traditional and archaeological sites, locate and record prehistoric sites and monuments, and carry out the salvage of archaeological excavations as required by the *National Cultural Property (Preservation) Act (1965)* and the *Environmental Planning Act (1978)*. This register is known as the National File of Traditional and Prehistoric Sites (the National File).

The National Cultural Property (Preservation) Act (1965)

As required by the *National Museum and Art Gallery Act (1992)*, management and protection of cultural heritage and property in PNG is vested in NMAG and the National Cultural Commission (NCC) under the *National Cultural Property (Preservation) Act (1965)*—the country's primary National legislation relevant to immovable cultural resources (i.e., archaeological and cultural sites). The Act attempts to protect such sites from damage or destruction and pertains specifically to 'any property, movable or immovable, of particular importance to the cultural heritage of the country', including 'any object, natural or artificial, used for, or made or adapted for use for, any purpose connected with the traditional cultural life of any of the peoples of the country, past or present'. Hence, the Act is applicable to pre-European-contact, European-contact ('historic'), as well as maritime archaeological sites.

The Act details particular offences associated with national cultural property that are potentially relevant to development projects:

> Section 9(1): A person who, without lawful and reasonable excuse wilfully destroys, damages or defaces any national cultural property;
>
> Section 9(2): A person who, by force, threats, fraud, misrepresentation, undue influence or in any other manner, obtains the destruction, damaging, defacing, confiscation or yielding up of any national cultural property;
>
> Section 15(1): A person who, without the written consent of the Commission, exports or removes from the country any national cultural property.

Furthermore, Section 20(1) of the Act highlights that it is an offence not to report the discovery of particularly important types of cultural property.

National Cultural Commission Act (1994)

Under the *National Cultural Commission Act (1994)*, the National Cultural Commission (NCC) is responsible for, amongst other things, preserving and protecting traditional and contemporary cultures of PNG. In practice, NMAG performs a number of the statutory functions of the NCC in relation to the heritage protection and the *National Cultural Property (Preservation) Act (1965)*.

Conservation Areas Act (1978)

While NMAG and the NCC are empowered with primary legislation for managing and protecting cultural heritage, the Conservation and Environment Protection Authority (CEPA)—formerly the Department of Environment and Conservation (DEC)—also has some legislative overlap with heritage issues. For example, the *Conservation Areas Act (1978)* makes provision for the establishment of conservation areas, 'to provide for the preservation of the environment and of the national cultural inheritance by the conservation of sites and areas having particular biological, topographical, geological, historic, scientific or social importance and the management of those sites and areas'.

War Surplus Material Act (1952)

The *War Surplus Material Act (1952)* and accompanying *Regulations (1952)* protect all materials from WWII and other times of defence for the period 1939–1952 (e.g., plane wrecks and other vehicles and machinery, structures and building, unexploded ordnance). The Act is relevant to terrestrial contexts (including underground) along with internal waters and territorial seas. These materials are deemed absolute property of the State.

Cemeteries Act (1955)

Section 29(5) of the *Cemeteries Act (1955)* identifies that it is an offence to exhume a body without an order or authorisation.

Criminal Code Act (1974)

Section 236(b) of the *Criminal Code Act (1974)* identifies that it is a misdemeanour to improperly or indecently interfere with, or offer any indignity to, any dead human body or human remains, whether buried or not.

3.3. National policy fit

Whereas the Project is committed to operate in compliance with PNG's legislative framework, it also endeavours to fit closely with the country's national policy aims and align with PNG's sustainable development goals.

Constitution

The Project's biomass power generation will diversify the electricity supply industry in PNG, which is currently dominated by hydropower, oil (diesel) and gas. The Project is consistent with the PNG Government's initiatives and policies to provide a long-term energy solution that provides secure and sustainable base-load power.

The Project is consistent with the constitutional goals and directives of PNG, which promote the development of its resources through various policies aimed at encouraging (foreign) investment. While encouraging foreign investment and development, it is a priority of the PNG Government to ensure that its citizens are on the receiving end of the benefits.

As outlined in the Constitution of PNG, key relevant aspirations and principles for the development of the nation are presented in Goals 2, 3 and 4:

We declare our second goal to be for all citizens to have an equal opportunity to participate in, and benefit from, the development of our country.

We declare our third goal to be for Papua New Guinea to be politically and economically independent, and our economy basically self-reliant.

We declare our fourth goal to be for Papua New Guinea's natural resources and environment to be conserved and used for the collective benefit of us all, and be replenished for the benefit of future generations.

MVB will ensure that local skills and resources are maximised to provide opportunities for PNG citizens to participate in, and benefit from, the Project. In developing the plantations and power plant, the Project will provide significant employment opportunities during construction and operation, and will enhance the capacity of the local and/or regional workforce and infrastructure to support future development projects. This in turn will also contribute to the economy, employment opportunities and longer-term improvements in infrastructure and services. Furthermore, the Project will create employment in a region distant from conventional energy resources, in a manner that creates social, environmental and development opportunities for PNG citizens.

Planning national development

PNG is rich in petroleum and mineral resources – which the National Government acknowledges as being instrumental to finance strategies to achieve its development objectives – but the development challenges it faces are numerous. The country has deteriorating transportation, education, and health infrastructure, ongoing law and order problems, and difficulties in improving life expectancy, school enrolment and literacy rates.

As a result of the inability to improve services and the general lack of economic development through much of PNG since Independence, the National Government initiated a series of reviews of laws, governance, and administrative processes. In late 2008, the Government established a National Strategic Plan Taskforce (NSPT) to prepare a 40-year national development plan. Within two years, PNG's development aspirations, objectives and strategies had been documented in:

- Vision 2050
- PNG Development Strategic Plan, 2010–2030
- Medium Term Development Plan, 2011–2015
- Medium Term Development Plan 2, 2016– 2017

The vision and plans acknowledge that much of the rural population is not actively participating in the cash economy and basic service provision remains low. Benefits of development and resource projects need to be used to grow and diversify the economy, leading to better service delivery, improved education, improved health services and sound political leadership and structures.

Vision 2050

In 2009, the PNG Government, through NSPT, released *Vision 2050* (NSPT, 2010). It outlines the country's long-term strategic vision and reflects the aspirations of Papua New Guineans, with the goal that PNG will be ranked in the top 50 countries in the United Nations Human Development Index by 2050.

Vision 2050 maps out PNG's development initiatives for the next 40 years and identifies seven strategic pillars underpinning economic growth and development. The development of the Project particularly aligns with the following three strategic pillars:

- Human Capital Development, Gender, Youth and People Empowerment

  The Project will provide employment-related training, which will increase the skills base of local and/or regional communities.

- Wealth Creation

  The Project will strengthen and support a productive regional economy, with landowner participation, and will present a potential new source of wealth and growth for Papua New Guinea.

- Environmental Sustainability and Climate Change

  The Project will mitigate the effects of climate change by capturing carbon in cyclically growing plantations, and will provide a more sustainable source of electricity with lower greenhouse gas emissions than fossil fuel alternatives.

PNG Development Strategic Plan 2010-2030

The PNG Development Strategic Plan 2010-2030 (PNGDSP) translates the focus areas of Vision 2050 into concise directions for economic policies, public policies and sector interventions with clear objectives, quantitative targets, and baseline indicators. The PNG Development Strategic Plan is based on a series of strategies and targets that will contribute to economic growth and aims for a fivefold increase in national income levels by 2030, lifting PNG to middle income status.

The Project is consistent with the country's long-term goal for energy development as outlined in the PNGDSP (DNPM, 2010), which states:

> *All households have access to a reliable and affordable energy supply, and sufficient power is generated and distributed to meet future energy requirements and demands.*

The PNGDSP states the goal that by 2030, at least 70% of PNG households will have access to electricity, and around 25% of the nation's generation capacity will be renewable energy other than hydroelectricity. It also states that "in partnership with the private sector, energy development from renewable sources will be pursued, including biomass". The Project is consistent with this goal.

A forecast in 2010, as part of the PNGDSP, estimated that PNG's demand for energy was likely to exceed supply by 2014/2015. As such, the development of new electricity generation capacity in the next few years (and in particular, renewable energy) is aligned with the Government's development strategy.

The PNGDSP states that the nation's long-term goal with regard to climate change is to 'contribute to global efforts to abate greenhouse gas emissions' (DNPM, 2010). A biomass power plant will have significantly less greenhouse gas emissions than a diesel- or heavy fuel oil (HFO) power plant, while the replacement of grasslands with tree plantations will contribute to increased absorption of carbon from the atmosphere. Therefore, the Project is in alignment with the PNGDSP and, more specifically, the *PNG National Climate Compatible Development Management Policy*, which promotes renewable energy sources.

The PNGDSP also has a stated goal for PNG to 'build a forestry sector that is sustainable and highly profitable' (DNPM, 2010). In relation to this, the Department of National Planning and Monitoring has

set a 2030 target of a 'substantial increase in plantation forests'. The PNG Forest Authority has a related target of reaching 150,000 ha of plantation forests in PNG by 2025. The Project will contribute to these targets.

Medium Term Development Plan

The Department of National Planning and Monitoring has developed shorter-term initiatives in the form of Medium Term Development Plans that have goals stemming from *Vision 2050*, aim to implement the PNGDSP, and are the benchmark for all sectoral, provincial, district and local level government plans. The *PNG Medium Term Development Plan 2016-2017* (DNPM, 2015) defines forestry assets as strategic and states that:

> *…government investment will focus on developing and strategically positioning these assets to meet the needs of current as well as future generations of Papua New Guineans.*

The PNG Government, through its Medium Term Development Plan, is also targeting a major electrification program that will see more than 55% of households having access to power by 2025, with biomass power contributing up to 42 MW of the generation mix. To make this happen, the country requires domestic power solutions that are scalable, sustainable and deliver competitively priced energy. Diesel and HFO generation are to be reduced to 60 MW (2020) and 40 MW (2025), targeting an emissions intensity reduction of 40% by 2020.

PNG Electricity Industry Policy

The Project directly addresses a number of relevant objectives of the *PNG Electricity Industry Policy* particularly with regard to:

- **Landowner participation** (Electricity Industry Policy Section 4.4.5 page 21). Actively seeking landowner participation, and establishing arrangements with landowners.
- **Environmentally-sound technologies** (Electricity Industry Policy, pp 28 and 29). Using technologies for electricity generation that are environmentally and socially sound (i.e., biomass power as opposed to fossil fuels).
- **Emissions reduction** (Electricity Industry Policy, p. 29). Qualifying under the Project under the Kyoto Clean Development Mechanism or similar international emissions reduction schemes.

PNG National Climate Compatible Development Management Policy

The Project directly addresses a number of relevant objectives of the *PNG National Climate Compatible Development Management Policy*, particularly with regard to:

- **Land use, land-use change and forestry (LULUCF) sector emission abatement mitigation programs, projects and reforms** (NCCDMP Section H(2a), p. 12). LULUCF emissions reductions through initiatives that reduce and sequester GHG emissions, and by dis-incentivising GHG emitting activities, emphasizing co-benefits from sustainable development, ecosystem conservation, biodiversity protection, community engagement, and equitable distribution of benefit through the identification of appropriate carbon ownership rights.
- **Green Economic Development** (NCCDMP Section H(2b), p. 12). Promote low-carbon growth and investment while increasing environmental quality and social welfare by incentivising investments in low carbon infrastructure and technology development,

renewable energies, energy efficiency, transport, waste management, manufacturing and construction, and industrial processing sectors.

- **Sustainable Land Use Planning** (NCCDMP Section H(2d), p. 12). Promote establishment of nation-wide sustainable land use planning, starting from community-Ward-LLG level, to District-Provincial and National levels, whilst ensuring collaboration of all relevant Government Departments in considering climate change resilience.

3.4. International frameworks and standards

In addition to the key international frameworks and standards discussed below, this SIA is also cognisant of additional (international) guidance documentation as referred to in Table 11.

3.4.1. Equator Principles

Developers who seek project financing from international finance institutions confront stringent environmental and social policy accountability. As the Project might seek financing from international finance institutions, the assessment of the Project's impact (social, environmental, and economic) has been prepared in accordance with the international requirements of the *Equator Principles*. The Equator Principles represent a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects. Many international finance institutions have adopted the Equator Principles in order to ensure that the projects they finance and advise on are developed in a manner that is socially responsible and reflect sound environmental management practices.

The Equator Principles are primarily intended to provide international finance institutions with a minimum standard for due diligence to support responsible risk decision-making. Under its first principle, *Principle 1: Review and Categorisation*, projects are categorised commensurate with their nature, scale, stage, and level of environmental and social risks and impacts. *Category A* projects have potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented. *Category B* is for projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures. *Category C* is for those projects with minimal or no adverse environmental and social risks and/or impacts.

Under *Principle 2: Environmental and Social Assessment* all Category A and Category B projects are required to assess the environmental and social risks and impacts of the proposed project. The assessment process is detailed in *Principle 3: Applicable Environmental and Social Standards*, and requires compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. In addition, projects located in Non-Designated Countries are required to conduct the assessment process against the applicable *IFC Performance Standards on Environmental and Social Sustainability* (Performance Standards) (IFC, 2012) and the World Bank Group *Environmental, Health and Safety Guidelines* (EHS Guidelines) (WBG, 2007). Under the Equator Principles, Designated Countries are those countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment. Papua New Guinea is not listed as a Designated Country, requiring the additional compliance with IFC Performance Standards and the World Bank Group EHS Guidelines.

3.4.2. IFC Performance Standards on Environmental and Social Sustainability

Adhering to the requirements of the Equator Principals, the proponent has committed the Project to complying with the *IFC Performance Standards on Environmental and Social Sustainability* which require environmental and social impact assessments.

The IFC Performance Standards provide guidance on how to identify and manage environmental and social risks and impacts. They establish the standards that proponents are to meet throughout the life of an investment by the IFC, specifically:

> *They are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of its direct investments (including project and corporate finance provided through financial intermediaries), IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced.*

PS 1: Assessment and Management of Social and Environmental Risks and Impacts

Objectives:

- To identify and evaluate environmental and social risks and impacts of the project
- 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.
- To promote improved environmental and social performance of clients through the effective use of management systems.
- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately.
- To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

PS 2: Labour and Working Conditions

Objectives:

- To promote the fair treatment, non-discrimination, and equal opportunity of workers.
- To establish, maintain, and improve the worker-management relationship.
- To promote compliance with national employment and labour laws.
- To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the supply chain.
- To promote safe and healthy working conditions, and the health of workers.
- To avoid the use of forced labour.

PS 3: Resource Efficiency and Pollution Prevention

Objectives:

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.
- To promote more sustainable use of resources, including energy and water.
- To reduce project-related GHG emissions.

PS 4: Community Health, Safety and Security

Objectives:

- To anticipate and avoid adverse impacts on the health and safety of the Affected Communities during the project life from both routine and non-routine circumstances.
- To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

PS 5: Land Acquisition and Involuntary Resettlement

Objectives:

- To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs.
- To avoid forced eviction.
- To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.
- To improve, or restore, the livelihoods and standards of living of displaced persons.
- To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resource

Objectives:

- To protect and conserve biodiversity.
- To maintain the benefits from ecosystem services.
- To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

PS 7: Indigenous Peoples

Objectives:

- To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples.
- To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts.

- To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner.
- To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle.
- To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present.
- To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.

Applicability:

IFC Performance Standard 7(1) defines 'Indigenous Peoples' as "social groups with identities that are distinct from mainstream groups in national societies … often among the most marginalized and vulnerable segments of the population". Applying strict criteria of 'minority' and 'other' to the PNG context would rule out all of the 700-plus ethnic groups as 'indigenous'. On the other hand, assuming that 'indigenous' does not derive its meaning from the numerical predominance or presence of certain 'others', but rather from whether those people are 'native' to a country in the sense of "originate/occur naturally"[5] (i.e., have descent from the populations which inhabited the country) better captures the ethnic populations of PNG – whom all-together not only constitute a populous majority in the country, but own 97 per cent of the land mass under customary law.

IFC recognizes that there is no universally accepted definition of 'Indigenous Peoples' and remarks in Guidance Note (GN) 7(5) that "the term 'indigenous' may also be considered to be sensitive in certain circumstances." As a result, Performance Standard 7 does not define, use, or require use of the term 'Indigenous Peoples' to determine its applicability. Furthermore, PS7(4) recognizes that different countries use various terms, including but not limited to, indigenous ethnic minorities, hill tribes, scheduled tribes, minority nationalities, first nations or tribal groups – which may all be used to identify 'Indigenous Peoples'.

In the case of Papua New Guinea the term 'Indigenous Peoples' is not used within the country, as its inhabitants, apart from a very small percentage of recent immigrants, are all 'indigenous' (FSC, 2016). It is more common in PNG to use the term 'customary landowners', which to various degrees reflects the characteristics used by IFC to shape its notion of 'Indigenous Peoples'.

The term 'Indigenous Peoples' as employed by IFC is not intended in a strict but rather generic sense. PS7(5) refers to "a distinct social and cultural group possessing the following characteristics in varying degrees":

- *Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;*
- *Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;*
- *Customary cultural, economic, social, or political institutions that are separate from those of the mainstream society or culture; or*
- *A distinct language or dialect, often different from the official language or languages of the country or region in which they reside.*

[5] The fact that peoples may have emigrated many thousands of years before from other continents is irrelevant in this context since human occupation on the mainland of PNG pre-dates that for modern humans in Europe.

Assessing the characteristics of the Project Affected Communities against the above criteria can help determine their qualification as 'Indigenous Peoples'. It should be noted that the non-cumulative formulation by IFC of the above characteristics significantly extends the qualifying conditions, suggesting that even one of these factors can qualify a group as 'Indigenous Peoples'.

- *Self-identification*
  The Project area is inhabited by the Wampar ethnic group. While Wampar people self-identify as members of a distinct cultural group and as such recognise themselves as separate from other ethnic constituencies in PNG, they generally do not self-identify as 'Indigenous Peoples' but do identify with the descriptor of being 'customary landowners'.

  Taking the descriptor of 'customary landowner' to reflect the notion of 'Indigenous Peoples' in the PNG context would result in all of the 700-plus ethnic groups to be 'indigenous'. In PNG, mainstream society is in its very essence the patchwork of these social groups with separate identities. However, this overarching mélange of social groups making up mainstream society are not by default among the most marginalized and vulnerable segments of the population. The Wampar people do not have less "voice" in the area or in PNG than other groups.

- *Collective attachment*
  For the Wampar people traditional belief in malicious spirits and agencies (*masalai*) persists and are believed to inhabit rivers, rocks and big trees found on their ancestral territories and the natural resources therein. The cultural heritage and archaeology study conducted as part of the SIA uncovered a total of 43 cultural heritage and archaeological sites within Area A of collective significance to the Wampar people. As such, it can be concluded that the Wampar people have a collective attachment to their ancestral land.

- *Customary institutions*
  Wampar social organisation is based around membership of clan (*sagaseg*) with leadership roles based loosely on the 'big man' (i.e., achieved not ascribed) archetype found across PNG societies. Besides customary institutions, Wampar society is generally governed by PNG's local, provincial and national institutions and systems. The Wampar, like most PNG ethnic groups, use a combination of customary institutions and local, provincial and national ones.

- *Distinct language or dialect*
  The Wampar people in the Area A refer to their language as *Dzob Wampar* ('Wampar talk'). Wampar-speakers south of the Markham River identify as speaking a different dialect to Wampar living north of the Markham River; they also identify as constituting a different sub-group of Wampar – the Wampar *Saab* – and refer to other Wampar as Wampar *Fofon*. The Wampar people in the Project Area A thus have their own distinct dialect that distinguishes them from other Wampar people. However, Wampar people generally also speak *Tok Pisin* and/or English and are therefore able to communicate and be understood by the rest of the population.

Going by these qualification criteria, the Wampar people (and by extension all of PNG's customary landowners) reflect to some degree the characteristics used by IFC to ensure that certain groups have a voice and are treated in a manner that is consistent with their customs.

Additionally, it is difficult to set apart the Wampar people as 'Indigenous Peoples' in contrast to the country's other 700-plus ethnic groups when weighing in particular the intent of the IFC to protect minority social groups, with identities distinct from mainstream groups, that are among the most marginalized and vulnerable segments of the population. Indeed, the Wampar people are not particularly marginalized, especially vulnerable, or a minority group disparate from a mainstream majority group.

While the Wampar people can be considered a distinct social and cultural group in the country and in the region in which they reside, their degree of 'separateness' is moderated by their equal opportunity for participation and decision-making in the Project at the same level as a small number of the in-migrated non-Wampar people living in the Project area.

Accordingly, while the Wampar people can technically be considered 'indigenous peoples', both country context and project context do not warrant singling out the Wampar people for special protection and treatment as opposed to other project affected peoples and groups, all of whom would be treated with special attention to customs and traditional institutions as outlined in PS7(10–17).

The Project's conversion of under-utilized Project Affected Communities' land into biomass plantations is associated with a range of environmental, economic, and social impacts – described respectively in the Environmental Assessment report (ERIAS Group 2017), the Economic Impact Assessment (Economics Consulting Services (ECS) 2017), and the SIA. A number of these identified impacts can be described as 'adverse' to the Project Affected Communities and fall within the circumstances described in PS7(13–17), warranting voluntary expansions by the proponent of the ICP process to FPIC.

While there is no single accepted definition of FPIC, its key elements, as defined in the UN Permanent Forum on Indigenous Issues report (UNPFII, 2005), capture the outcomes of the International Workshop on Methodologies regarding FPIC and Indigenous Peoples – as summarized by Buxton and Wilson (2013):

- Free: people are 'not coerced, pressured or intimidated in their choices of development';
- Prior: 'their consent is sought and freely given prior to authorisation of development activities';
- Informed: 'they have full information about the scope and impacts of the proposed development activities on their lands, resources and well-being'; and
- Consent: 'their choice to give or withhold consent over developments affecting them is respected and upheld'.

FPIC as an ethical expression of a human right is uncontroversial, but PS7(12) does not give adequate expression to a circumstance in which an affected constituency declines consent to a proposed development. FSC provides the following understanding of FPIC which underscores their certification process:

> "The right to FPIC includes the right of indigenous peoples and local communities to give, withhold or withdraw consent to those activities that would affect their rights. That is different from an engagement process which gives the Organization the right to take the final decision. Engagement by itself does not include the right to say 'No', whereas a process based on the right to FPIC does" (FSC, 2012, 8).

With parts of the FPIC framework still being debated[6], practical implementation is best approached as an iterative process (Figure 3) to be understood through the lenses of international and national legal frameworks (von Ketteler 2014; Campbell, et al. 2012). It is an ongoing process of engagement and meaningful consultation with the explicit objective of disclosing relevant information, identifying impacts, accommodating rights and interests of the affected communities, and obtaining their continued consent.

Figure 3: FSC iterative six step FPIC process (von Ketteler 2014)

With the evolving requirements and understanding, FPIC is potentially shifting the basis of SIA from being subordinate to EIAs to being the process that enables FPIC to occur and most particularly when the results are disseminated to assist the community envision its own future (Esteves, Franks, and Vanclay 2012, 37).

For an FPIC process to be undertaken properly and fairly, there are some preconditions: primarily, that all parties have sufficient resources and capacity to be able to participate effectively. Importantly the host communities should be apprised of the national and international laws concerning 'biomass' energy projects, the benefit streams subject to Government legislation and/or proponent-affected landowner discretion/negotiation, legal processes for dispute resolution, and their land rights.

The creation of an 'informed' host community requires a resource investment but is consistent with the Forest Stewardship Council (2012) guidelines on FPIC which recommends engaging an independent third party. For this Project the proponent has committed to utilising a national lawyer as 'local advocate'[7] with the following roles and responsibilities:

- To provide independent advice/information to Project landowners about their rights, responsibilities and options on land, compensation and resettlement under national PNG and International law;

[6] There is ongoing discussion about the definition and implementation of Broad Community Support, consent, veto and 'the right to say no', and hence the question if FPIC is achieving its aim of ensuring effective participation.
[7] This model of ICP has previously been used by the PNG LNG project in their Resettlement Program.

- To independently certify that landowners understand any MOU or similar negotiated agreement and witness by signature any written contract;
- Assist with dispute/problem resolutions;
- Assist drafting Project land use and compensation agreements to be compliant with PNG law.

This 'local advocate' initiative will assist/manage the risk of a constituency that is not well informed and which may thus sign agreements with long-term commitments over which they are unclear. In a 'change of mind' scenario the presence, availability and access to independent legal advice may ensure that in potential cases of litigation agreements will not be nullified agreements and pose a threat to the sustainability of the project.

PS7 Requirements:

- Conduct an environmental and social risks and impacts assessment process to identify all communities of Indigenous Peoples within the project area of influence who may be affected by the Project.
- Avoid adverse impacts on Affected Communities of Indigenous Peoples where possible.
- Minimize, restore, and/or compensate unavoidable adverse impacts in a culturally appropriate manner commensurate with the nature and scale of such impacts and the vulnerability of the Affected Communities of Indigenous Peoples.
- Undertake an engagement process with the Affected Communities of Indigenous Peoples, including stakeholder analysis and engagement planning, disclosure of information, consultation, and participation, in a culturally appropriate manner.
- Obtain the FPIC of the Affected Communities of Indigenous Peoples in the following circumstances:
    - Where there are project impacts on lands and natural resources subject to traditional ownership or under customary use.
    - Where relocation of Indigenous Peoples from lands and natural resources subject to traditional ownership or under customary use is unavoidable.
    - Where significant project impacts on critical cultural heritage are unavoidable.

PS 8: Cultural Heritage

Objectives:

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing of benefits from the use of cultural heritage.

3.4.3. World Bank Group's Environmental, Health and Safety (EHS) Guidelines

The World Bank Group EHS Guidelines are technical reference documents that are specifically referred to in the IFC Performance Standards and provide general and industry-specific examples of good industry practice. The *General EHS Guidelines* provide guidance to users on common EHS issues that are potentially applicable to all industry sectors and should be used in conjunction with the relevant *Industry Sector Guidelines*. Although the Project's generating capacity of 30 MW is less than the 50 MW minimum specified in the thermal power plants guideline, MVB has decided to use this guideline for guidance during Project planning and development.

3.5. Corporate sustainability principles

Oil Search, as the proponent, is committed to operate the Project in a manner that meets its corporate environmental and social sustainability principles as outlined in its *Health, Safety, Environment and Security Policy* (Appendix A) and its *Social Responsibility Policy* (Appendix B).

The Company's *Social Responsibility Policy* outlines a commitment to:

> "Proactively identify, evaluate, transparently report and manage any risks, threats or impacts related to our operating context that have the potential to adversely affect the environment, the wellbeing of the local community or our social license to operate".

Further to its corporate policies, Oil Search is a member of the business-led Global Compact network in Australia which brings together signatories to the UN Global Compact, including a number of Australia's leading companies, non-profit organisation and universities, to advance corporate sustainability and the private sector's contribution to sustainable development. As the world's largest corporate sustainability initiative, the UN Global Compact is both a practical framework for action and a platform for demonstrating corporate commitment and leadership.

In 2016, Oil Search reinforced its corporate commitment to promoting positive social change in PNG by joining leading global companies in support of the United Nations Sustainable Development Goals (SDGs) and currently contributes directly or indirectly to 13 of the 17 SDGs.

Other corporate commitments to social change include employment opportunities, improved livelihoods, and local enterprise development. Oil Search supports the creation of economically independent communities by providing employment opportunities and access to supply chains. This has several benefits including improving supply chain reliability, supporting Oil Search's social licence to operate, helping to mitigate landowner related issues, building strong local businesses, and facilitating community economic development.

4. Context

4.1. National and regional context

4.1.1. Power in PNG

The PNG Biomass project aligns with the development priorities of the PNG Government. PNG has one of the lowest per capita consumption rates of electricity in the world. Access to electricity remains one of the country's most significant development challenges. With only 13% of PNG's population connected to a power grid, many people do not have access to reliable power capable of supporting their everyday needs. The lack of access reflects constraints from both the rugged PNG topography and the fact that most of the population is dispersed in rural areas that are not served by electricity . Those who are connected to one of the three main PNG power grids pay among the highest electricity prices in the world. The PNG Government is therefore seeking solutions that will substantially improve the population's access to electricity and that will result in a reduction in its cost. The country is therefore an ideal candidate for distributed generation and small-scale (domestic or village level) power, as reflected in the various PNG Government development goals and planning strategies described in Chapter 2.

Currently, the total installed power generation capacity in PNG is approximately 800 MW (excluding power generation relating to the PNG LNG Project), of which half is on-grid generation supplied by

PNG Power Limited (PPL) and several smaller Independent Power Producers (IPPs). These IPPs operate under Power Purchase Agreements (PPAs), with PPL as the buyer.

4.1.2. Provincial and local context

The Ramu grid extends from Lae and Madang in the east to Mt Hagen and Mendi in the west, with a 132 kVA transmission line running along the Markham Valley near the Highlands Highway. It is currently PNG's largest and fastest growing grid, and is located in the most populous area of the country. Although options such as a transmission line to connect the Port Moresby grid to the Ramu grid have been raised, these are unlikely to occur given factors such as the terrain, high costs and seismic issues. Therefore, the Ramu grid is, and will likely remain, the largest separated grid, which also has the greatest opportunity to significantly increase electricity connection rates from a very low baseline level.

However, the reliability of the Ramu grid's supply network is variable. Current generation supply is primarily from PPL, which owns the Ramu Hydro Power Stations with installed capacity of 77 MW. The power stations are supplemented by intermittent power supply from primary diesel and HFO generators (owned by PPL and other smaller IPPs). The demand is driven primarily by commercial, industrial and mining customers, which make up approximately 86% of sales. Low residential sales indicate the present lack of household connections, which is forecast to drive significant growth in the future.

Lae, which is the second largest city in PNG, is the country's largest industrial centre. The nearby highland provinces have the highest population density in the country and the Project area in the Markham Valley is a significant agricultural hub. Many companies have had to install stand-by and/or off-grid diesel generation because of the lack of reliable supply via the grid. Based on forecast power requirements, it is estimated that the required latent and self-generating industrial (baseload) power is 20 to 30 MW in Lae, and this will largely be met by existing hydro-electricity dispatch and the PNG Biomass Markham Valley IPP units (which are the subject of this assessment). In addition, new industrial and other loads are being added to the system, and PNG Biomass Markham Valley will provide the ability to meet this demand.

4.2. Community profile

4.2.1. District and Local-Level Government

The PSA is located in the Wampar Rural LLG of the Huon Gulf District, which has in total three LLGs: Morobe Rural, Salamaua Rural (district headquarters), and Wampar Rural. The district spans 7,401 km^2 of which 1,906 km^2 is occupied, and is bounded by the Rumu River in the west. Beer (2002) states that for Wampar the 'Rumu River is a natural border to the Adzera in the northwest' – also repeated in the Project Social Mapping Report (De Gedare 2013, 14). However, other sources (Dangerfield 1971, 0; Holzknecht 1974; May and Tuckson 2000, 128, 130), along with SIMP's cultural heritage interviews with Wampar groups in Area A, indicate that the ethnic/language boundary is further to the west and corresponds with the Leron River (i.e., the Leron River bridge of the Highlands Highway). This is supported by the identification of a number of Wampar cultural heritage sites west of the Rumu River, extending towards (but not beyond) the Leron River.

The highest population density is northwest of the Chivasing area with 33 persons/km^2while the Markham and Watut valleys have 13 persons/km^2. Huon Gulf is the largest district in the province with an average annual rainfall ranging from 1,700 mm in the Markham Valley, to over 3,700 mm south of Lae. Altitude varies from sea level to over 2,500 m in the Bowutu Mountains. People in the Markham

and Watut valleys cultivate moderate intensity banana gardens, and coconut is also an important food. The Markham Valley is limited by poor soils, frequent flooding and a long dry season. Economic activities derive from sales of fresh produce, betel nut (before the crop failure in 2007/2008), modest production of cocoa and coconuts from the lower Markham Valley and employment on livestock estates and out-grower sales of poultry.

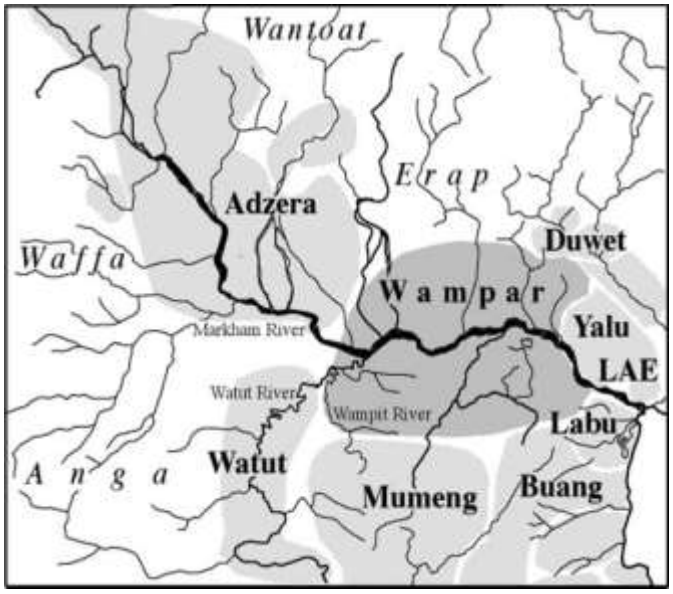
4.2.2. Ethnic group constituency

There are two major ethnic groups inhabiting the Project area:

1. The Wampar (12,000-15,000) who occupy Area A and the PSA; and
2. The Adzera (30,000) who reside west of the Leron River in Area B.

With the PSA restricted to Area A, the SIA deals exclusively with the Wampar ethnic group.

Figure 4: Ethnic group locations



4.2.3. The Wampar

The Wampar, often previously referred to as Laewomba or Lahewomba, self-reference as *Ngaing Wampar* ('Wampar people') and their language as *Dzob Wampar* ('Wampar talk'). *Dzob Wampar* is just one of the 96 different languages spoken in Morobe Province. Wampar-speakers south of the Markham River (e.g. at Chiatz and Mare villages – outside the PSA) identify as speaking a different dialect to Wampar living north of the Markham River; they also identify as constituting a different sub-group of Wampar – the Wampar *Saab* – and refer to other Wampar as Wampar *Fofon*.

The present day settlement pattern of Wampar is very much the culmination of a century of change, contact and successive in-and out-migration. During World War II, for example, the Wampar dispersed and lived in small hamlets; after the war they returned to their villages. Importantly, as ethnographers have described (Sack and Clark 1979; Sack 1976; Holzknecht 1974; Holzknecht 1973; Fischer 1992; Stürzenhofecker 1930), the Wampar boundaries were fixed by colonial processes at a point in time when their territorial expansion was at its peak.

Today, the Wampar live in nine main villages (Tararan, Chivasing, Gabsongkeg, Munum, Ngasawapum, Gabantsidz, Wamped, Mare and Gabmadzung), five of them close to the Highlands Highway. The concentration of the population in villages is a post-contact phenomenon, developed

under the influence of colonialism and Christianisation after 1911 (Beer 2015). The Wampar were first mentioned in reports of German gold miners and colonial officers at the beginning of the 20th century. They are subsistence gardeners and participate in commercial activities, the market economy and agribusiness. Many work in Lae as teachers, nurses and mechanics.

4.2.4. Subsistence patterns

Subsistence gardening is focused in areas of good soil, especially towards the foothills on either side of the Markham Valley and along deposition areas of river channels. When Wampar experience dry periods the villagers are able to use the otherwise swamped and wet soils which retain their moisture. The majority of Wampar families maintain gardens that supply bananas (their staple food) and areca nuts for consumption and sale. Coconuts, vegetables, corn, onions, tomatoes, pineapples, watermelons, taro, yams, sweet potatoes and peanuts are also grown. Today, the market economy is almost as important as the subsistence economy. Purchased goods – rice, sugar, tea, bread, biscuits and canned goods (sardines and corned beef) – supplement the diet.

In the PSA villages residents continue to hunt both in the long kunai and in the forest areas mostly for bandicoot and wild pig. A significant number of people also raise cattle, pigs and chickens. There are small trade stores in most villages selling tin fish, soap, cooking oil etc. In all of the PSA villages small trading occurs along the highway, both in established markets and in temporary makeshift shelters.

Major cash crops include copra, peanut, cocoa and oil palm. Oil palm, sugarcane, chickens and cattle are the four most important agribusiness activities on a large commercial scale in the Markham Valley. Cattle exist both in the Leron plains and adjacent to Nowa village. Families typically have approximately one to two hectares of garden area.

The Wampar formerly had a booming cash crop economy based on the growing and selling of buai (betelnut or areca nut). After an unknown pest hit the areca palms in 2007, devastating the harvest and killing off most mature palm trees, there was a dramatic shift in economic activities towards the cultivation of cacao and cattle farming.

4.2.5. PSA villages and demography

Within the PSA there are five villages: Tararan, Chivasing, Kokok, Nowa (Noa), and Bampu (Bampulompon). Tararan and Chivasing are the largest villages in the PSA, whilst Kokok and Bampu represent small satellite hamlets respectively of these two villages. Nowa is an outlier village composed of an immigrant enclave. The population data for these five villages, as well as the number of SIA surveys undertaken, is listed in Table 12.

Table 12: PSA village demography and SIA Survey coverage

Village	2011 Census Population	2011 Census Households	2016 Number SIA Household surveys	2016 Percentage SIA Household surveys
Chivasing	614	134	91	49%
Tararan	548	124	68	34%
Bampu	NA*	NA*	14	65%[8]
Kokok	303	53	22	17%
Nowa (Noa)	479	102	45	26%
Estimated Totals	**2059**	**426**	**240**	**38.2% (average)**

* Data not available

4.2.6. Social organisation

Until the 1970s all Wampar conceptualized themselves as members of one of about thirty named social groups called *sagaseg* (Fischer 1994; Fischer 1975). Wampar speak of *sagaseg* as patrilineal groups, but, as across PNG, the incorporation of non-patrilineal kin is common. Moreover, there is documented evidence in history of the fusion of non-related *sagaseg*. The clans were totemic and exogamous[9] in the past. However, both in function and hegemony of descent ideology the system has undergone change in response to rapid development and inter-ethnic relations. Marriages within the same *sagaseg* were formerly subject to sanctions, but this is no longer the case, and some young people have even become unclear about their clan membership (Beer 2006).

Each Wampar village has a multi-clan composition. Previously these groups were physically demarcated in the settlement but today clans-people are intermixed residentially. Allied villages in the past would cooperate for fighting, exchange, ceremony and annual kunai burning. The resilience of the agnatic system[10] has everything to do with the way it still defines land rights and tenure. The major clan names remain constant having been recorded in the literature for more than 60 years (Sack 1976; Dangerfield 1971).

Major Wampar clans in the PSA are:

- Feref
- Muswarang
- Oroganzon
- Orogwangin
- Owangrompon
- Chuaif
- Zeaganzon
- Orogazog
- Montar

[8] Bampu is an outlying hamlet of Tararan census unit. If we include it in the Tararan column that would yield a 66% figure of households covered for that census unit, and an averaged 40% representative sample across the four communities.
[9] The practice of marrying outside a specific ethnic group, class or social group – in this case the clan.
[10] In Papua New Guinea there are patrilineal and matrilineal societies whose main asset – land – is passed down through the male line and female line, respectively. The agnatic system is based on patrilineality and involves the inheritance of land, property, rights, names, or titles by persons through male kin.

4.2.7. Leadership

The Wampar have multiple leadership roles based loosely on the 'big man' (i.e., achieved not ascribed) archetype found across PNG societies. Since contact and colonial administration in the early 1900s the church appointed and trained people as church elders, pastors, and teachers. The early administrations also appointed village leaders such as *tutuls*, and *luluais* in the 1960s. Since independence in 1975, new leadership types were introduced such as village court officials, and youth and women's leaders.

4.2.8. Marriage

Sister-exchange was previously the preferred marriage form within a village cluster as these created alliances and sequential marriages between the groupings. Residence was patrivirilocal – where the couple after the wedding live in the village of the husband's parents – and there were prevailing affinal name avoidances and other taboos. Early inter-ethnic marriage was largely between Wampar and Adzera (Beer 2006) but from the 1960s onwards, men from more distant coastal and lowland areas were increasingly marrying in. After the 1980s Wampar men were taking wives from disparate provinces including the highlands.

4.2.9. Land rights

The intersection of changed descent, kinship and affinity relations is felt mostly in the land tenure system. The patrilineal lineage remains the main landowning group. Normally, male children inherit the rights to their father's lands whereas daughters inherit land rights only if they have no brothers, stay unmarried, or their lineage is rich in land and they are married to landless Wampar or non-Wampar. Land can never be permanently alienated from the clan group and decisions to lease still require group consent. Trees such as coconut palms are owned individually by those who planted them, whether they are on the planter's own land or not.

According to Wampar tradition, the first small group of men to cross the Markham River from the south (upper Watut) 'put' their names on stretches of grassland and bush areas. People who migrated later laid claim to such areas from these original namings and claims. Ownership of rights to particular areas of land and bush is vested in the descendants of the ancestor who was believed to have 'named' these areas. One of the members of the clan, usually the oldest active male, is the custodian and controller of this land for the group, but is not its owner.

Through being born into a particular clan, and more especially into a particular sub-clan, one inherits rights of usage to certain areas of grassland and to certain areas of bushland and forest. In Wampar where marriage is normally between members of clans or sub-clans within the one village, one can as a result have access to land rights in both groups.

Land in the past could also be won through warfare and Wampar claims to land are bolstered by a recitation of how some of the group's ancestors had 'spilt their blood' on this land. The bases for land right claims are thus as follows:

1. 'Discovery' or 'pioneering'[11] of unoccupied lands through exploration by the 'first clan/s'; this may not entail subsequent settlement.
2. Occupation since 'time immemorial', following the creation or emergence of clan ancestors in the landscape and subsequent inheritance from forebears.

11 Cf. Burton, J. 1991. "Social mapping." In *Customary Land Tenure: Registration and Decentralisation in Papua New Guinea, IASER Monograph 29*, edited by P. Larmour, 195-217. Boroko: Institute of Applied Social and Economic Research. "Pioneering'...mean[s] movement to exploit unutilised areas that are *not now* claimed by others'.

3. Conquest.
4. Purchase or lease using traditional valuables or money.

Problems arise when interethnic couples have their right to use land for other purposes than gardening contested. This is especially the case with uxorilocal non-Wampar men (i.e., matrilocal lineage; when the married couple resides with or near the wife's parents), their children may be differentiated by a range of sometimes derogatory terms: *miks pikinini* (mixed child), *miks manki* (mixed boy), *miks meri* (mixed girl), or *pikinini bilong ngaeng yaner* (child of a non-Wampar man). Children from these marriages are dependent for their livelihood on the usufruct rights of their mothers, which are now being passed down to them, although this may be contested by the mother's kin.

There are different types of land in use. The first major distinction is between mountain land and valley land: mountain land hardly enters Wampar calculations since it is so far away from village areas. Its main use, even now, is for hunting. Traditionally, in Wampar areas most of the kunai grass covered valley floor was not used except for the annual burning-off of the grass, and partly to hunt wild pig and game in the tall grassland areas.

4.2.10. Religion

The Wampar have been exposed to mission activity for a century and are all converts to various denominations including Seven Day Adventists, the Assembly of God, the Lutheran Renewal and PNG Revival churches. Traditional belief in malicious spirits and agencies (*masalai*) persist and they are believed to inhabit rivers, rocks and big trees. The advent of modern medical science has not completely erased traditional beliefs about sorcery and angry ancestral spirits as the source of sickness and death.

4.2.11. Sources of conflict over land

Notwithstanding the land tenure ideology described above, development and resource projects have a potential to be catalysts for landowners to subvert convention where they can. The collapse of the areca palm trade and the attractiveness of palm oil, sugar cane and agribusiness have led to instances where Wampar clan lands have been sub-divided and allocated to each family group/ lineage for sole stewardship. This gives families over-arching rights to do with the land parcel as they wish with very little input from the leaders or the clan group.

While detailed discussion of the risks associated with these practices is provided in Chapter 5, we can usefully summarise the circumstances likely to result in social problems:

1. **Social iniquity**: Where decision-making about land parcels is concentrated in or monopolized by a handful of males iniquities arise both in terms of perceived advantage and in the distribution of cash benefits from tillage. This is less about any shortage of land *per se* and more about who can and cannot use clan land for agribusiness.
2. **Non-participant jealousy**: Land lease agreement negotiations with individual family heads, rather than with the entire clan, can induce jealousy by non-participant farmers.
3. **Non-Wampar landowner identification**: Where the land involves a non-Wampar it has potential to ignite land disputes. Much of the desired land plots for the Project are owned by a number of different groups but also governed in part by state leases. Other land in the PSA is under commercial lease to Rumion and Markham Farms etc. Many enterprising PSA farmers have leased state land and then re-leased it to the Project for a small profit. Whilst such land

lease does not cause any immediate issues, the increasing interethnic marriages has meant some women married to non-Wampar also now receive land from their fathers. Children from mixed marriages are counted as Wampar, whether it is the father or mother who is the 'stranger'. However, if their parents have been separated for a long time and if the children have lived with the non-Wampar parent in his or her place of origin, they are no longer considered 'landowners'. There is then a risk that some outside non-resident Wampar will press for identification as 'project area clan landowners'. Such claims are likely to be grounded in a cultural logic that emphasises (1) the Wampar ethnicity of a parent; (2) shared ancestry by same name dispersed clan segments or lineages, i.e., the putative relatedness of people who are members of clans with the same name residing in communities elsewhere in the region.

The existence of counter-claims to land parcels, often unknown to the various claimant parties, is not unusual in the context of PNG where rural groups rarely formally register titles and oral history is the general form of testament to title. Such circumstances do not necessarily cause conflict, violent or otherwise, unless (a) one party starts to use land resources, or (b) derives a monetary benefit from some intervention by an internal or outside party such as a development project. The placement of a 'cash/compensatory' value on the land and its resources may derive from land purchase, improvements or rental (lease), or from due benefits (e.g., crop share/equity) for use because the owners are deemed 'landowner beneficiaries'. The real exclusion of a person or persons from access to such benefits may provoke a legal or armed response, or both.

This scenario is one already experienced following the demise of the areca palms (cf. Beer 2006a: 35). Farmers then turned to growing cacao and began to actively secure the boundaries of their land and delimit the access for those they considered as having no rights. Large tracts of land were also fenced for cattle grazing and new herds were established. As cattle farms require a sizeable investment, families began documenting their lineage history to retain proof of ownership and even went to court to establish legal title to their land. Land came into focus as the only source of long-term wealth, and the discourse about male foreigners, or *ngaeng yaner*, turned more hostile.

The degree to which the Project engenders land disputes will to some extent depend on the success of its business development programs and efforts to establish a business entity that provides for the equitable distribution of benefits. The competing constraints are between respecting and acknowledging the self determination of landowners/clans to steward their own land tenure systems and rights (ensuring the Project does not create deep divisions between have and have-not constituencies) whilst simultaneously attempting to gain some security to, and sustainability of, biomass supply.

The village of Nowa presents as particularly problematic. It was settled some 50 years ago by Menyama people from Engate who were ceded land by Tararan. They technically have no land of their own. Project participation by Nowa villagers would be limited and then as 'tenants' of Wampar hosts whom they would undoubtedly have to appease through some tithe in those circumstances where they do not lease state land on a lease-back arrangement.

4.2.12. Household economy

The national fiscal scenario for 2016–2018 appears one of slowed growth and a trajectory on which PNG is unlikely to meet its power capacity targets as set in the various National Planning programs. At the local level the cultural blueprints of gender inequity, impacts of gender-based violence on employment and business bottom lines, the complex panoply of land rights which can engender disputes, and competition from oil palm commercial enterprises will prove challenges for the Project. A significant proportion of the rural population in Morobe Province effectively has no, or very limited,

access to formal financial services (BPNG, PNGINA, WB 2015). In addition, the range of financial services available to rural communities is narrow.

Not only is a high percentage of rural respondents (60–80 per cent) without any financial products but women are more likely to report having no financial products than their male counterparts. Data indicate 80–90 per cent of households are running short of money after meeting household expenses, particularly those households that only have informal sector income. As shown in Table 13, whilst a range of expenditure causes are cited, those households whose principal source of income is in the informal sector or self-employed, not surprisingly, cite income related causes for running short of money. In particular, a failure to plan is one of the most commonly cited causes.

These findings are relevant to understanding the livelihood profiles of the PSA communities because they signify the kind of potential tangible benefits to be had from project generated employment opportunities, land rentals, biomass crop shares, and intercropping on household incomes.

Table 13: Reasons for Household Cash Shortage (BPNG, PNGINA, WB 2015: Table 17)

	Urban		Township		Rural	
	Informal Sector/Self-Employed	Formal Sector	Informal Sector/Self-Employed	Formal Sector	Informal Sector/Self-Employed	Formal Sector
Insufficient low income	33	18	31	61	42	23
Failure to plan ahead	31	26	31	11	34	24
Fluctuating unreliable income	6	0	27	4	35	18
Unexpected expenses/events	38	22	23	22	11	32
Increased cost of food	20	26	19	14	18	27
Need to provide help to others	24	23	15	14	6	37
Overspending	31	44	27	37	16	34

5. SIA sectoral analyses

5.1. Chapter outline

This chapter provides the consolidated outcomes of the sectoral analyses that were conducted as part of the SIA Study. The following sectors are discussed below:

- Provincial sectoral analysis:
    - Monetary economy.
    - Economic infrastructure.
    - Education and training.
    - Benefit streams.
- Community consultation and participation:
    - Resettlement.
    - Project induced in-migration.
- Agriculture and land.
- Health:
    - Health systems issues.
    - Communicable respiratory diseases linked to housing and camps.
    - Vector-related disease.
    - Sexually-transmitted infections including HIV/AIDS.
    - Soil, water and waste-related diseases.
    - Food and nutrition-related issues.
    - Non-communicable diseases.
    - Accidents/injuries.
    - Potentially hazardous materials, noise, vibration and short term chemical exposures.
    - Social determinants of health.
    - Veterinary medicine and zoonotic diseases.
    - Cultural health practices.
- Gender:
    - Representation and access to income.
    - Domestic and interpersonal relations.
    - Division of labour.
    - Land resources and gender implications.
    - Gender and education.
    - Access to project information.
- Human rights.

- Cultural heritage and archaeology.
- Ecosystem services:
    - Provisioning and cultural services

5.2. Provincial sectoral analysis

5.2.1. Methodology

The provincial sectoral analysis uses the general methodology described in Chapter 2.

5.2.2. Identification and discussion of impacts

MONETARY ECONOMY

Most of the villages in the PSA have to date lacked the means to fully utilise their natural resources for significant economic benefit. There are several key compounding factors that will potentially affect the impact that the Project may have in the province and the PSA:

- Financial literacy levels in project area villages are relatively low.
- The Project will provide only limited power plant employment opportunities after the construction period.
- The area is constrained in development of commercial crop businesses due to its variable seasons and distance from Lae city.
- The relatively low population in the project area means that workers from outside the immediate local area may be required to fill trade, skilled and some semi-skilled positions during the construction period.

Higher income levels due to project employment

A number of PSA residents are expected to gain employment with the Project during construction and operations. Plantation employment at full capacity is estimated at 472 positions, while power plant employment during the construction phase is estimated at 230 positions, and 40 positions in the operational phase (i.e., post-construction).

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Higher income levels due to the payment of crop share and land rental

Landowners who have committed land to the Project will receive crop share payments once the project is operational and annual land rentals once their land is planted with trees or initially as ‘holding pattern fee’.

For low-income households with no other income earning opportunities, the increase in cash income levels will significantly increase disposable household income which can be used both for subsistence and durable goods consumption. However, these statutory benefits may be treated as ‘windfall income’ and be (fully) consumed rather than (partially) saved or invested.

The financial benefits derived from crop share and land rental will have a significant impact on income levels. Consequently, it has the potential to create income inequality between the customary landowners and other local 'non-participating' residents of the same area.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Higher income levels due to increased business activity arising from direct project business opportunities

A proportion of landowners may utilise business opportunities associated with the Project during operations to enhance their income earning capability.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased employment and income levels as a result of landowner company or business group activities

The Project will provide construction-related contracts and some business opportunities in the operations phase concerning plantation management, logistics and fiscal services. It is envisaged that the landowners will have at least one representative umbrella landowner company or business group to facilitate local business opportunities. This entity will employ people to undertake work such as clearing, weeding, planting and transport. Although potentially higher during construction, employment and income levels will continue during operations, albeit at a relatively lower level.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased expenditure on housing, store foods, recreational pursuits

The pattern across most projects in PNG is that Project Affected People (PAPs) tend to predominantly invest incomes in either durables or consumables. The PSA community profile as peri-urban/semi-rural suggests that large amounts of windfall income will be used for improved housing, however, this is not an explicitly stated priority for PSA households. There is a high likelihood that large expenditures will be diverted to consumables and replacement of old or broken previous purchases.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Discontent due to limited post-construction employment opportunities at power plant

Power plant employment during the construction phase is estimated at 450 positions. However, post-construction there will be an estimated 40 positions available for employment at the power plant in the operational phase. The number of employment opportunities at the power plant could produce some discontent. Management of PSA resident employment expectations will be crucial.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Inflation of food prices at markets

The price of locally available products, both from stores and in markets, could increase in line with income levels. This inflation is most likely during the construction phase when cashed up employees and families indulge in greater consumption of purchased foods.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

ECONOMIC INFRASTRUCTURE

Improvements to local road networks and service infrastructure

There will be improvements to local village level feeder roads and enhanced PMV operations, and thus improved access to markets for local produce and people. However, it is unlikely the Project will dramatically affect service infrastructure or performance across areas examined above such as banking, telecommunications, air services, shipping etc. How far the assimilative capacity of these services may be further stretched as a result of the Project impacts is directly tied to anticipated levels of project induced in-migration.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased demand for recreation and entertainment

The indirect impacts of increased disposable household and personal cash incomes can increase consumption patterns predicted in respect to consumables, drugs, gambling, alcohol and other recreational and entertainment pursuits. With more clarity about the modelling of how land rental, land compensation and biomass crop share payments will be distributed amongst PAPs, it will be easier to more accurately gauge potential indirect impacts. Some continued growth of Highlands Highway businesses along the road can be anticipated—especially by migrant entrepreneurs—but this will continue to be constrained by access to land.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased demands on public health and social order service infrastructure

An increased demand for recreation and entertainment can have indirect impacts on public health and social order services. However, in the urban and peri-urban environments of Lae any increases in the velocity or presence of such activities and consequences can be hard to gauge other than through statistics possibly kept by the public health system and law enforcement agencies. It is unlikely in the short-term that increased expenditure by males on pursuits that have an adverse impact on law and order will overwhelm the capacities of the system to cope or respond. At the current stage of the Project, the ongoing trial plantations, employment income and wage-labour exercises have not resulted in adverse impacts on social order and service infrastructure.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

EDUCATION AND TRAINING

Substantial school infrastructure has been built and maintained in Morobe Province over the past decade. The quality of school infrastructure is only one of several compounding factors that impact on education levels. Other factors include:

- The type and standard of teachers' houses.
- The capacity of teachers.
- The curricula and availability of teaching materials.
- Attitudes among children, their parents and the local community towards education.
- The budget for education support, and cash flow problems delaying access to funds which restricts the level of support providers to teachers and schools and limits supervision.
- The State’s Tuition Free Policy, which provides an opportunity for many more parents to have their children attend school and is consequently causing overcrowding and other problems as

schools struggle to cope with higher numbers of students, boarders and often limited boarding and classroom facilities to manage these increased numbers.

Increased school enrolments as education costs become less prohibitive

The increase in income levels that will result from the Project (employment, crop share, land rentals and business activities) will increase the capacity of households to meet education costs. The PEPE (2014) study noted that the tuition-fee-free policy (announced 2011) led to an increase in school enrolments. Between 2011 and 2012 enrolments increased by 17 per cent, the same percentage increase that occurred in the 2002 attempt at introducing free education. In response to the SIA Household Survey question Q:G-3, "What are the main reasons for not attending school for each child"? 'school fees'[12] (26 per cent) was commonly cited, the second highest incidence of explanations given. Accordingly, this gives some credence to the expectation that school enrolments could increase.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased skills as local workers are trained by the project

While most of the locally recruited construction workforce is expected to be engaged on a casual or short-term basis for general labouring and semi-skilled positions, basic site induction and workplace training will be required. Although not necessarily of a technical nature, this basic training will increase skill levels and the future employment prospects of those trained.

Additional training may also be provided for those workers who are employed on a longer-term basis that may include security officers and other support staff necessary during the operations phase. Factors that limit the transfer of skills to the local workforce include (i) the limited number of job opportunities during the power plant operations phase and (ii) the low education levels and limited work experience among local residents.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

BENEFIT STREAMS

The SIA takes the view that for both firm and farmer the majority of the risks and rewards derive quite critically from 'land'. Continued access and security of tenure defines the dependencies of both Project and people. The Project requires certainty of commitment of land resources to stay in business; the people require continued access to certain types of land for their livelihood and income. The key to success for both Project constituencies must then lie in ensuring there is a mutually agreed and beneficial regime for the management of this resource which delicately negotiates a

12 The TFF policy allows for some discretionary charges to still be made by schools. In addition, costs are incurred for uniform, transport, pens, books etc and when parents cite 'school fees' they are referencing these types of extra costs.

middle ground between flexibility of discretion about use and a fixity of decision-making for the Project management. These are the bases and preconditions for project sustainability.

Equally, the key for long-term success for the Project is the cohesiveness and proper, equitable operation of the landowner entities that are formed to (a) hold land that is leased to the Project; and (b) take advantage of spin-off business opportunities that the Project generates. If there is disharmony within these entities it will inevitably negatively impact Project operations.

There is merit in having two separate landowner entities for land holding and local business development. Most residents in the Project area would at least understand that any land holding entity would be owned by or represent only those whose land has been committed to the Project. However, in relation to local business development, all local Project area residents, whether Project landowners or not, would consider themselves to be affected by the Project and expect to be able to participate in local business opportunities arising from its operation. It would therefore appear prudent to promote/facilitate the incorporation of a local business entity that is more representative of the whole project impact area through wider shareholding interests.

The major challenge for the Project will be the establishment of business and landholding entities capable of melding disparate interests of potentially affected peoples and which conforms to principles of transparency—community consent to and knowledge of its structure; equity—that no project stakeholder constituency, ethnic, gender or generational, is disadvantaged or disempowered by the entity both in constitution and distribution of dividends; and mandated—that representation reflect, and be publicly seen to reflect, the mandate of the affected and impacted Project landowners.

The risks associated with these challenges are those that derive from failure to ensure the entities are established with the appropriate levels of support by the community to mitigate potential conflict and disputes.

Increased business awareness and financial literacy

An increase in experience of and understanding about business is likely to occur as local people become shareholders and possibly office bearers in local representative business entities.

Involvement in the cash economy as an employee or by starting a small family or group business enterprise should result in a greater understanding of basic business principles, savings and the management of funds. Certain community members may become directors or office bearers in local entities and thus acquire an understanding of business.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased entrepreneurship and small-scale business activity

The project will act as a catalyst for development of small-scale business activities that may support project activities (e.g., transport, security, etc.)

The increase in income levels that will result from the project (employment, crop share, land rentals and business activities) will increase the capacity of households to start their own small enterprises or

acquire shares in the local representative business entity. Local start-up business activity is therefore likely.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Real or perceived business inequities or disadvantages

The establishment of one or more business entities has a potential to engender dispute and result in real or perceived inequities or disadvantages across the PSA.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

5.3. Community consultation and participation

5.3.1. Methodology

The community consultation and participation assessment uses the general methodology described in Chapter 2.

5.3.2. Identification and discussion of impacts

RESETTLEMENT

Increased levels of land dispute

The business arrangements for lease of land will act as a catalyst for people to self-define as 'landowners' vs. 'land-users/landholders'. The ethnographic literature has indicated problems in *ngaeng yaner* ('outsider') attribution for children of mixed-ethnic marriages, people who have settled for three generations or more, and women as 'landowners' who have inherited land from fathers, etc. The potential for increased levels of land dispute is high, as follows:

- Heightened tensions as land is given a new cash/economic value by the Project.
- Expectation to corporately share income benefits will exacerbate efforts to include or exclude people.
- Resentment against people who are third generation settlers 'acting like landowners'.
- Increased and induced litigation and/or disputes about land title that will continue to and follow closure as original lessors may likely have died.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Economic displacement due to restricted land usage discretion and long-term lease periods

Loss of land (economic displacement) use and discretion over land use will occur due to project infrastructure (power plant, roads, construction lay-down sites, etc.) and plantation lands subject to irreversible state leases. More specifically:

- State lease controls will mean a degree of restricted access, freedom of use, and decision-making about use of large areas devoted to plantation.
- Whilst there will be some food garden destruction this will be offset by inter-cropping opportunities and enhanced income opportunities.
- The prolonged lease periods in the context of PNG can lead to intergenerational conflict as younger successors visualise alternative use or income opportunities for the same land but are legally constrained by decisions of preceding generational kin.
- Landowners who seek to challenge the lease arrangements by litigation can enmesh the Project in endless conflict, with potential loss of biomass supply.
- Awaiting State lease-back arrangements five years after initial start-up is a high-risk strategy in respect to ‘change of mind’ scenarios and use of land for alternative agribusiness options.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Land shortage due to over commitment to the Project

There is a high risk of farmers either (a) over committing land resources in terms of acreage, or (b) committing large areas of secondary wood grassland regrowth either through ignorance, greed, or poverty. If the control of these decisions is in the hands of a business entity that does not strictly monitor this situation then there is potential for some land-shortage with flow-on secondary and cumulative impacts to both subsistence and income. More specifically:

- Unless there is systemic control of areas leased with robust monitoring, ecosystem services will be impacted.
- Cumulative economic displacement (even though voluntary in nature) may cause some level of livelihood hardship for land-use constituencies such as foragers, short-term commercial farmers, etc.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

PROJECT INDUCED IN-MIGRATION

Project-induced in-migration is predicted to be relatively 'low' in scale. There will be some influx and some in-migration but it will be highly transient and small in scale, not at a level which will challenge the assimilative capacity of the communities, and for the most part be restricted to the construction period. There will not be a rapid consequential growth in population as a result of the Project.

Increased project-induced in-migration demands on physical and social infrastructure

There is a potential cumulative (i.e., additive) impact given the noted increases in urban drift and ongoing increases in migration, but these are not expected to induce tipping-levels for infrastructure demand.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased tension and land disputes due to small-scale in-migration

Land access will be a limiting constraint and there will be few Project related jobs available to outsiders. In-migration is most likely to be concentrated in those with kinship or descent ties to landowners for the purpose of job seeking, or servicing the business entity. It will be composed of both sponsored/hosted and voluntary people.

Access to land by migrants will continue to be channelled through the clan system and employment will similarly be controlled on a preferential basis by the Landowner Company, i.e., PSA employment seekers will get first opportunity. It is highly unlikely given the proximity of Lae town that there will be any mushrooming of squatter settlements on PSA land.

Non-resident 'clans-people', *bona fide* as well as claimant, are likely to drift back to claim land rights or claim a share in the rental and crop share income streams. This could generate possible disputes from claimant non-resident landowners on land title and indirectly on income from rental and crop share.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased business activity and new skill sets due to small-scale in-migration

One can expect some increased building of structures along roads both by business minded landowners and by outsiders given permission or a lease by landowners. New business start-ups

from entrepreneurs are likely and roadside trade stores could increase. Some increased market participation by landowners and outsiders from other provinces could occur. In-migrants may bring skill sets to assist project entities and increase velocity of trade at markets.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

5.4. Agriculture

The agriculture and land assessment reports on smallholder (i.e., village-based) agriculture and land use in the PSA focus on the following questions:

- Where do local people currently get their food from?
- Where do local people currently get their cash from?
- What might be the potential Project impacts on local food and cash supply?
- How could the project improve local living conditions?

5.4.1. Methodology

The agriculture and land assessment uses the general methodology described in Chapter 2. In addition, the following methods were utilised:

- Review of available literature on land use, physical environment and agriculture for the region.
- Liaison with Dr Mike Bourke who was part of a research team which surveyed and mapped agricultural production in Morobe Province during the early-1990s (Bourke et al 2002).
- On-the-ground field surveys in five communities and food markets during the second half of October 2016, along with several traverses by road and foot throughout the eastern and central parts of Area A.
- Community meetings with between eight to twelve men and women interested in agricultural issues to gather data regarding food production, gathering, consumption and cash income.
- Surveys of fresh food prices in local markets (e.g., 40 Mile market).

5.4.2. Identification and discussion of impacts

Potential loss of subsistence resources

There is a potential risk that if certain grassland and secondary forest areas are committed to the project for plantation development, some loss of subsistence resources will occur over and above existing trajectories of land pressure.

The Project will primarily use grasslands for its eucalyptus plantations and on a significantly larger scale than any current smallholder activity. This could lead to a substantial decline in the availability and accessibility of an asset that is utilised and depended on by less powerful people across the region for their livelihoods. There is a potential risk this will disadvantage some people and push them into more peripheral areas (which might also compromise their building materials and firewood

supplies). The secondary impacts may extend to intra-clan and intergenerational conflict if community leaders do not consider the present and future needs of all their members when making important resource allocation decisions. As noted above, 'change of mind' scenarios are inimical to Project sustainability which in itself prevents later considerations about alternative uses of that land, or alternative plans if there is a shortage of either land area or land type.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Inter-cropping increases subsistence and cash crop incomes

The positive benefits of inter-cropping are increased subsistence and cash crop incomes for the landowners who take advantage of this opportunity. Intercropping food plants with triploid banana, crops and perennial tree species is an established practice throughout the PSA though the areas involved are usually modest and the produce is used for both self-consumption and sale. Purely commercial food gardens such as peanut, cucumber and watermelon are generally mono-cropped and located in grasslands. Large-scale inter-cropping will probably only be viable during the wetter period of the year (December to March) given the low rainfall conditions. Plantings must be limited to crops that tolerate poorer soil fertility and competition for scarce ground moisture, with later cycles subject to increased shading and oil residue as the eucalypt crown closes in the ten to twelve month period. As the zones involved will also be controlled by those landowners who have signed MOUs with the Project, not everyone may have access to these areas or opportunities as the opportunities are limited to the lessors.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Diminished wild game due to loss of grassland and secondary forest

There is a potential risk that the populations of bandicoot and wild boar may be diminished as a hunting prey in the immediate environs of the villages adjacent to plantations because of loss of grassland and secondary forest. Wild game may stay away from plantation sites impacting the contribution of game to income, diet, subsistence, and recreational enjoyment.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Large-scale inter-cropping could oversupply markets and force prices down

Households in the PSA currently produce a modest surplus of foodstuffs from smaller-sized plots. Local demand is poor and most of these goods are transported to Lae, though not all output can always be sold. The scale of the plantations and associated inter-cropping potentials carries the risk that an oversupply of crops onto a limited market may force prices down, result in unsold excess produce, and act to diminish the enthusiasm for participation in inter-cropping practices.

If the Project allows for inter-cropping in the circumstances of a sequential development of up to 16,000 hectares, and people take advantage of this opportunity (even for just one or two planting cycles before the tree crown closes) market prices could potentially collapse due to a massive oversupply. This could have far reaching effects unless increased production can be met by greater demand. Even if markets can be expanded, the sustainability of higher output levels beyond the initial seven-year plantation establishment phase is doubtful given the residual impact on most food crops of eucalyptus oil in the soil. The result could be an expansion of short-term commercial gardening into more peripheral areas and pressure on resources.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

5.4.3. Conclusions and considerations

The key impacts for this sector of agriculture and land are:

- Loss of land used for food gardens, cash cropping, foraging and wild foods.
- Inequitable access to inter-cropping opportunities and benefits.
- Reduction in hunting areas and wild game hunting.
- Collapse of market prices with consequential crop wastage and lower inter-cropping participation.

While land acquisition is expected to cause limited economic displacement, management of land and livelihood impacts will be addressed and mitigated in the Project's Livelihood Restoration Plan.

Potential to improve food production

Most species of subsistence and commercial food crops that could be introduced to the region are already present in the villages surveyed. There are, however, many improved and more productive cultivars available from other locations across PNG (including sweet potato, cassava, open-pollinated varieties of corn, peanuts, yam, guava, mandarin, orange and various vegetables) that could prove a useful addition to villagers' suite of crops.

A number of innovative agricultural techniques that have been adopted elsewhere in PNG are also likely to be successful in the PSA. These include production of out-of-season pineapples, grafting of suitable citrus varieties onto appropriate rootstock, and more recently developed crop propagation and vegetable production techniques. In an area characterised by poor shallow soils and possible resource access issues affecting certain sectors of the population, land improvement practices, such as composting and use of manure, could even be combined with legume rotation and fallowing to improve soil fertility in beds specifically used for more intensive market gardening activities.

Assistance with more substantial land management techniques in a region subject to frequent inundation could also reduce some instances of agricultural pressure noted in the communities surveyed and improve land potential, particularly in flood plain areas. This aligns well with the SIA ecosystem survey finding that 41 per cent of respondents are now using swamp-prone areas for food gardens during dry periods or drought.

Two programs worthy of possible further investigation are as follows:

1. Promote increasing awareness about the benefits of simple drainage systems.
2. Provide mechanical interventions, based on sound engineering and environmental advice, to stabilise/reclaim river banks and build flood/waterway retention barriers.

Concerns about (and evidence of) problems with insect/pest attack and plant disease on crops is currently minimal in the PSA. Vegetation change and new agricultural practices throughout the region, particularly the replacement of cocoa and coconut at Markham Farm with oil palm, PNG eucalyptus plantations on grasslands, and changing climatic conditions, could upset this status quo.

Potential to increase cash incomes

Cash income earned by rural households usually generates improved demographic parameters in PNG, including reduced infant and child mortality, higher levels of literacy and greater life expectancy. This contrasts with the windfall payouts derived from mining, petroleum or logging royalties and compensation which tend to be dissipated rapidly and are rarely used to improve the lives of family members.

MVB has signed MOUs with principal landowners as representatives of the nine clans within Area A. Concerns were voiced in the communities surveyed, and particularly in Nowa, that most financial benefits (rent and income) from plantation operations will consequently flow to a limited number of people who already control access to land and resources. This includes allocation of the wage labouring positions associated with the Project and distribution of any casual employment payments for occasional clearance of regrowth in newly established plantings.

Given the significant transport links and marketing opportunities in this region, there are several possibilities to expand the range of benefits available to people and thereby generally improve household incomes and hence welfare levels. The following preliminary suggestions require further investigation by smallholder agriculture specialists to vet and develop the concepts further.

Cocoa
Plantings of cocoa increased throughout the region following the decline of locally grown betel nut in 2007/2008. As a perennial tree crop, smallholder cocoa is only a realistic option for those households with longer-term access to larger landholdings, but the benefits can be significant. Most cocoa sold in the PSA communities surveyed is wet bean (currently attracting prices of K1.80 to K2 per kilogram) and growers must transport their produce to large central fermentaries/buying points at Chivasing or Kokok.

An alternative is provided by the small-scale fermentary/drier units developed by the PNG Cocoa and Coconut Research Institute (CCRI) for two-hectare holdings, which enable households to receive higher prices for their produce and buy wet bean from their neighbours. Although technically illegal, these units have also been used to dry-roast products such as canarium (galip) and peanuts, thereby increasing shelf-life and market prices, and reducing the threat of aflatoxin poisoning.

There is no sign of significant problems with black pod or pod borer in the region, the crop can be inter-planted with other popular species such as betel nut, triploid banana and some hardier shade tolerant food crops, and oil palm is replacing established nearby cocoa plantations (e.g., Markham Farm) that had reputations for producing high quality output. Given these conditions, the option of supporting local smallholder cocoa production and processing through technical and marketing assistance (and possibly low-interest loans) is worth investigating further.

Intercropping

Landowners can interplant crops such as peanut, cucumber, watermelon and pumpkin, which has already been included in spacing and species trials conducted by the Project. Initial results were limited due to the close spacing of plantation rows (3 metres apart) allowing only two plantings before the tree crown closed after 8-10 months. In the latest trials, plantation row spacing will increase to 3.5 metres, though this will probably only extend the growing period for inter-planted crops to 12 months.

Other intercropping income-generating options in the Markham Valley that might be equally viable and worthy of further investigation are links with SP Brewery's cassava/ethanol program (Business Advantage PNG 2015; Taule 2016) and Mainland Holdings' sorghum project.

Coconuts

Despite surplus production of coconuts there is no interest and little point in pursuing downstream processing opportunities such as copra or virgin coconut oil production given the marginal returns to labour and investment when compared to the prices currently received from local and urban sales of drinking and dry coconuts.[13]

Fresh food marketing

Improving the facilities and layout at 40 Mile Market could enhance its profile as a focus for quality fresh food sales in the central Markham Valley. This may involve protracted discussions with current sellers who have vested interests in maintaining the status quo and the surrounding residents/landowners who dominate its operation—there is also no evidence of sufficient current demand for such a facility at that location. Instead, it would probably be more beneficial to develop the marketing skills of key women who regularly sell at Lae Central Market to help differentiate their produce, reduce losses due to handling and spoilage, and find ways to improve local access to transport.

Processed food

The demand for convenience/'fast food' items along the Highlands Highway from passing drivers and PMV passengers has already spawned an emphasis on cooked meat (chicken, pork and particularly sausages), fried bananas, and baked goods (including sweet buns, cakes and scones) at both 40 Mile and 41 Mile markets, and at other road-side canteens. With minimal product differentiation between sellers, there remains a significant opportunity to provide training and financial support or low-interest loans to encourage and enable local women to pursue other down-stream processing, marketing and diversification strategies (i.e., using flour made from sweet potato, cassava or banana, producing fresh fruit drinks, cold meat and salad rolls, and cooked combination meal boxes using other garden foods such as pumpkin, pawpaw and capsicum). This might increase their income earning opportunities, the market for local produce, and the financial benefits enjoyed by their families. Improving hygiene standards and awareness of human nutrition issues could also be part of such a program and possibly impact on local and household practices.

[13] For more information on why crops with low returns to labour are unpopular with villagers in PNG, see Bourke and Harwood 2009: Section 5.2/Table 5.20.1.)

Animal husbandry
Morobe Province was the most important beef-producing region in PNG during the mid-1970s, accounting for 43 per cent of the national herd. A high proportion of these animals were in the Markham Valley, where the smallholder cattle population was estimated to be 10,200 head in 1976 (Brunton 1980, 55-59; Bourke and Harwood 2009, Section 2.6). Despite a decline in numbers over the past 40 years, there remain significant quantities of cattle and horses in the environs and the communities surveyed reported ongoing, if sporadic, sales of both animal types to Lae and the Highlands. The possibility of investigating opportunities to enhance this sector should be considered, though the beneficiaries would be those who control larger landholdings.

Broader community benefits could be accrued from a similar exercise focusing on improvements to domesticated market-quality chicken and pig production, particularly given widespread local experience with both species, a readily available supply of day-old chicks, and nearby wage-earning/captive populations such as the oil palm operation at Markham Farm, Leron Forestry, Wawin National School and the Biomass operation itself.

5.5. Health

The key objectives of the Health Impact Assessment (HIA) are to:

- Review key Project literature (e.g., social and environmental baseline studies).
- Hold formal and informal discussions with the Project technical team, local community members, and health care representatives.
- Define, ground truth and evaluate the potentially affected communities (PACs).
- Search and review the relevant public literature.
- Develop a sufficient level of baseline health data for the overall Project Study Area (PSA) and highlight any critical data gaps.
- Evaluate the potential health impacts on the PACs within the proposed PSA.
- Employ qualitative, semi-quantitative or fully quantitative data for assessment of health impacts, where impacts can be neutral, positive or negative.

5.5.1. Applicable legislation

The HIA follows the approach outlined by the International Finance Corporation (IFC) to assess and address potential community health impacts that might typically be encountered in the development of industrial projects. However, it is not designed to address occupational health aspects of work environments.

The HIA results are considered within a broad set of secondary data that were identified through a literature review of the relevant published PNG National Department of Health (NDOH) publications (2010; National Department of Health 2013). The available information, including survey results, is structured by means of the Environmental Health Area (EHA) framework, as described below.

5.5.2. Methodology

The methodology of the EHA framework defines the types of health impacts and provides a structure for organising and analysing potential project impacts on the community (Table 14). The EHA classification includes all of the biomedical and social concerns originally developed by key international health and development agencies (i.e., WHO and World Bank Group) and is used by the oil and gas industry (i.e., IPIECA) and international multilateral lending institutions (i.e., IFC).

Table 14: Environmental Health Areas (EHAs)

	Environmental Health Areas (EHAs)
1.	**Health services infrastructure and capacity** Physical infrastructure, staffing levels and competencies, technical capabilities of health care facilities at district levels; program management delivery systems; coordination and alignment of the Project to existing national- and provincial-level health programs, and future development plans.
2.	**Respiratory and housing issues** Acute respiratory infections (bacterial and viral), pneumonias, tuberculosis; respiratory effects from housing, overcrowding, housing inflation.
3.	**Vector-related diseases** Mosquito, fly, tick and lice-related diseases (e.g., malaria, schistosomiasis, dengue, onchocerciasis, lymphatic filariasis, yellow fever)
4.	**Sexually transmitted infections** HIV/AIDS, syphilis, gonorrhoea, chlamydia, hepatitis B.
5.	**Soil- and water (sanitation)-related diseases** Diseases that are transmitted directly or indirectly through contaminated water, soil or non-hazardous waste (e.g., diarrhoeal diseases, Giardiasis, worms, water access and quality, excrement management).
6.	**Food- and nutrition-related issues** Stunting, wasting, anaemia, micronutrient diseases (including deficiencies of folate, Vitamin A, iron, iodine); changes in agricultural and subsistence hunting, fishing, and gathering practices; gastroenteritis (bacterial and viral); food inflation; feeding behaviours and practices.
7.	**Non-communicable diseases (NCD)** Hypertension, diabetes, stroke, cardiovascular disorders, cancer, obesity, and mental health.
8.	**Accidents and injuries** Road-traffic related, spills and releases, construction (home- and Project-related) and drowning.
9.	**Exposure to potentially hazardous materials** Pesticides, fertilizers, road dust, air pollution (indoor and outdoor, related to vehicles, cooking, heating, or other forms of combustion or incineration), landfill refuse or incineration ash, and any other project-related solvents, paints, oils or cleaning agents, by-products, or release events.
10.	**Social determinants of health (SDH)** Including psychosocial, social production of disease, political economy of health, and ecosocial issues such as resettlement or relocation, violence, gender issues, education, income, occupation, social class, race or ethnicity, security concerns, substance misuse (e.g., drug, alcohol, smoking), depression and changes to social cohesion.
11.	**Veterinary medicine and zoonotic diseases** Diseases affecting animals (e.g., bovine tuberculosis, swinepox, avian influenza) or that can be transmitted from animal to human (e.g., rabies, leptospirosis, etc.).
12.	**Cultural health practices** Role of traditional medical providers, indigenous medicines, and unique cultural health practices.

The HIA uses a standard impact assessment methodology:

- Identification of potential health impacts.
- Description of the issue and impact.
- Risk analysis that considers the significance of potential health impacts based on a consequence and likelihood risk matrix.
- Assessment of potential impact across the PSA and, if appropriate, for the different PACs, i.e., relevancy.

Potential project-related health impacts are identified by triangulating interactions between the 'Project-PSA-PAC' and the baseline health data. Both 'inside to outside' and 'outside to inside' project fence impacts are considered.

Specific impacts and issues are described. Environmental Health Areas health effects categories are utilized, and direct, indirect and cumulative effects are considered.

A direct effect demonstrates a specific cause-and-effect relationship. Important indirect effects can include increases in community rates of certain communicable diseases that are associated with significant Project-induced influx into local communities by job seekers. In this situation, the presence of a large Project construction camp can temporarily attract a large number of job seekers and service workers into local communities. Over relatively short time periods, this influx can significantly alter the spread and transmission of many diseases like malaria, tuberculosis and sexually transmitted infections (STIs). The development of specific health management plans covering the construction phase is critical. The health impact process is designed to assessment and highlight those issues that pose the greatest community health risk during the construction and operations time periods.

Indirect effects are often of equal or greater significance than the more observable direct impacts that are related to accidents, injuries or sudden releases of potentially hazardous materials. The HIA analyses both potential direct and indirect effects. Theoretically, there are a virtually limitless number of indirect effects that could be hypothesized. In order to manage this:

- A set of most likely indirect effects should be constructed on the basis of past relevant experiences at similar projects.
- As appropriate, a fit-to-purpose monitoring and evaluation system should be developed in an overall Community Health Action Plan.

Cumulative effects analysis is complex and often difficult to perform because the effects:

- May arise on a human receptor at any scale.
- Are triggered by multiple causes, e.g., interaction of multiple health issues on one receptor (individual).
- Are generated by multiple impact pathways, e.g., surface and ground water impacts such that overall water resources are adversely affected with subsequent changes in nutrition, community cohesion (psychosocial) and/or livelihood. Hence, the cumulative effects of an activity/intervention may be either (a) additive—incremental accumulation or (b) synergistic—produced by the interaction or combination of effects in the past, present and reasonably foreseeable future. Typically, the cumulative health impacts are interdependent with environment and social, e.g., water-related issues, etc.

Differences in exposure and susceptibility to potential health impacts exist at a temporal (construction versus operation phase) and spatial scale (e.g., communities in proximity to any proposed Project camps or staging areas). Consequently, the relevance of any proposed mitigation measures may vary for the different Project phases as well as for the different PACs across the overall PSA.

Community health risk matrix tool

The community health risk matrix tool has been developed to be generally analogous to the methodology utilized for environmental and social risk assessment. However, there can be differences that are unique to each discipline. The purpose of this overall risk tool is to provide a transparent and uniform system for evaluating the most important community health risks of the proposed project.

To arrive at a consequence level, six criteria were identified (Table 15) and a 'value' is assigned for each. The 'interpretation' column provides qualitative and semi-quantitative guidance for assigning values. Based on the 'spread' of values, the assessor will then choose an overall consequence level.

Table 15: Community Health Consequence/Severity Tool

Consequence Dimension	Value	Interpretation
Duration of Health Effect	Short-term (Lower)	0 to 14 days; considered to be acute
	Medium-term (Moderate)	14 to 365 days; considered to be intermediate
	Long-term (Higher)	365 days and longer; considered to be chronic
Scale / Extent	Localized (Lower)	Small number of households and people (100 or less, e.g. hamlet, compound); effects are geographically limited to household footprint.
	Moderate	Medium sized community (100 to 1000 people), restricted to the geographic area of the community including their proximate fields.
	Widespread (Higher)	Large community(s); large numbers of people (1000 or greater); including peri-urban settlements, affecting most or all of a nearby population; likely to have regional effects.
Magnitude / Intensity	Minor (Lower)	Irritation or inconvenience; nuisance effect which is fully reversible; no treatment or minor treatment needed.
	Moderate	Moderate illness or injury; possibly recurrent but not persistent; effects alter ability to perform activities of daily living; short-term treatment or moderate treatment needed.
	Significant (Higher)	Fatality; disabling or debilitating – permanently or over a substantial period of time. Likely to reduce life expectancy; persistent decrease in ability to perform activities of daily living or longer-term tasks; long-term or extensive treatment needed.

Sensitivity Dimension	Value	Interpretation
Treatment Inaccessibility	Lower	Local health care facilities and staff are present and can adequately manage health issues; adequate treatment/supplies available
	Moderate	Local health care facilities are intermittently functional; Some treatment available
	Higher	Local health care facilities are not functional or not present; no treatment or only minor treatment available
Susceptibility	Lower	Relatively healthy, resilient population; immunizations complete and preventative practices in place
	Moderate	Need to periodically stress health promotion/disease prevention and treatment programs; moderately resilient population; periodic outbreaks due to average preventative practices
	Higher	Pre-existing poor level of health and pre-existing disease with no preventative practices in place; cumulative impacts are critical
Disengagement	Lower	Highly engaged in affairs that directly or indirectly affect their and/or neighbouring communities; high awareness & control of risk factors
	Moderate	Highly engaged in affairs that critically affect their community; moderate appreciation or awareness of health risk factors
	Higher	Minor engagement or no engagement at all; dissociative character; little cohesiveness; may only react occasionally; lack of appreciation or awareness of risk

Consequence severity interpretation (Table 16) provides interpretive guidance for assigning an I–IV consequence level. The six dimensions are relatively equally weighted; however, the three sensitivity dimensions (treatment inaccessibility, susceptibility, disengagement) are used in close calls between consequence severity categories.

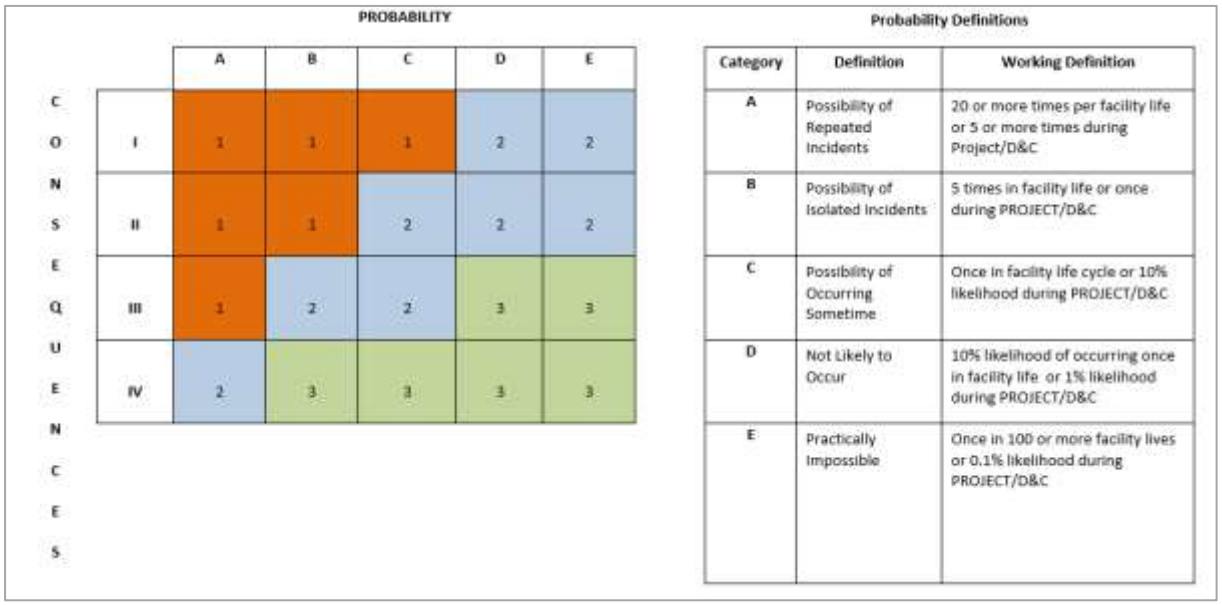
Table 16: Consequence Severity Interpretation

Consequence Level	Safety/Health Considerations	Interpretation examples of environmental impact considerations
I – Critical	Fatality(ies); serious injury requiring medical treatment to members of public	Sensitivity averages higher; scale, duration and intensity of consequences average higher.
II – High	Serious or lost time injury / illness	Sensitivity averages moderate or higher; scale, duration and intensity of consequences average moderate or higher.
III – Moderate	Restriction of work or medical treatment	Sensitivity averages lower to moderate; scale, duration and intensity of consequences average in the moderate range Sensitivity is lower, but scale, duration and intensity of consequences are above moderate Any sensitivity with scale, duration and intensity of consequences averaging lower or mostly lower
IV – Low	First aid / minor injury	Sensitivity is lower; scale, duration and intensity of consequences average in lower to moderate range

Consequence is then considered within five probability categories. The probabilities are not describing the 'inside the fence' situation, rather the probability of Project-related occurrences in the community during the Project lifetime. By definition, many of the environmental health areas and their associated health effects can have significant/critical consequence, i.e., consequence rating "I." Therefore, it is critical to consider the probability and modifying dimensions. Figure 5 shows the five probability categories A-E. The overall risk matrix is a four consequences x five probabilities matrix.

The risk matrix produces a risk rating number between 1–3, where the most significant risks are assigned a numerical value of '1'. An overall risk value of "1" does not mean an adverse outcome is going to occur; rather, that this topic area should be carefully considered as management plans are developed and implemented.

Figure 5: Community Health Risk Matrix



The final assessment outcomes of each dimension (consequence; sensitivity; impact; risk) consolidated for each identified EHA impact in a health impact assessment matrix (Table 17).

Table 17: Blank template of health impact assessment matrix

Consequence Dimension			Sensitivity Dimension		
Duration	Scale / Extent	Magnitude	Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower	Lower	Lower	Lower
Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Higher	Higher	Higher	Higher	Higher	Higher

Impact Dimension			Risk Dimension		
Phase	Valence	Nature	Consequence Level	Probability Category	Risk rating
Construction	Positive	Direct	I – Critical	A	1
Operation	Negative	Indirect	II – High	B	2
Closure		Cumulative	III – Moderate	C	3
			IV – Low	D	
				E	

5.5.3. Identification and discussion of impacts

EHA #1 – HEALTH SYSTEMS ISSUES

The capacity and quality of health care services is satisfactory via Wampar Health Centre (HC) and access to Lae hospitals. The Project will be self-contained for internal medical services and should not impact either access by communities to local health care or provision of services.

Capacity and services of local health system (EHA 1.1)

The Project will employ a number of people, particularly during construction. The level of overall hiring is likely to be <400 over 24-28 months of the construction phase. During operations employees will be primarily local. The existing capacity of the health care system is currently managing to provide adequate care to local communities. Potential Project-Induced In-Migration (PIIM) is expected to be minimal. The Project is not expected to affect staffing at the local health care system. The project will be self-contained for emergency response.

Consequence Dimension		
Duration	Scale / Extent	Magnitude
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Sensitivity Dimension		
Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Impact Dimension		
Phase	Valence	Nature
Construction	Positive	Direct
Operation	Negative	Indirect
Closure		Cumulative

Risk Dimension		
Consequence Level	Probability Category	Risk rating
I – Critical	A	1
II – High	B	2
III – Moderate	C	3
IV – Low	D	
	E	

EHA #2 COMMUNICABLE RESPIRATORY DISEASES LINKED TO HOUSING AND CAMPS

Acute Respiratory Infections (ARI) are a major health concern in the Project region and TB is a significant issue in Morobe Province and within the PSA area. Overcrowding can potentially be an issue, particularly in a construction work camp setting. However, the likelihood of large-scale construction camps appears to be low.

TB transmission (EHA 2.1)

TB is prevalent in the PSA recognized as a major concern community health risk. There is the ability for case detection and treatment of TB patients within the PSA at Wampar HC, and in Lae city.

TB transmission is often particularly related to a construction camp environment, or where overcrowding or PIIM can potentially promote the risk of transmission of TB bacillus. The potential transmission of TB within the Project workforce/community is potentially a serious health risk that can negatively affect construction and operations. However, the overall workforce size and likely distributed and local nature of the workforce tends to mitigate the importance of this risk scenario.

Project related TB transmission is not likely to occur above the pre-existing baseline level of transmission over the duration of the facility life (Category D). While the inherent risk is significant, i.e., a consequence level of I, the overall risk rating for TB transmission is 2 due to the variety of mitigating factors.

Consequence Dimension		
Duration	Scale / Extent	Magnitude
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Sensitivity Dimension		
Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Impact Dimension		
Phase	Valence	Nature
Construction	Positive	Direct
Operation	Negative	Indirect
Closure		Cumulative

Risk Dimension		
Consequence Level	Probability Category	Risk rating
I – Critical	A	1
II – High	B	2
III – Moderate	C	3
IV – Low	D	
	E	

ARI and other communicable diseases including measles (EHA 2.2)

Acute Respiratory Infection (ARI) is a common cause for consultation at the health centres that serve the PSA area and indicate that transmission levels are high. The causative agents of ARIs in the PSA area are not characterized due to the limited diagnostic abilities of the local health system. However, infections of the nose, throat and lungs (e.g., common cold or influenza) are an important cause of visits to health centres.

Many ARIs are highly communicable and could be transmitted back and forth by staff rotating between the community and the work site. Alternatively, a respiratory disease epidemic could take place only within the camp environment. Project workers can also develop ARIs at work locations and transmit them in their home environments. In-migration of people can increase the risk for transmission of ARI, particularly if overcrowding occurs. The likelihood of significant PIIMs is minimal/modest, however.

Project related ARIs are expected to occur at least five or more times in the community per facility life (Category B) with a consequence level of III and hence overall risk rating of 2.

Consequence Dimension			Sensitivity Dimension		
Duration	Scale / Extent	Magnitude	Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower	Lower	Lower	Lower
Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Higher	Higher	Higher	Higher	Higher	Higher

Impact Dimension			Risk Dimension		
Phase	Valence	Nature	Consequence Level	Probability Category	Risk rating
Construction	Positive	Direct	I – Critical	A	1
Operation	Negative	Indirect	II – High	B	2
Closure		Cumulative	III – Moderate	C	3
			IV – Low	D	
				E	

EHA #3 – VECTOR-RELATED DISEASE

Project activities may have an impact on malaria and other vector-related diseases (VRD). For example, project activities can alter the breeding potential of mosquitoes as well as increase in-migration into the PSA that enlarges the human parasite pool.

Malaria transmission (EHA 3.1)

Malaria is present in the PSA area and is an important public health threat, and may result in health impacts to the Project, particularly expatriates. The local health system in the PSA has capacity for the control and management of malaria. The inside the fence work camp will need robust malaria control and management procedures. Within the PSA communities, field surveys indicate a high level of awareness regarding malaria and widespread distribution of insecticide-treated bed nets at a household level.

There are three major impact pathways for malaria transmission related to the Project:

1. Modification of the environment frequently changes the breeding habitat for mosquitoes. The Project may influence the breeding habits of these vectors through (i) on site construction activities that promote environmental alteration and pooling of water (e.g., borrow pits, puddles and lay-down yards) and (ii) long-term forest plantation development.

   During construction, under certain environmental conditions, populations of the mosquito vectors could increase very quickly and increase the risk for disease transmission through increase vector densities and human vector contact. Although these changes may be highly localised they will need to be managed as far as possible through environmental modification and source reduction. Conversely, Project related activity could decrease and/or change habitat, which could decrease mosquito breeding sites.

   During operations, the change in grassland ecology to forest plantation could potentially impact the presence/absence and behaviours of mosquito populations. In general eucalyptus trees act as

mosquito repellents; however the long-term adaptability of forest mosquitoes to a plantation setting is unknown. In general in terms of mosquito flight-range the distance from the forest plantation to major human villages is an important mitigating factor. While some anopheles species have 2-4 km flight range, in practice the flight range tends to be <500 m.

2. The influx of people into the PSAs (particularly staging and work camp areas) may influence the malaria burden. An increased concentration of people from outside the area may enlarge the circulating pool of the malaria parasite leading to an increase risk for disease transmission. However, the likelihood of significant PIIMs is low. The use of Third Country Nationals (TCNs) is a possibility but the potential size of this added cohort of workers is likely quite small.
3. Improved socio-economic conditions may result in (i) better health education; (ii) increased affordability of vector control measures (e.g., insecticide-treated bed nets, repellents); (iii) better house constructions (e.g., closed roofs) and (iv) better access to malaria diagnosis and treatment. All those factors would decrease the risk of malaria transmission.

Consequence Dimension		
Duration	Scale / Extent	Magnitude
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Sensitivity Dimension		
Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Impact Dimension		
Phase	Valence	Nature
Construction	Positive	Direct
Operation	Negative	Indirect
Closure		Cumulative

Risk Dimension		
Consequence Level	Probability Category	Risk rating
I – Critical	A	1
II – High	B	2
III – Moderate	C	3
IV – Low	D	
	E	

Transmission of arboviral diseases (EHA 3.2)

As in other areas of PNG, arboviral diseases are likely occur in the PSA as there are increasing reports of cases of dengue, dengue haemorrhagic fever, and Chikungunya occurring in PNG.

Dengue has epidemic potential and an explosive outbreak could occur with consequent reputational and financial impact. The environment in the PSA is suitable for the transmission of arboviruses and arthropod vectors are likely to be widely distributed.

Arthropod vectors prefer to breed in man-made containers and the Project is likely to increase the amount of potential breeding sites at lay-down yards, construction areas (e.g., tyres, barrels, jars, etc.) and camp sites. Transport of goods and equipment (by roadway) from endemic areas may also play a role as infected larvae or eggs can be transferred from endemic areas.

However, the plantation/forest environment is not typically associated with dengue transmission as the arthropod vector is a ‘domesticated' mosquito that prefers close human proximity and has a short flight range.

Consequence Dimension		
Duration	Scale / Extent	Magnitude
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Sensitivity Dimension		
Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Impact Dimension		
Phase	Valence	Nature
Construction	Positive	Direct
Operation	Negative	Indirect
Closure		Cumulative

Risk Dimension		
Consequence Level	Probability Category	Risk rating
I – Critical	A	1
II – High	B	2
III – Moderate	C	3
IV – Low	D	
	E	

EHA #4 – SEXUALLY-TRANSMITTED INFECTIONS INCLUDING HIV/AIDS

Sexually-transmitted infections (STIs), worker interaction with local communities, and in-migration are important issues to consider. Potential STI impacts are primarily a construction phase issue. The social and health assessment is that PIIMs is minimal/modest. In addition, the work camp footprint is similarly likely to be modest.

Transmission of STIs and HIV (EHA 4.1)

In the PSA, there is evidence of affirmative knowledge on HIV transmission and prevention. The HIV prevalence rate in the specific PSA villages is not known; however, the overall HIV data from Wampar HC indicates prevalence levels are likely within PNG national rates of <1 per cent. There are established voluntary counselling and testing services at the Wampar HC and in Lae. The health services in the PSA and Lae have institutional capacity to manage HIV/AIDS care and treatment.

There are general risk factors that are observed in the context of any development/construction project. The Project could influence STIs and HIV transmission in the PSA in staging areas and work camps/construction areas in multiple direct and indirect ways based on four general mechanisms, often referred to as the ‘4 Ms’:

- Mobility: The need to transport equipment and consumables to the Project will occur, particularly during the construction phase. Existing public roads will be used to transport equipment and supply. The distance from the port of Lae to the Project worksite is relatively short; hence the likelihood of transport operators engaging in casual sexual practices along the transport corridor is considered to be minimal.

- Depending upon camp organisation and location, TCNs may also influence STI transmission. The TCN workforce may come from countries where the HIV prevalence rates are different than PNG and also carry subtly different viral strains. TCNs may interact with locals as they rotate in and out of work camps and port of entry locations. The current numerical estimate for TCNs to be employed in Project construction and operation is small; hence, the potential impact is minimal.

- Money: Women and young girls are vulnerable to the effects of transactional sexual engagements. People (generally men) who benefit directly and indirectly from the Project may have more money available to partake in various forms of transactional sex. This may introduce more opportunistic sexual encounters where women are given payment or payment-in-kind (i.e., food, clothes, airtime and other gifts) for sexual favours and companionship.

- Men: Men play a predominant role in the local society and will form the bulk of the workforce due to the physical demands of construction work. Transport, construction and security workers are likely to be male dominated sectors.

- Mixing: Project induced in-migration will bring together different population groups that may mix with the host population. This may result in mixing of people with higher disease prevalence with those with low prevalence of disease and also introduce different virus strains as discussed above.

Consequence Dimension		
Duration	Scale / Extent	Magnitude
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Sensitivity Dimension		
Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Impact Dimension		
Phase	Valence	Nature
Construction	Positive	Direct
Operation	Negative	Indirect
Closure		Cumulative

Risk Dimension		
Consequence Level	Probability Category	Risk rating
I – Critical	A	1
II – High	B	2
III – Moderate	C	3
IV – Low	D	
	E	

EHA #5 – SOIL, WATER AND WASTE-RELATED DISEASES

Water, sanitation and waste-related conditions can pose a considerable risk for the transmission of diarrhoeal diseases, parasitic infections and skin infestations. The PSA has access to protected drinking water and latrines.

Access to safe drinking water and related diseases (EHA 5.1)

Water-related diseases are strongly linked to the absolute per capita volume of water available for personal hygiene, e.g., bathing, hand washing, etc. Potential direct impacts linked to Project activities regarding water sources and access are considered in the environmental assessment and are considered to be minimal.

Consequence Dimension			Sensitivity Dimension		
Duration	Scale / Extent	Magnitude	Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower	Lower	Lower	Lower
Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Higher	Higher	Higher	Higher	Higher	Higher

Impact Dimension			Risk Dimension		
Phase	Valence	Nature	Consequence Level	Probability Category	Risk rating
Construction	Positive	Direct	I – Critical	A	1
Operation	Negative	Indirect	II – High	B	2
Closure		Cumulative	III – Moderate	C	3
			IV – Low	D	
				E	

EHA #6 – FOOD AND NUTRITION-RELATED ISSUES

Malnutrition is not simply related to food availability but is linked to a complex interaction between disease, feeding practices (linked to education), hygiene, sanitation and household food security.

Malnutrition and food related diseases (EHA 6.1)

Based on Wampar HC data, there are low levels of malnutrition and anaemia diagnosed in the PSA. Malnutrition and anaemia levels may further improve with enhanced income and employment opportunities triggered by the Project. Potential Project related food nutrition related disease transmission is not likely.

Consequence Dimension		
Duration	Scale / Extent	Magnitude
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Sensitivity Dimension		
Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Impact Dimension		
Phase	Valence	Nature
Construction	Positive	Direct
Operation	Negative	Indirect
Closure		Cumulative

Risk Dimension		
Consequence Level	Probability Category	Risk rating
I – Critical	A	1
II – High	B	2
III – Moderate	C	3
IV – Low	D	
	E	

EHA #7 – NON-COMMUNICABLE DISEASES

WHO predicts that the incidence of non-communicable diseases (NCDs) will increase significantly over the next two to three decades. NCDs affect all countries but their impact is particularly severe in low- and middle-income countries. This epidemiological transition is due to increased urbanisation and development. Due to the size and scope of the Project the impacts on this transition are likely to be minimal/modest.

Non-communicable and life style-related diseases (EHA 7.1)

NCDs are chronic in nature and take time to evolve at the village level.

Consequence Dimension			Sensitivity Dimension		
Duration	Scale / Extent	Magnitude	Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower	Lower	Lower	Lower
Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Higher	Higher	Higher	Higher	Higher	Higher

Impact Dimension			Risk Dimension		
Phase	Valence	Nature	Consequence Level	Probability Category	Risk rating
Construction	Positive	Direct	I – Critical	A	1
Operation	Negative	Indirect	II – High	B	2
Closure		Cumulative	III – Moderate	C	3
			IV – Low	D	
				E	

EHA #8 – ACCIDENTS/INJURIES

The Project will operate roadways with vehicles that have the potential to interact with, and potentially impact, PSA residents. More specifically:

- Road and traffic accidents (RTAs) can cause injuries and possible fatalities.
- Releases/spills can be associated with roadway accidents.
- Increased risk of accidents/injury will be related to construction and operations activities.

Occupational health and safety at the workplace is out of scope for the present HIA and is addressed by other Project-specific plans.

Traffic- and operations-related accidents (EHA 8.1)

RTAs are increasingly common in PNG. There is generally poor road safety awareness and practices in both vehicle users and pedestrians.

The Project will minimally increase traffic loads relative to the current baseline on the Highlands Highway, the busiest road in PNG. RTAs pose a significant risk for the Project. The capacity of the local health system adjacent to the PSA for a major multi-victim accident is minimal/modest.

Consequence Dimension			Sensitivity Dimension		
Duration	Scale / Extent	Magnitude	Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower	Lower	Lower	Lower
Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Higher	Higher	Higher	Higher	Higher	Higher

Impact Dimension			Risk Dimension		
Phase	Valence	Nature	Consequence Level	Probability Category	Risk rating
Construction	Positive	Direct	I – Critical	A	1
Operation	Negative	Indirect	II – High	B	2
Closure		Cumulative	III – Moderate	C	3
			IV – Low	D	
				E	

EHA #9 – POTENTIALLY HAZARDOUS MATERIALS, NOISE, VIBRATION AND SHORT TERM CHEMICAL EXPOSURES

Potential impacts related to noise, vibration and short-term chemical exposures are covered in the EIA and SIA documents. The primary concerns related to the potential for Project driven community exposure to hazardous materials, including in particular pesticides and fertilizers during operations

Exposure to pesticides/fertilizers (EHA 9.1)

The Project is a potential source of exposure to pesticides and fertilizers during operations. Worker exposure should be controlled and managed by standard operating procedures. Proposed pesticides and fertilizers are registered in PNG. However, pesticides and fertilizers can 'leak out' into the community in an uncontrolled manner, i.e., theft, inadvertent environmental release (air, water, soils).

Exposures to potentially hazardous materials pose a significant risk for the Project. The capacity of the local health system for hazardous materials exposures is minimal/modest.

Consequence Dimension			Sensitivity Dimension		
Duration	Scale / Extent	Magnitude	Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower	Lower	Lower	Lower
Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Higher	Higher	Higher	Higher	Higher	Higher

Impact Dimension			Risk Dimension		
Phase	Valence	Nature	Consequence Level	Probability Category	Risk rating
Construction	Positive	Direct	I – Critical	A	1
Operation	Negative	Indirect	II – High	B	2
Closure		Cumulative	III – Moderate	C	3
			IV – Low	D	
				E	

EHA #10 – SOCIAL DETERMINANTS OF HEALTH

Changes in social determinants of health (SDH) are typically associated with employment and income.

Health inequalities (EHA 10.1)

Through the creation of employment and income generation opportunities, the Project has the potential to modestly improve the socio-economic conditions across the PSA. Overall these improvements are 'health positive.' However, health inequalities may develop. Health inequalities are differences in health status experienced by certain population groups. For example, people in lower socio-economic groups are more likely to experience chronic ill-health and die earlier than those who are more advantaged. Health inequalities are not only apparent between people of different socio-economic groups, they exist between different genders and different ethnic groups.

Consequence Dimension		
Duration	Scale / Extent	Magnitude
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Sensitivity Dimension		
Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower
Moderate	Moderate	Moderate
Higher	Higher	Higher

Impact Dimension		
Phase	Valence	Nature
Construction	Positive	Direct
Operation	Negative	Indirect
Closure		Cumulative

Risk Dimension		
Consequence Level	Probability Category	Risk rating
I – Critical	A	1
II – High	B	2
III – Moderate	C	3
IV – Low	D	
	E	

EHA #11 – VETERINARY MEDICINE AND ZOONOTIC DISEASES

Zoonotic diseases are those which originate from animals but can be highly pathogenic to humans. Lack of knowledge regarding the burden of zoonotic disease transmission is a chronic problem in PNG. Local health facilities lack the clinical and laboratory capability to accurately diagnose these diseases.

Zoonotic diseases (EHA 11.1)

The extent of zoonotic disease in the PSA is unknown. The environmental/ecologic change from grassland to forest could change the mix and movement of small mammals. Interaction between communities and potentially changed proximate ecology is unknown.

Consequence Dimension			Sensitivity Dimension		
Duration	Scale / Extent	Magnitude	Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower	Lower	Lower	Lower
Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Higher	Higher	Higher	Higher	Higher	Higher

Impact Dimension			Risk Dimension		
Phase	Valence	Nature	Consequence Level	Probability Category	Risk rating
Construction	Positive	Direct	I – Critical	A	1
Operation	Negative	Indirect	II – High	B	2
Closure		Cumulative	III – Moderate	C	3
			IV – Low	D	
				E	

EHA #12 – CULTURAL HEALTH PRACTICES

Shift to traditional medicine and informal health sector (EHA 12.1)

The Project is unlikely to play any major role in influencing cultural health practices in the PSA. A rating of IV-E-3 is appropriate.

Consequence Dimension			Sensitivity Dimension		
Duration	Scale / Extent	Magnitude	Treatment inaccessibility	Susceptibility	Disengagement
Lower	Lower	Lower	Lower	Lower	Lower
Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Higher	Higher	Higher	Higher	Higher	Higher

Impact Dimension			Risk Dimension		
Phase	Valence	Nature	Consequence Level	Probability Category	Risk rating
Construction	Positive	Direct	I – Critical	A	1
Operation	Negative	Indirect	II – High	B	2
Closure		Cumulative	III – Moderate	C	3
			IV – Low	D	
				E	

5.5.4. Conclusions and considerations

While a number of the defined environmental health areas (EHAs) have potentially critical negative consequences, in reality, there are numerous modifying/mitigating consequence and sensitivity dimensions that lessen the actual likelihood of a measurable negative impact.

The most significant concerns with a risk rating of 1 are related to (i) transmission of arboviral diseases; (ii) accidents/injuries during construction; (iii) transmission of HIV and STIs; (iv) zoonotics; (v) exposure to hazardous materials, and (vi) social determinants of health. Even within this 'higher rated group of potential impacts', there are substantial mitigating factors such that the overall likelihood of significant, observable health impacts is considered to be low.

5.6. Gender

5.6.1. Methodology

The gender assessment uses the general methodology described in Chapter 2 and the key gender impacts identified for the Project have been categorised according to those presented in the World Bank's *Papua New Guinea - Country gender assessment for the period 2011-2012* (CGA) (World Bank 2012).

5.6.2. Identification and discussion of impacts

REPRESENTATION AND ACCESS TO INCOME

The Project is anticipated to increase wage employment for women, especially in the nurseries where they demonstrate the fine motor skills required for the tasks. In this regard the Project has the potential to positively impact the lives of women should it make specific efforts to educate and train women for employment, or provide or assist in providing targeted programs and resources for financial literacy.

Lack of gender diversity in (business) representation

There is virtually no representation of women (plus female elders, youth, children and persons with a disability) on landowner groups, business entities, and forums for discussions relating to land lease-leaseback arrangements; business organization and investment strategies – rationalized by claims women lack 'ownership' of land.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Inequitable distribution of land lease and crop share

Inequitable distribution of land lease and crop share benefits to women, elders, youth, children, persons with a disability, landless outsiders, and children of inter-ethnic, transcultural marriages may occur.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased income levels for women

Higher incomes for women employed as wage-labourers in nurseries and from intercropping crops sold in local markets are expected to occur.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

DOMESTIC AND INTERPERSONAL RELATIONS

Increases in disposable cash incomes for males and females in the PSA are anticipated. For males these will result largely from land derived compensations, rents and crop share, cash-cropping, Landowner Company (Lanco) activities and some project employment; for females perhaps from the same land derived income streams (though at a lesser quantum), from increased market sales of cash crops, from employment in nurseries and perhaps in Project-related business entities that will be established.

These outcomes, by analogy with other regions in PNG, may generally lead to some increase in domestic disharmony, disputes and Gender-Based Violence (GBV) incidents. This has a potential to impact the Project's bottom line, and will require mitigation measures to assist in alleviating these issues. The study *Gender violence in Papua New Guinea: The cost to business* (Darko, Smith, and Walker 2015) provides insights and statistics on costs in three categories:

1. Staff time lost due to GBV, either through staff being personally affected or supporting a colleague during work hours.
2. Costs of GBV-specific training and services for which a proportion can be allocated to GBV costs—this includes phone lines, counselling, health care, alcohol abuse awareness training, etc.
3. Indirect costs—time and resource costs of staff turnover and recruitment based on estimates of GBV as the cause.

Increased family disharmony

Increase in family disharmony due to cashed up males marrying more wives may occur.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased demand for female transactional sex workers

Increase in women and girls driven into transactional sex work in order to meet their need for cash, and who are attracted to Project areas, may occur.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased gender-based violence

Increase in gender-based violence, due to (a) higher incomes by women in cash cropping and wage labour enterprises with refusals to share with men; (b) cashed up males increased resort to drugs, sex workers and alcohol, may occur.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased workforce absenteeism due to gender-based violence

Increase in workforce absenteeism due to GBV may pose a problem for employers, and work relationships with other co-workers; repercussions of domestic disputes can spill over to workforce attendance if intra-ethnic or inter-ethnic fighting occurs.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

DIVISION OF LABOUR

The risk the Project poses is that extra burdens will be placed on young teenage women to assist with domestic duties such as childcare, livestock husbandry and gardening, because both parents are engaged in wage labour on the Project.

Increased family burdens on younger female adolescents

Increased burdens on younger female adolescents may occur due to income/wage earning absentee parents – these burdens may involve looking after elderly and young, livestock, gardens, etc.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

LAND RESOURCES AND GENDER IMPLICATIONS

The Project is relatively small-scale but with a potentially large-scale footprint. It is a project where community and commerce intersect around the single most important resource in PNG society, i.e., land. How the Project will impact women is very much determined by the cultural scaffold of women's property rights, decision-making, domestic labour divisions and their envisaged roles in society.

In Wampar, women as producers of food had access to clan land parcels for foraging and thus can be considered to have 'use rights' to land. However, women rarely had decision-making powers with regard to land ownership, lease or commercial uses. Their brothers were, and are today, usually the custodians of the kin group's property, responsible for any political decision concerning it. It is this lack of agency in decision-making that renders them disadvantaged in development contexts where land resources and access to land are central.

Inequitable gender rights to land usage and resources

Disregard of women's / girls' use rights to land may occur through the exclusion of women's representation in consultation and meetings about land, and cash compensation payments being made to all-male landowner groups.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Inequitable gender impacts of resource loss

Loss of land resources of importance to women may occur, resulting in women's loss of access to and use of productive ecosystems; and loss of potential income collection of forest resources, firewood etc. This may result in increased strain on subsistence and anxiety levels amongst women.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

GENDER AND EDUCATION

Whilst great strides towards educational parity have been made in Morobe Province, resource projects are renowned for impacting the provision of educational services and school attendance rates. Experience from the mining and petroleum sector in PNG has shown that teachers tend to apply for well-paid administration jobs and their teaching positions remain unfilled for months. Equally, adolescents avail themselves of cash benefit streams or short-term employment rather than attend classes.

Loss of cultural and indigenous knowledge

Loss of elder women's knowledge of land and lore if grassy woodland areas and hunting wild game diminishes may occur. Change in contexts for transmission of cultural knowledge will impact indigenous knowledge sustainability

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased family pressures lead to higher school drop-out rates

Increased pressure on female adolescents to work at home or marry may lead to higher drop-out rates at school.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

ACCESS TO PROJECT INFORMATION

Given the anticipated participation of women in the Project, there is a large risk that unless a targeted program of education about land law, custom and rights is instigated women will be disadvantaged in obtaining justice, equitable participation and fair income streams. Whilst it is not the responsibility of the Project to undertake 'education' of the populace, the adherence to FPIC processes compels some proactive behaviour that ensures women are provided with the opportunities to protect their rights and make informed decisions.

In the above regard for women 'to have a voice' and possible leadership function, they need to be empowered by some formal instrument or code of behaviour because the cultural blueprints of gender work against such participation. It is a slow evolution in which mind-sets will change with transitions to modernity but each opportunity has to be maximised to ensure these rights are respected and adhered to.

Absence of gender-sensitive stakeholder engagement

A potential risk is that no gender-sensitive initial engagement and on-going consultation with women and other socially vulnerable groups occurs, and that information flow is only through men.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

5.6.3. Conclusions and assessment

The human rights case for greater involvement of women in the development and resource sector due to legislative requirements for gender equality is straightforward: women constitute half of Papua New Guinean society and therefore should share equally in the benefits from the development and resource sector, and women should not bear a greater burden than men from the risks of such sectors.

The CGA 2011–2012 portray the parlous state of affairs for women and socially vulnerable groups, particularly where they are impacted by resource development projects. Despite the national government's intentions and the exceptional work conducted by NGOs over the past few decades (to establish and maintain relationships of and social structures that support gender equality), little real change at the local level has occurred in the main areas of concern: equal opportunities for women, equal treatment of women, women's equal entitlement to the benefits and wealth produced by their country.

The IFC contends that women have a crucial role in achieving sound economic growth and poverty reduction and women are an essential part of private sector development. The IFC expects its clients to minimise gender-related risks from business activities and unintended gender differentiated impacts. It is the presence of resource development projects and the rapid modernisation of previously rural communities that produces ongoing social, cultural, political and economic challenges for women.

It is recommended that key steps be taken to ensure that the rights of women and members of socially vulnerable groups are understood and actions are designed and implemented to ensure the rights of these social groups are not impaired. This is most effectively managed by the design and implementation of a detailed Gender Impact Management Plan.

5.7. Human rights

5.7.1. International rights, standards and guidance

The most widely embraced list of human rights is presented in the International Bill of Rights, a compendium of three treaties ratified by 159 countries, incorporating political, civil, cultural, social and economic rights (United Nations 1948; 1966a; 1966b) The International Bill of Rights consists of:

- The Universal Declaration of Human Rights (UDHR), adopted in 1948.
- The International Covenant on Economic, Social and Cultural Rights (ICESCR).
- The International Covenant on Civil and Political Rights (ICCPR) and its two Optional Protocols.

In addition, the UN Global Compact (to which Oil Search Limited is a signatory) asks companies to commit to ten universal sustainability principles, and to support broader UN and societal goals such as the Sustainable Development Goals. The ten principles are derived from:

- The Universal Declaration of Human Rights.
- The International Labour Organisation's Declaration on Fundamental Principles and Rights at Work.
- The Rio Declaration on Environment and Development.
- The United Nations Convention Against Corruption.

UN Global Compact

Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights

Respecting human rights ('do no harm') means, as elaborated by the UN Guiding Principles on Business and Human Rights (UNGP) (United Nations 2011):

- Not causing or contributing to adverse human rights impacts through a business's own activities and addressing any impacts that occur; and
- Seeking to prevent or mitigate against adverse human rights impacts that are directly linked to a business' operations, products or services by their business relationships, even if the business has not contributed to those impacts.

Supporting human rights refers to voluntary actions that advance and promote human rights. This could include actions through core business activities, strategic social investment and philanthropy, advocacy and public policy engagement, partnerships and collective action (although supporting human rights cannot substitute for respecting human rights). In practice, respecting and supporting human rights are often closely interlinked.

Principle 2: Businesses should make sure that they are not complicit in human rights abuses

Principle 2 refers to being implicated in a human rights abuse that another business, government, individual or group is causing. The risk of complicity in human rights abuses is particularly high in areas of weak governance or where human rights abuses are widespread; however, the risk exists in every country for every sector.

Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining

Freedom of association refers to the right of all workers and all employers to freely and voluntarily establish and join organisations of their own choice. These organisations have the right to freely carry out their activities, including the promotion and defence of their occupational interests, without interference. Collective bargaining refers to a voluntary process or activity through which employers and employees discuss and negotiate their relations, including terms and conditions at work. The UN Global Compact does not require companies to change their industrial relations frameworks, and expresses no view on whether any particular national law meets international standards. The International Organisation of Employers developed an Employers' Guide to the UN Global Compact, which elaborates further on what the Labour Principles mean for businesses.

Principle 4: Businesses should uphold the elimination of all forms of forced and compulsory labour

Forced and compulsory labour includes slavery, bonded labour or debt bondage, physical abduction or kidnapping, physical confinement in a work location, the work or service of prisoners if hired to or placed at the disposal of companies or others involuntarily and without supervision of public authorities, work required to punish opinion or expression of views, exploitative practices such as forced overtime, withholding, the lodging of deposits (financial or personal documents, e.g. passports) for employment, and non-payment of wages and induced indebtedness.

Principle 5: Businesses should uphold the effective abolition of child labour

'Child labour' is a form of exploitation that is a violation of a human right. While the term 'child' refers to all girls and boys under 18 years, not all under-18s must be removed from work. International standards distinguish what constitutes acceptable or unacceptable work for children at different ages and stages of their development.

ILO Convention No. 182 requires governments to give priority to eliminating the worst forms of child labour undertaken by all under-18s (slavery, prostitution, pornography, illicit activities and work likely to harm the health, safety or morals of the child).

Principle 6: Businesses should uphold the elimination of discrimination in respect of employment and occupation

Discrimination in employment and occupation refers to treating people differently or less favourably because of characteristics unrelated to merit or the inherent requirements of the job (e.g. race, colour, sex, religion, political opinion, national extraction, social origin, age, disability, HIV/AIDS status, trade union membership and sexual orientation). Discrimination can arise in a range of situations, such as recruitment, remuneration, hours of work, security of tenure, job assignments, performance assessment and promotion, maternity protection, training and opportunities and occupational health and safety matters.

Principle 7: Businesses should support a precautionary approach to environmental challenges

Principle 15 of the Rio Declaration defined the precautionary approach as follows:

> Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

In short, where there is a threat of serious or irreversible damage to health or the environment, even if the threat is not fully understood or established, prevention is better than cure. Businesses should support cost-effective measures to protect the environment and not use scientific uncertainties as an excuse to postpone actions to address environmental challenges.

Principle 8: Businesses should undertake initiatives to promote greater environmental responsibility

Agenda 21, the UN action plan developed at the 1992 Rio Earth Summit, explained the business and industry in sustainable development as follows:

> Business and industry should increase self-regulation, guided by appropriate codes, charters and initiatives integrated into all elements of business planning and decision-making, and fostering openness and dialogue with employees and the public.

Corporate environmental responsibility is now recognised as a core business issue. In addition to risk management outcomes, taking an environmentally responsible approach supports the long-term viability of businesses in an increasingly resource-constrained world, and can also spur innovation. Stakeholders, including customers, investors, governments, employees and NGOs, also expect businesses to minimise their environmental impact, and where possible have a net positive impact.

Principle 9: Businesses should encourage the development and diffusion of environmentally friendly technologies

Environmentally friendly technologies include those that protect the environment, reduce pollution, use all resources more sustainably, recycle more waste and product and/or manage waste more effectively than those they replace. They may be specific devices or entire processes or systems.

Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery

Principle 10 commits UN Global Compact participants not only to avoid bribery, extortion and other forms of corruption, but also to develop policies and concrete programs to address corruption. The UN Convention against Corruption is the underlying legal instrument for Principle 10.

International Finance Corporation's Standards and Guidelines

The IFC Performance Standards establish a private regulatory framework in respect of labour and working conditions; environmental practices; workplace health and safety; community health, safety and security; land acquisition and involuntary resettlement; relations with indigenous communities and preservation of cultural heritage. To determine the relevant human rights landscape applicable to the business activity, the IFC recommends that companies should:

- Identify the international conventions the host country has signed and ratified.
- Examine the host country's incorporation of international conventions into national laws.
- Ascertain whether gaps in the protection of human rights are prevalent in the national laws, and its application.
- Conduct a gap analysis exercise on the company's conduct in relation to human rights issues addressed in the host country's legal framework.

Where gaps in host country commitments are identified, companies should determine the extent to which the national law and practice, or lack of it, might undermine or put at risk the company's responsibility to respect human rights.

IFC's Policy on Environmental and Social Sustainability (paragraph 12) and Performance Standard 1 (paragraph 3) explicitly recognises the responsibility of business to respect human rights.

The IFC notes that an assessment on the host country's performance regarding economic, social and cultural rights may be guided by the:

- Present state of the local economy, its current phase of growth or recession.
- National and local management of economic development, and in particular its impact on local communities.
- Enterprise and educational opportunities.
- Adherence to labour standards and general workplace conditions.
- Accessibility to basic social services and facilities.
- Treatment of vulnerable groups and individuals.
- Prevalence of corruption.
- Prevalence of any forms of discrimination.

International Finance Corporation's Voluntary Principles on Security and Human Rights

Of the IFC's Voluntary Principles on Security and Human Rights, the Voluntary Principle of importance to the Project is that relating to interaction between companies and private security personnel. The IFC recognises that where host governments are unable or unwilling to provide adequate security to protect a company's personnel or assets, it may be necessary to engage private security providers as a complement to public security. In this context, private security may have to coordinate with state forces such as law enforcement to carry weapons and to consider the defensive local use of force.

5.7.2. Methodology

Human Rights Impact Assessments (HRIA) are a part of the Human Rights Due Diligence process outlined in the United Nations (UN) Guiding Principles for Human Rights and Business, developed between 2005 and 2011. While governments retain the express responsibility to protect, promote and fulfil human rights, businesses are called upon to 'respect' human rights. Jointly, companies and governments are expected to provide access to remedy for victims of human rights abuses. The

incorporation of companies into the human rights regime reflects the economic and political influence companies can have in states that face challenging governance issues. It also acknowledges that capital development has implications for humanity well beyond the Project area.

International best practice for ethical resource development companies requires that their employees, their families, host communities, suppliers and consumers of their products all are situated under the protective mantle of the United Nations Universal Declaration of Human Rights (UDHR). Respect for human rights is essential to the companies' social performance work in that it is seen to assist a company to build trusting and collaborative relationships with host communities. The strong and valid business drivers for ensuring that the human rights impacts of projects are assessed and managed include the minimisation of reputational, operational, financial and legal risks and the establishment of a 'social licence to operate'.

Human Rights and Business

HRIAs serve two primary purposes:

1. To provide detailed, field based information for management, so that actions can be taken to potentially avoid causing, contributing to, or benefiting from adverse human rights impacts.
2. To identify risks to a company's 'social license to operate'.

The former is elaborated further below, and the latter is based in a process of understanding 'rights-holders'. Recognising and understanding rights-holders enables a company to foresee conflicts with the community and address them proactively. Social license is not a formal legal document issued by government authorities but rather refers to the level of acceptance or approval by local communities and stakeholders of the project and its operations. The seeking of social license can include steps such as engaging in questions of Free, Prior and Informed Consent (FPIC) among the Wampar people, fostering relationships with representatives of the Wampar community, and commissioning a HRIA and Human Rights Action Plan (HRAP).

Human Rights Due Diligence

The UN Guiding Principles borrow a term from securities law to describe the responsibility of companies to understand their human rights impacts in order to 'know and show' that adverse impacts are managed. Due Diligence is defined in Principle 17 of the Guiding Principles to "cover adverse human rights impacts that the business enterprise may cause or contribute to through its own activities, or which may be directly linked to its operations, products or services by its business relationships".

'Complicity': Managing Business Relationships

The comments to Guiding Principle 17 clarify that a company may 'contribute' to adverse human rights impacts "when a business enterprise contributes to, or is seen as contributing to, adverse human rights impacts caused by other parties." This is referred to as 'complicity'. Complicity has both non-legal and legal meanings, i.e., "As a non-legal matter, business enterprises may be perceived as being 'complicit' in the acts of another party where, for example, they are seen to benefit from an abuse committed by that party. As a legal matter, most national jurisdictions prohibit complicity in the commission of a crime, and a number allow for criminal liability of business enterprises in such cases" (United Nations 2011: Commentary, UNGP 17). The non-legal interpretation of complicity is relevant to rights-respectful corporations because it is an indicator of risks to social licence to operate, hinging on the perceptions of rightsholders.

HRIA draws on quantitative data, qualitative data and narrative statements to incorporate both the actual impacts an operation may have on human rights as well as perceived impacts. Perceptions not only influence the way communities see a company's relationships with less rights-respectful actors, they also are a driver for the actions of government agents. The World Bank's World Governance Indicators, the premier database of global governance performance, is based on perceptions because:

> *First, perceptions matter because agents base their actions on their perceptions, impressions, and views. If citizens believe that the courts are inefficient or the police are corrupt, they are unlikely to avail themselves of their services. Similarly, enterprises base their investment decisions - and citizens their voting decisions - on their perceived view of the investment climate and the government's performance. Second, in many areas of governance, there are few alternatives to relying on perceptions data. For instance, this has been particularly the case for corruption, which almost by definition leaves no 'paper trail' that can be captured by purely objective measures. Third, we note that even when objective or fact-based data are available, often such data may capture the de jure notion of laws 'on the books', which often differs substantially from the de facto reality that exists 'on the ground'. Sharp divergences between de jure and de facto measures of business entry regulation [have been documented] and corruption is important in explaining the extent to which the former differ from the latter.*[14]

5.7.3. Identification and discussion of impacts

Increased safety and security concerns

Increased travel by project workers who use PMV may result in these workers being exposed to possible *raskol* activity; women and young girls are particular high risk targets as are cashed-up men and youth. Potential consequences include:

- Increased risk of safety and security concerns for women, girls and children outside village, walking along Highlands Highway and proposed road route(s).
- Potential for increased male-on-male tension due to conflict over land and income streams.
- In-migration to the area of outside males seeking employment or in-marriage is a potential threat to the safety and security of children.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased social pressure on women to take up employment

Women exposed to male-to-male pressure to take up employment and income earning opportunities increases pressures women to become wage-earners.

This could result in increased burden on young adolescents to fill-in for absentee mothers.

[14] http://info.worldbank.org/governance/wgi/index.aspx#home.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Increased domestic disputes leading to GBV and FSV

Increased domestic disputes about income distribution and land in combination with increased use of drugs and alcohol can lead to increases in GBV and Family and Sexual Violence (FSV)

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Disregard of socially vulnerable persons' rights and opportunities

The Project should ensure that socially vulnerable persons' rights are not disregarded or ignored. They should be treated as a person before the law in relation to all aspects of the project. Of particular concern are compensation, crop share payments and business development funding and education, employment and training opportunities.

The Project should recognise that socially vulnerable persons may have a limited understanding of their constitutional rights and due process. In particular, access to opportunities for receipt of financial compensation and business funding may not be well understood by some women. Lack of recognition of women and socially vulnerable persons before the law could lead to deprivation of liberty, and failure to realise potential and opportunities.

The Project should carefully assess any potential lack of gender-sensitivity amongst contractors and security personnel and monitor their behaviour towards socially vulnerable persons.

Women and socially vulnerable persons have a right to employment and training; women's potential for employment should not be curtailed by local male politics or ignorance of their civil and constitutional rights. Limited understanding of PNG employment laws, constitution and regulations governing projects results could deny opportunity and due process.

Cultural blueprints for female participation persist. Therefore, proactive strategies are required to ensure effective participation and voice in respect to project activities and decision-making. Women's right to participate in public life includes the right to participate in all benefits of the project, including employment, education and training, and receipt of business development funding, land lease decisions and distribution or sharing structures.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Misunderstanding of employment rights and obligations

Failure to educate workers in all aspects of employment conditions, engagement, rights, redress options and laws can lead to 'misconceptions and understandings'.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Limited stakeholder consultation with women and vulnerable social groups

Limited consultation with women and vulnerable social groups, in a language that they understand, relating to all aspects of the project, may occur, as may inadequate reporting of EA/SIA findings to women, and other PAPs.

Lack of gender-sensitivity amongst government personnel to recognise and manage the disadvantages of women and socially vulnerable persons may occur, as may abuse of FPIC processes and inadequate ICP.

Potential exists in land lease contexts for educated elites to co-opt decision-making processes at expense of real landowners or those with a right to contribute their opinions. Socially vulnerable are at risk of having their vote, voice or wishes overridden by others or elites if not properly consulted.

Limited direct and appropriate consultation may occur with non-Wampar persons, in a language that they understand, relating to opportunities and rights. Minorities such as in-migrants or internally displaced persons who have located to Wampar territory may not be offered the opportunities that are available to them as community members. Nowa community, predominantly non-Wampar on Wampar land, appear especially vulnerable in the project context.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

5.7.4. Conclusions and considerations

The HRIA's major concerns are in regard to the impacts on women and 'socially vulnerable groups'. Development and resource projects primarily target males as key persons to benefit from a project due to their assumed capacity for community and political leadership, their organisation of landowner associations, and their availability and capacity for 'hard labour', employment and entrepreneurial

activities. The HRIA analysis has taken particular account of the vulnerability of potentially affected individuals, groups, households and communities in the PSA.

The two key human rights impacts in relation to the Project are:

- **The lack of women's legal and social empowerment, coupled with their lack of a political voice in the PSA.**

  While women may speak in public meetings, they are likely to be excluded from important discussions relating to compensation, payments, employment and business funding opportunities. Recognising women's lack of a political voice is particularly important when planning public information and consultation sessions.

- **Socio-cultural changes in and around the PSA are likely to trigger, or reinforce existing, violence against women and children.**

  Changes to levels of income earned by women may alter established relations of power within and between households with consequent 'punitive' actions taken against women and children.

The Project's proponent (i.e., Oil Search) Social Responsibility Policy (Appendix B) incorporates the commitment to:

> *Operate(ing) with integrity at all times as well as adopting and advocating for principles, practices and standards that respect diversity, local culture, human rights, labour rights, women's protection and empowerment, and the environment, and which contribute towards combatting corruption.*

It is only in the last few years that both 'gender' and 'human rights' abuses in PNG have received the headline attention by both the Government of PNG and outside agencies. It is acknowledged that the intersection of culture and commerce in a developing nation which has partially transitioned to modernity is fraught with problems. Western concerns and models do not easily overlap onto cultural scaffolds that have no place for, or do not indigenously recognise, 'gender equity ideologies', 'equitable distribution of benefits' etc. In this regard recommendations have to be sensible and recognise that 'solutions' are part of an evolutionary process in which change can be pedestrian and imperceptible on occasions.

As a consequence, it is imperative that both a *Gender Impact Management Plan* and a *Human Rights Impact Management Plan* be designed to mitigate the risks and uncertainties identified above.

5.8. Cultural heritage and archaeology

5.8.1. Applicable legislation and standards

The following legislation is applicable to this sector (details are provided in Chapter 3):

- *National Cultural Property (Preservation) Act 1965*
- *War Surplus Material Act 1952*
- *Cemeteries Act 1955*
- *Criminal Code Act 1974*

- *IFC Performance Standard 8*

International Finance Corporation (2012) Performance Standard 8 follows a similar definition of 'cultural property' to that of the United Nations Educational, Scientific and Cultural Organisation (UNESCO), which includes:

> *Sites having archaeological (prehistoric) paleontological, historical, cultural, artistic, and religious values, as well as unique natural environmental features that embody cultural values, such as sacred groves….intangible forms of culture, such as cultural knowledge, innovations and practices of communities embodying traditional lifestyles are also included. The requirements of this performance standard apply to cultural heritage regardless of whether or not it has been legally protected or previously disturbed.*

Natural features of the landscape such as specific hills, waterholes, waterways, etc., which may be modified yet nevertheless regarded as significant by local communities, are included under IFC Performance Standard 8. Such places are also of relevance in the sense that it may not be appropriate to only protect an archaeological site (e.g., a particular ancestral settlement) while at the same time destroying its immediate surroundings (e.g., an associated water source), if these immediate surroundings also form part of a site's culturally significant context.

Paragraph 7 of IFC Performance Standard 8 states that:

The client will not remove any cultural heritage, unless the following conditions are met:

1. There are no technically or financially feasible alternatives to removal.
2. The overall benefits of the project outweigh the anticipated cultural heritage loss from removal.
3. Any removal of cultural heritage is conducted by the best available technique (i.e., best professional cultural heritage salvage standards).

IFC Performance Standard 8 also clearly stipulates that:

> *[I]n addition to complying with relevant national law on the protection of cultural heritage, including national law implementing the host country's obligations under the Convention Concerning the Protection of the World Cultural and Natural Heritage and other relevant international law, the client will protect and support cultural heritage by undertaking internationally recognised practices for the protection, field-based study, and documentation of cultural heritage.*

Compliance with these internationally recognised performance standards also requires informed and timely reporting of anticipated impacts of proposed developments on cultural heritage sites to local community groups. In this regard IFC Performance Standard 1 (Social and Environmental Assessment and Management Systems) is also relevant.

Paragraph 19 of IFC Performance Standard 1 states:

> *Community engagement is an on-going process involving the client's disclosure of information. When local communities may be affected by risks or adverse impacts from a project, the engagement process will include consultation with them. The purpose of community engagement is to build and maintain over time a constructive relationship with these communities. The nature and frequency of community engagement will reflect*

the project's risks to and adverse impacts on the affected communities. Community engagement will be free of external manipulation, interference or coercion and intimidation, and conducted on the basis of timely, relevant, understandable and as accessible information.

Paragraph 20 relates to disclosure to affected communities:

Disclosure of relevant information helps affected communities understand the risks, impacts and opportunities of the project. Where the client has undertaken a process of Social and Environmental Assessment, the client will publicly disclose the Assessment document. If communities may be affected by risks or adverse impacts from the project, the client will provide such communities with access to information on the purpose, nature and scale of the project, the duration of proposed project activities, and any risks to and potential impacts on such communities. For projects with adverse social or environmental impacts, disclosure should occur early in the Social and Environmental Assessment process and in any event before the project construction commences, and on an ongoing basis.

Paragraph 26 states:

The client will disclose the Action Plan to the affected communities. In addition, the client will provide periodic reports that describe progress with implementation of the Action Plan on issues that involve ongoing risk to or impacts on affected communities, and on issues that the consultation process or grievance mechanisms has identified as of concern to those communities. If the management program results in material changes in, or additions to, the mitigation measures or actions described in the Action Plan on issues of concern to the affected communities, the updated mitigation measures or actions will be disclosed. These reports will be in a format accessible to the affected communities. The frequency of these reports will be proportionate to the concerns of affected communities but no less than annually.

5.8.2. Methodology

The Papua New Guinea National Museum & Art Gallery (PNG NMAG) issued a permit to undertake cultural heritage work and provided a specialist field researcher to accompany the SIA Study team. Fieldwork interviews and surveys were conducted over two weeks including clan interviews to determine community views and perceptions and site surveys to record cultural heritage sites.

The primary survey method is clan cultural heritage interviews to establish the cultural heritage sites known by landowning clans to be located within the PSA. During cultural heritage interviews clan members were asked to consider the significance of their cultural heritage sites (i.e., in terms of a graduated scale: low, medium, high) and potential/hypothetical site management options in relation to the Project (e.g., buffer zones, managing tambu sites, and so on). Attempts were also made to understand local perceptions towards the aesthetic value of cultural heritage site contexts and potential changes or impacts to this in relation to landscape changes associated with the project (e.g., grasslands becoming forested).

Participants in ground surveys were clan leaders (and/or men elected by clan leaders) who had knowledge of the location, significance and cultural context targeted sites. Two kinds of surveys methods were employed to visit and record sites:

1. Ground survey: the archaeologists, clan representatives and VLO visited the site on foot and conducted a formal site recording; and
2. Equestrian survey: clan representatives (including VLO) visited sites on horseback that were located in dense and/or remote locations and were beyond the scope of the ground survey.

During both the ground and equestrian surveys additional cultural heritage sites that had not been discussed during interviews were identified.

5.8.3. Identification and discussion of impacts

Disturbance to spirit sites

Spirit sites represent the most common cultural heritage site type within the PSA. Thirty of the total 35 sites are classified as spirit sites. These sites are regarded as *tambu* (dangerous/forbidden/prohibited) and clan informants invariably highlighted the potential dangers associated with inappropriate access or proximity. Such trespassing/intruding is believed to have various consequences such as disorientation, illness or even death. Proximity to these sites needs to be specifically managed by the appropriate clan landowner who will generally need to visit the site in advance and talk/consult with the ancestral spirits before other visitors (i.e., especially from other clans or outsiders) can safely be in proximity to the site area.

These sites generally take the form of particular vegetation and/or drainage features and can sometimes be spatially expansive (e.g., entire creek systems, sago or forest areas); they can also directly relate to former settlement sites and burial/cemetery sites. In addition to direct physical trespass/intrusion, noise (e.g., loud voices or machinery) can also be regarded as a factor in terms of disturbance to spirits at such sites. In cases where spirits are believed to inhabit drainage areas, environmental impacts (e.g., water pollution or increased sedimentation) can also sometimes be interpreted locally in terms of cultural site impact. Experience with the management of such spirit sites across Melanesia more generally indicates that negative occurrences during Project operations may potentially be linked to disturbance of spirit sites if appropriate management measures have not put in place and followed. For example, if a worker becomes sick and they are known to have been operating near a spirit site without the knowledge/permission of the appropriate landowner then this may be attributed a causal link by the local community, with potential to impact Project operations and community relations. In some instances communities may elect to conduct precautionary ceremonies; e.g., a *toksori* ceremony to relocate a particular spirit or groups of spirits.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Disturbance to former settlement sites

Eleven former settlement sites were recorded within the PSA and one campsite settlement. These sites are usually also regarded as spirit sites by the local community and so recommendations and context associated with spirit site management should be incorporated. These sites are often linked to ancestral burial locations (graves) and in two cases village cemeteries. In addition to high cultural/social/political significance these sites also have high scientific significance due to the

presence of surface or subsurface material; former settlements represent the most important archaeological site type in terms of the potential to develop better understanding of the antiquity and nature of human occupation in the local region and area more generally.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Rare	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Disturbance to burial/cemetery sites

Four cultural heritage sites were known by clan informants to involve isolated burial locations (graves). While often spatially associated with former settlements, burials are sometimes related to sudden deaths and located in other locations. Two village cemeteries were identified and local oral history suggests that the north side of former village settlements is where such cemeteries were traditionally located. Burial/Cemetery sites are also closely linked to ancestral spirits. Clan oral history invariably records the details of the deceased at burial sites, however, they were generally said to be unmarked and their precise locations were not known. The management of burial/cemetery sites needs to incorporate recommendations of former settlement and also spirit sites.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Rare	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Disturbance to skull house sites

A single skull house site was recorded which has high cultural/social/political significance to the local community along with educational significance for the next generation of traditional custodians.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Rare	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Disturbance to historic sites

Both historic sites recorded are U.S. Air Force WWII plane wreck/crash locations. These sites are protected by the War Surplus Material Act (1952) and deemed property of the State. One site also has a complicated relationship with local clan perceptions of spiritual agency that remains only partially documented. This site should be regarded as a spirit site and/or further interviews should be conducted with the relevant clan representatives to better understand and document this site.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Rare	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Disturbance to archaeological sites

One exclusively archaeological site was documented – i.e., this site is not directly tied to oral tradition. However, any site displaying physical evidence of past human activity can likewise be classified an archaeological site, whether that be in the form of durable material culture such as pottery and/or stone tools, or in relation to the presence of ethno-botanic plant species. All archaeological sites in the PSA are regarded as having high scientific significance due to the dearth of knowledge regarding the antiquity and nature of human occupation in the area and region more generally. Inherently it is archaeological sites (currently unknown to the community) that are the most at risk of being impacted in terms of disturbance to subsurface sediments (e.g., strip ploughing that exposes potsherds). Thus, the development of a suitable Chance Find Protocol represents the key to managing the potential discovery of these sites during Project operations, and fulfilling legislative requirements, e.g., it is an offence under the *National Cultural Property (Preservation) Act (1965)* not to report the discovery of such sites. Various mitigation measures are appropriate depending on the scale and nature of archaeological material discovered; for example, surface collection and relocation of isolated potsherds may be appropriate, however in instances where rare or extensive cultural occupation features are encountered then test-pit or archaeological salvage excavations might be recommended to be performed by an appropriately-qualified person. Furthermore, sites where archaeological materials are discovered can subsequently be incorporated into the local cultural heritage sensitivity frameworks as something belonging to the ancestors (Tok Pisin: *samtingbilongtumbuna*) which may require supplementary management recommendations be applied.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Rare	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

5.8.4. Conclusions and recommendations

A total of 43 cultural heritage and archaeological sites are indicated as located within the PSA, all of which are associated with seven landowning clans. These 43 sites can be categorised as follows:

- Eight (8) previously recorded and registered sites identified during review of the NMAG National File. Unfortunately, the NMAG file data was incomplete and lacked definition and fundamental information (in some cases site type, site name, identifying clan, GPS location) and the associated report was not available for review/verification. These sites were not verified during the SIA study and cannot be further incorporated into the impact assessment at this stage. Pending the supply of required site information these sites can be addressed in terms of the future development of the Project Cultural Heritage Management Plan (CHMP).
- 21 sites visited/recorded (ground survey) by an archaeologist and now also registered with NMAG.
- Nine (9) sites visited/recorded (equestrian survey) by the Project Village Liaison Officer.

- Five (5) sites not visited/recorded but indicated to be located within the PSA during clan cultural heritage interviews.

Excluding the eight previously recorded sites, 35 sites are pertinent to the SIA heritage impact assessment. Many of these sites are multi-component sites (e.g., spirit + burial + former settlement site). All these sites have a *high* significance rating in relation to at least one of the assessment criteria and can be classified in terms of site type as follows:

- **Spirit** sites with high cultural/social and educational significance.
- **Former settlements** with high cultural/social/political, educational and scientific significance.
- **Burial/Cemetery** sites with high cultural/social/political significance.
- **Skull house** sites with high cultural/social/political and educational significance.
- **Historic** sites (WWII plane wrecks) with high historic significance.
- **Archaeological** sites with high scientific significance.

The developmental and operational nature of the Project suggests that the avoidance and management of cultural heritage sites will largely be actively controlled and informed by the clan landowning 'growers' (i.e., those landowning groups, families, households or individuals who elect to develop plantations on their clan land). The quintessential input for the management of cultural heritage sensitivities within the PSA is thus focused stakeholder engagement and, specifically, the development of a community-informed Cultural Heritage Management Plan (CHMP).

A key finding in terms of the spatial distribution and significance of known cultural heritage sites within the PSA is that *kunai* grasslands—the preferred landscape for Project plantations—appear to be the least significant vegetation community for cultural heritage sensitivities identified by clan landowners. Other vegetation communities (e.g., sago and regrowth forest areas) host the majority of known cultural heritage sites. However, dynamic landscape changes and (potentially associated with) long-term human occupation in the region means that archaeological sites unknown to the local communities have the potential to be situated within subsurface sediments of grasslands. Furthermore, in some instances rapid grassland development is known to have now covered certain cultural heritage sites.

The focus of this assessment was tangible and immovable cultural heritage (i.e., cultural heritage *sites*); however, associated intangible cultural heritage sensitivities (e.g., songs and stories linked to particular sites) were also encountered. Potential impacts to these site-specific aspects of intangible cultural heritage are addressed here within the recommendations and impact assessment pertaining to cultural heritage sites.

Potential impacts to cultural heritage sensitivities range from local to national extents, the former in relation to significance of these sites to clans and future generations of custodians, the latter reflecting the scientific significance of these sites and their legislative framework. While these risks are routinely associated with direct impacts, spirit sites also involve the potential for indirect impacts associated with disturbance through proximity and/or danger to individuals culturally categorised as trespassers/intruders. To manage these risks the mitigation strategy is outlined in terms of general recommendations, including the future development and application of a CHMP and associated Chance Finds Protocol (CFP) designed specifically for the Project, along with site specific recommendations.

The development of a CHMP is a priority as this will operate as an overarching vehicle to coordinate and apply the general and specific site type recommendations and mitigation measures. In particular, the CFP is a primary measure for mitigation against the discovery and disturbance of archaeological sites, and meeting associated legislative requirements—this will be relevant to disturbance associated with construction of the power plant site and also that associated with the development of plantation areas. The CHMP should also be developed to address the potential that sites known to people not involved (either directly or indirectly) in cultural heritage interviews and surveys, including those perhaps known only to women, have been overlooked in the present assessment.

Ultimately, the nature of the Project, in conjunction with application of the recommended mitigation measures, and ongoing stakeholder engagement, suggests the residual impacts will be minimal for the cultural heritage and archaeological sensitivities identified within the PSA.

General recommendations are as follows:

- Avoid direct impacts to known cultural heritage and archaeological sites in relation to Project development and operation activities (sites are protected by a range of legislation).
- Manage and respect community sensitivities in relation to known cultural heritage sites through regular and focused consultation with relevant clan landowners and (where appropriate) develop and maintain site buffer zones.
- Develop and conduct cultural heritage and archaeology inductions for Project staff and contractors to generate awareness of local cultural heritage sensitivities including management and avoidance strategies.
- Develop a Cultural Heritage Management Plan that incorporates a Chance Finds Protocol.
- Employ a qualified archaeologist to be present and monitor during ground surface activities associated with the construction of the proposed power plant facility.

Specific recommendations are as follows

- Disturbance to spirit sites: Identity any spirit sites proximal to Project activities and conduct focused stakeholder engagement to establish appropriate site and clan specific protocols. The establishment and maintenance of a buffer zone is recommended.
- Disturbance to former settlement sites: Identify former settlement sites in proximity to Project activity areas and establish and maintain buffer zones to prevent direct disturbance to surface and subsurface sediments known to contain cultural materials. If the former settlement is also regarded as a spirit site then also follow corresponding recommendations.
- Disturbance to burial/cemetery sites: Identify burial/cemetery sites in proximity to Project activity areas and establish and maintain buffer zones to prevent direct disturbance. Where there are associations with spirit sites and/or former settlement sites then follow corresponding recommendations.
- Disturbance to skull house sites: Avoid direct disturbance to this site. In the advent of Project activity in the vicinity construct a fence around the site in consultation with clan landowners.
- Disturbance to historic sites: Avoid direct disturbance to these sites. In the advent of Project activities in the vicinity establish and maintain a site buffer zone. Where applicable apply recommendations for a spirit site.

- Disturbance to archaeological sites: Avoid direct disturbance to known archaeological sites. Develop a suitable Chance Finds Protocol within the overall CHMP to manage the discovery of, and mitigate impacts to, archaeological sites. Employ a qualified archaeologist to monitor the large-scale ground disturbance associated with construction of the proposed power plant site.

5.9. Ecosystem services

Ecosystem services are the many benefits – large and small, direct and indirect – that ecosystems provide to people. These consist of the natural products and processes that contribute to beneficiary wellbeing, as well as the personal and social enjoyment derived from nature.

5.9.1. Applicable legislation and standards

IFC Performance Standards 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

Oil Search Limited Social Responsibility Policy

FSC National Forest Management Standards for Papua New Guinea

5.9.2. Methodology

Ecosystem services can be divided into the following four categories (WRI 2013)

1. **Provisioning services** – the goods and products people obtain from ecosystems, such as agricultural products, food, timber, fibre, construction materials and water for drinking.
2. **Regulating services** – the benefits people obtain from the ecosystem's control of natural processes, such as climate and disease control, purification of water and air, control of pests, natural hazard mitigation and water flow regulation.
3. **Cultural services** – the non-material benefits people obtain from ecosystems, such as benefits obtained from spiritual and sacred sites and aesthetic enjoyment.
4. **Supporting services** – the natural processes that maintain the other services, for example, nutrient capture and recycling, primary production, and pathways for genetic exchange.

5.9.3. Identification and discussion of impacts

PROVISIONING AND CULTURAL SERVICES

Loss of subsistence, income, and recreational resources due to conversion of grasslands and secondary forest areas

There is a potential risk that if certain grassland and secondary forest areas are committed to the project for plantation development some loss of subsistence resources will occur over and above existing trajectories of land pressure. There is also a potential risk that the populations of hunting prey (e.g., bandicoot and wild boar) may be diminished in the immediate environs of the villages adjacent to plantations because of loss of grassland and secondary forest. Specifically, these may include:

- Loss of foraging land and forest resources adversely impacting women.
- Loss of gardens or potential garden land for poorer framers.
- Decrease in populations of hunting prey diminishing recreational enjoyment and contribution of game to income, diet and subsistence.

- Increased potential for land disputes, both inter-generational and intra-clan.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Decreased ecosystem provisioning of gardens and crop cultivation

Subsistence and livelihood income impact: changes in land use; land disturbance; reduced access to resources; changes to hydrology and drainage.

The magnitude of the impact depends on the percentage extent of land use versus available land for any one landowner. In general, land available for crops and intercropping will compensate for:

- Loss of food gardens.
- Loss of potential land.
- Loss of crop income
- Shortage of land/land types.
- Inter-generational and intra-clan disputes.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Decreased ecosystem provisioning of wild game and animal products and reduced cultural services

Subsistence and livelihood income impact: changes in land use; land disturbance; reduced areas for resources; change in diet contribution. More specifically, impacts may include:

- Loss of game (pigs, birds, bandicoot) and wildlife from changed land use.
- Loss of recreational enjoyment of wildlife and hunting.
- Loss of cultural knowledge about hunting because contexts for transmission are altered and/or diminished.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Decreased ecosystem provisioning of wild foods

Subsistence impact: changes in land use; land disturbance; reduced access to resources. More specifically, impacts may include:

- Loss of woody grassland and secondary regrowth areas.
- Loss of foraging resources.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Decreased ecosystem provisioning of building materials, fibres and resins

Livelihood impact: changes in land use; land disturbance; reduced access to resources. More specifically, impacts may include:

- Loss of woody grassland and secondary regrowth areas.
- Loss of access to resource abundant areas.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Decreased ecosystem provisioning of natural medicine resources

Livelihood and income impacts: changes in land use; land disturbance; reduced access to resources. More specifically, impacts may include:

- Loss of woody grassland and secondary regrowth areas.
- Loss of access to close resource abundant areas.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Decreased ecosystem provisioning of biomass fuel

Livelihood: changes in land use; land disturbance; reduced access to resources. More specifically, impacts may include:

- Loss of woody grassland and secondary regrowth areas
- Loss of access to close resource abundant areas

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

Decreased ecosystem provisioning of livestock grazing land

Livelihood impact: land availability for cattle, pigs etc.; reduced access to grazing changes to hydrology and drainage. The Project is not considered to have a significant impact on land resources available for grazing.

Nature	Duration	Extent	Magnitude	Likelihood	Manageability	Valence
Direct	Construction	Local	High	Uncertain	High	Positive
Indirect	Operation	Regional	Medium	Probable	Medium	Negative
Cumulative	Closure	National	Low	Confident	Low	

5.9.4. Conclusions and considerations

There is a critical need to manage the land use process throughout all phases of the Project cycle. The key risk lies in the slippage between Project intentions and Project outcomes. The controlling agency vested with the responsibility to monitor the area and type of lands being volunteered for plantations, and the impacts for each leasing social unit, whether this is an ILG or some other entity, has to be rigorous and diligent in the execution of its responsibilities.

The management of ecosystem service impacts will need to be closely integrated into the broader environmental and social management framework for the Project. This framework is outlined in the EA report and will be captured in the Project's construction and operations environmental and social management and monitoring plans. The management and monitoring plans should include a number of specific sub-plans covering different elements of the Project.

6. Social Impacts

This chapter contains all the potential social impacts identified and assessed in the SIA sectoral analyses. Two scenarios have been considered in the impact assessment: Without-Project and With-Project. The Without-Project scenario succinctly outlines the anticipated impacts of the project not proceeding, whilst the With-Project scenario outlines the anticipated social impacts associated with the Project proceeding.

For the With-Project scenario, all impacts were assessed following the general methodology outlined in Chapter 2. The disposition and associated risks of each impact are fully detailed in the sectoral scoping studies referred to in Chapter 5.

This chapter consolidates all the 72 identified impacts into a project impact matrix. High-level conclusions and recommendations follow the impact matrix and lead into the suggested mitigation strategies and management measures. Finally, a residual impact matrix is provided to demonstrate the anticipated effect of the mitigation strategies on each of the identified impacts.

6.1. Without-Project

This section discusses the impacts of a Without-Project scenario. All sectoral impacts in this section estimate the impacts of the Project not proceeding.

Monetary economy

There will be a very small reduction in local employment and income levels in the PSA. This derives from present trial phase employment levels. Impacts would be so insignificant in scale they do not warrant further detailed assessment.

Economic infrastructure

In a Without-Project scenario little change is expected in the status quo, unless some other commercial project is instigated.

Education and training

It is expected that there will be no change in terms of the number or quality of education facilities in the Project area.

Benefit streams

It is expected that there will be no change with respect to the scope, level or type of local business being carried out by people in the project area.

Governance

In a Without-Project scenario not much change is expected in the status quo, unless some other commercial project is instigated.

Agriculture and land

With population increase and a growing interest in cash generation, production pressure on resources is already rising throughout the PSA. In the absence of alternative income earning options, the result

could be an expansion in the area of land required for agricultural activities, a reduction in fallow lengths and poorer soils. For many households, particularly those with limited influence and access to resources (i.e., settlers and regular clan members) grasslands provide an important location for short-term food and market gardens, though some of these plots are also being converted to perennial tree cropping. Increased pressure on land resources.

Cultural heritage and archaeology

In a Without-Project scenario not much change is expected in the status quo, unless some other commercial project is instigated.

Gender

The gendered differentiations in education that presently exist will continue with marginal disadvantages in attendance rates and literacy, and constrained participation in higher education opportunities. Levels of domestic disputes and GBV will continue, though if the regional mining projects that have been foreshadowed materialise further absenteeism of males may occur. Levels of employment for women will not change without an external intervention such as a major project. Levels of access to rights and a political voice through legal and social empowerment and awareness will not dramatically change in the short-term.

Human rights

Human rights risks deal with ‘uncertainties’ and are typically assessed on the basis of probability and consequence. In a Without-Project scenario not much change is expected in the status quo.

Community consultation and participation

A Without-Project scenario results in lost opportunity from income from employment, land rental and crop share associated with the Project. However, landowners will retain control of the land and decision-making on its utilisation with avoidance of predicted land disputes. Land disputes will flare up irrespective of the Project with a continual tendency for tighter application of descent based access rules and less flexibility as perceptions of land shortage (i.e., specific types of land) increase.

The entrenched patterns of inter-ethnic marriage will continue but the lack of any major project or incentive for outsiders to migrate to the Markham Valley will mean a stable status-quo for demography.

Ecosystem services

In the absence of another project, landowners will continue to enjoy much the same levels of ecosystem services they have now though potentially diminished over time as more land is usurped for other purposes. Expansion of short-term commercial gardening into more peripheral areas will continue to erode proximal hunting areas.

6.2. With-Project

The Project is expected to have the following 72 identified positive and negative impacts (Table 18). Each impact is listed with its relevant sector, valence (i.e., positive or negative), and nature (i.e., direct or indirect). The following sections provide an impact discussion for each of the listed impacts as well as an impact assessment matrix.

Table 18: Identified project impacts matrix

Sector	Impact	Valence	Nature
Monetary economy	1. Higher income levels due to project employment	Positive	Direct
Monetary economy	2. Higher income levels due to the payment of crop share and land rental	Positive / Negative	Direct
Monetary economy	3. Higher income levels due to increased business activity arising from direct Project business opportunities	Positive	Direct
Monetary economy	4. Increased employment and income levels as a result of landowner company or business group activities	Positive	Direct / Indirect / Cumulative
Monetary economy	5. Increased expenditure on housing, store foods, recreational pursuits	Positive / Negative	Indirect
Monetary economy	6. Discontent due to limited post-construction employment opportunities at power plant	Negative	Direct
Monetary economy	7. Inflation of food prices at markets	Negative	Indirect
Economic infrastructure	8. Improvements to local road networks and service infrastructure	Positive	Direct
Economic infrastructure	9. Increased demand for recreation and entertainment	Negative	Indirect
Economic infrastructure	10. Increased demands on public health and social order service infrastructure	Negative	Indirect
Education and training	11. Increased school enrolment as education costs become less prohibitive	Positive	Indirect
Education and training	12. Increased skills as local workers are trained and employed by the Project	Positive	Indirect
Benefit streams	13. Increased business awareness and financial literacy	Positive	Direct
Benefit streams	14. Increased entrepreneurship and small-scale business activity	Positive	Indirect
Benefit streams	15. Real or perceived business inequities or disadvantages	Negative	Indirect
Community	16. Increased levels of land dispute	Negative	Direct / Cumulative
Community	17. Economic displacement due to restricted land usage discretion and long-term lease periods	Negative	Direct / Cumulative
Community	18. Land shortage due to over commitment to the Project	Negative	Direct / Indirect / Cumulative
Community	19. Increased Project-induced in-migration demands on physical and social infrastructure	Negative	Indirect / Cumulative

Sector	Impact		Valence	Nature
Community	20.	Increased tension and land disputes due to small-scale in-migration	Negative	Indirect
Community	21.	Increased business activity and new skill sets due to small-scale in-migration	Positive	Indirect
Agriculture and land	22.	Potential loss of subsistence resources	Negative	Direct / Cumulative
Agriculture and land	23.	Inter-cropping increases subsistence and cash crop incomes	Positive	Direct / Cumulative
Agriculture and land	24.	Diminished wild game due to loss of grassland and secondary forest	Negative	Direct / Indirect
Agriculture and land	25.	Large-scale inter-cropping could oversupply markets and force prices down	Negative	Indirect
Health EHA 1.1	26.	Capacity and services of local health system	Negative	Indirect
Health EHA 2.1	27.	TB transmission	Negative	Indirect
Health EHA 2.2	28.	ARI and other communicable diseases, including measles	Negative	Indirect
Health EHA 3.1	29.	Malaria transmission	Positive / Negative	Indirect
Health EHA 3.2	30.	Transmission of arboviral diseases	Negative	Indirect
Health EHA 4.1	31.	Transmission of STIs and HIV	Negative	Indirect
Health EHA 5.1	32.	Access to safe drinking water and water related diseases	Negative	Indirect
Health EHA 6.1	33.	Malnutrition and food related diseases	Positive	Indirect
Health EHA 7.1	34.	Non-communicable and life style-related diseases	Negative	Indirect / Cumulative
Health EHA 8.1	35.	Traffic- and operations-related accidents	Negative	Direct
Health EHA 9.1	36.	Exposure to pesticides/fertilizers	Negative	Direct
Health EHA 10.1	37.	Health inequalities	Positive / Negative	Indirect
Health EHA 11.1	38.	Zoonotic diseases	Negative	Indirect
Health EHA 12.1	39.	Shift to traditional medicine and informal health sector	Negative	Indirect
Gender	40.	Lack of gender diversity in (business) representation	Negative	Direct / Cumulative
Gender	41.	Inequitable distribution of land lease and crop share	Negative	Direct / Cumulative
Gender	42.	Increased income levels for women	Positive	Direct
Gender	43.	Increased family disharmony	Negative	Indirect

Sector	Impact		Valence	Nature
Gender	44.	Increased demand for female transactional sex workers	Negative	Indirect
Gender	45.	Increased gender-based violence	Negative	Indirect / Cumulative
Gender	46.	Increased workforce absenteeism due to gender-based violence	Negative	Indirect
Gender	47.	Increased family burdens on younger female adolescents	Negative	Indirect
Gender	48.	Inequitable gender rights to land usage and resources	Negative	Direct
Gender	49.	Inequitable gender impacts of resource loss	Negative	Direct
Gender	50.	Loss of cultural and indigenous knowledge	Negative	Indirect / Cumulative
Gender	51.	Increased family pressures lead to higher school drop-out rates	Negative	Indirect / Cumulative
Gender	52.	Absence of gender-sensitive stakeholder engagement	Negative	Direct
Human rights	53.	Increased safety and security concerns	Negative	Direct
Human rights	54.	Increased social pressure on women to take up employment	Negative	Indirect
Human rights	55.	Increased domestic disputes leading to GBV and FSV	Negative	Indirect
Human rights	56.	Disregard of socially vulnerable persons' rights and opportunities	Negative	Direct / Cumulative
Human rights	57.	Misunderstanding of employment rights and obligations	Negative	Direct
Human rights	58.	Limited stakeholder consultation with women and vulnerable social groups	Negative	Direct
Cultural heritage	59.	Disturbance to spirit sites	Negative	Direct / Indirect
Cultural heritage	60.	Disturbance to former settlement sites	Negative	Direct
Cultural heritage	61.	Disturbance to burial/cemetery sites	Negative	Direct
Cultural heritage	62.	Disturbance to skull house sites	Negative	Direct
Cultural heritage	63.	Disturbance to historic sites	Negative	Direct
Cultural heritage	64.	Disturbance to archaeological sites	Negative	Direct
Ecosystem services	65.	Loss of subsistence, income, and recreational resources due to conversion of grasslands and secondary forest areas	Negative	Direct / Cumulative
Ecosystem services	66.	Decreased ecosystem provisioning of gardens and crop cultivation	Negative	Indirect
Ecosystem	67.	Decreased ecosystem provisioning of wild game and animal products and reduced	Negative	Indirect

Sector	Impact	Valence	Nature
services	cultural services		
Ecosystem services	68. Decreased ecosystem provisioning of wild foods	Negative	Indirect
Ecosystem services	69. Decreased ecosystem provisioning of building materials, fibres and resins	Negative	Indirect
Ecosystem services	70. Decreased ecosystem provisioning of natural medicine resources	Negative	Indirect
Ecosystem services	71. Decreased ecosystem provisioning of biomass fuel	Negative	Indirect
Ecosystem services	72. Decreased ecosystem provisioning of livestock grazing land	Negative	Indirect

6.3. Impact mitigation and enhancement

Table 19 outlines the identified impacts of the Project, the associated risks, and the proposed mitigation (for negative impacts) and enhancement (for positive impacts) strategies and factors. Identified impacts which warrant similar response strategies are collated within the same 'impact category'.

This social impact assessment guides the development of the Project's Environmental and Social Management System (ESMS) that, along with the individual management plans, sets out the Project's commitments and details the mitigation and management measures it will implement to address the identified impacts.

Table 19: Mitigation and enhancement strategies and factors

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Monetary economy	1. Higher income levels due to project employment 2. Higher income levels due to the payment of crop share and land rental 3. Higher income levels due to increased business activity arising from direct project business opportunities 4. Increased employment and income levels as a result of landowner company or business group activities	• Lack of financial literacy can result in unwise spending patterns and lost opportunities for investment • Assisting with business advice and investment can promote enhanced value of incomes • Replacement expenditure dissipates any savings potential	• Encouraging workers to open bank accounts and paying wages into bank accounts to help promote a 'savings' culture. • Assisting with financial literacy workshops for employees that includes household budgets, investments, business, organising liaison with banking institutions. • Ensuring business entity is resourced and can access business development expertise. • Making payments to individual households rather than larger representative landowner bodies, clans or sub-clan groups where there is a chance of funds mismanagement by signatories to the bank accounts. • Consider co-opting NGO agency to implement adult education programs.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Monetary economy	6. Discontent due to limited employment opportunities at power plant post-construction	• Recruitment and employment have to be transparent and equitable	• Adopting recruitment strategies that ensure local people are given employment preference. • Identifying and actively promoting jobs for local women. • Providing pre-work and on-the-job training programs for local people interested in employment, particularly in trades areas that have local application post-construction with the Project or elsewhere. • The Project and its contractors adopting a buy-local procurement policy, particularly during the construction phase. • Giving preference to the landowner company and other local businesses when tendering work during all phases of the project; this could include provisions in major contracts stipulating that certain inputs such as unskilled labour and light vehicles be sourced from locally owned enterprises. • Providing support and training for the landowner company, its directors and management and preferably close involvement in the incorporation, share subscription and wording of the company constitution. Organising appropriate training for the directors regarding management of major landowner companies in the Project area to ensure awareness of their roles, responsibilities and penalties for non-compliance with statutory company requirements (including training on the preparation of tender documents, financial management, accounting, financial reporting, personnel management, etc.). • Close stewardship of major local contractor companies by the Project to ensure proper commercial practice, governance and compliance with their constitutions, pertinent legislation and terms of their contracts with the Project and construction contractors, including provisions in contracts requiring the representative local landowner business entity to provide regular financial reports and evidence of compliance with statutory requirements. • Ensuring that communities are aware of the provisions of their representative landowner company constitution with particular regard to shareholder eligibility, election of directors, dividend policy and frequency of board and other meetings. • Coordination with local authorities and other government entities that may be involved in associated social infrastructure construction during the operations phase, to ensure that wherever possible local landowner companies are involved in this work. • Project consideration of establishment of a landowner skills database to assist in ensuring that local employment is maximised during construction and also utilised later during the operations phase. • Identifying other business opportunities, including those not necessarily related to the project, for the landowner company and/or other local business people to undertake.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Monetary economy	5. Increased expenditure on housing, store foods, recreational pursuits 7. Inflation of food prices at markets	• Potential health and diet impacts • Lack of any savings regimes • Wasteful expenditure patterns • Harmful food choices • Price inflation of market goods	• Providing education workshops and assistance regarding wages, income and expenditure. • Providing health information to employees (e.g., posters and other awareness materials in prominent locations and which could also be used in village schools and health facilities). • Providing adult education in local villages to encourage a healthy lifestyle and healthy foods (including continued consumption of greens, fruit and other subsistence products). • Providing support for the promotion of health and healthy lifestyle education in local schools, including support of nurseries and similar in local school agriculture curricula.
Economic infrastructure	8. Improvements to local road networks and service infrastructure 9. Increased demand for recreation and entertainment 10. Increased demands on public health and social order service infrastructure		• No mitigation required.
Education and training	11. Increase school enrolment as education costs become less prohibitive 12. Increased skills as local workers are trained and employed by the Project		• No mitigation required.
Benefits streams	13. Increased business awareness and financial literacy 14. Increased entrepreneurship and small-scale business activity		• The Project could institute the provision of village-level awareness training or workshops by appropriate civil society groups or NGOs on financial literacy, thrift, savings and sustainable livelihoods to try and change current attitudes.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Benefits streams	15. Real or perceived business inequities or disadvantages	• Non-representative • No involvement of women • Uncontrolled boards of directors • Lack of proper financial controls • No audits • Undermined by *wantok* system which means loss of equitable opportunity to jobs	• Equity in directorships. • Assistance by NGO or others with business experience to steward, mentor and manage. • Gaining community consensus on the ownership structure of a local business entity, preferably one with the broadest possible representation by local project area clans. • Ensuring that a properly worded constitution is adopted to guide company operations, e.g., shareholding structure/eligibility, directors nomination and tenure, directors fees, dividend policy or formula, regularity of company meetings and similar. • Ensuring proper company incorporation and registration with various Government agencies for group tax, VAT and similar. • Facilitating some basic directors training on roles and responsibilities. • Ensuring robust auditing and due diligence safeguards are instituted.
Community	16. Increased levels of land dispute	• Heightened tensions as land given a new cash/economic value by the Project • Expectation to corporately share income benefits will exacerbate efforts to include or exclude people • Resentment against people who are third generation settlers 'acting like landowners' • Increased and induced litigation and/or disputes about land title that will continue to and follow closure as original lessors may likely have died.	• Ensure FPIC processes robustly instituted. • Ensure independent third-party legal witnessing of all agreements. • Ensure resettlement implementation team in place. • Ensure ICP is iterative and record of these engagements is accurate. • Involve Government agencies at inception. • Ensure Lessor agency/Business Entity well supported in its negotiations with participating landowners. • Avoid two-stage lease arrangements and obtain outright security at inception. • Maintain dialogue with the community using VLOs.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Community	17. Economic displacement due to restricted land usage discretion and long-term lease periods	• Prolonged lease arrangement to provide security of tenure to project may provoke intergenerational conflict or resort of litigation • Loss of opportunity to 'change mind' may lead to disputes with/within lessor agency resulting in restricted access, prolonged litigation, security risks, and loss of biomass supply	• Ensure FPIC processes robustly instituted. • Ensure independent third-party legal witnessing of all agreements. • Ensure resettlement implementation team in place. • Ensure ICP is iterative and record of these engagements is accurate. • Involve Government agencies at inception. • Ensure Lessor agency/Business Entity well supported in its negotiations with participating landowners. • Avoid two-stage lease arrangements and obtain outright security at inception. • Maintain dialogue with the community using VLOs.
Community	18. Land shortage due to over commitment to the Project	• Uncontrolled volunteering of land may lead to instances of land shortage – both type and quantity – if unmonitored.	• Ensure robust Land Use Policy & Program are in place which define maximum land areas and types which can be leased as a ratio of total land holdings of each leaseholder • Resettlement Policy Framework needs to be in place and reflect formula for land lease. • Resettlement implementation team (RIT) required to undertake leaseholder acreage and usage assessments to ensure no land shortages occur. • Leasing entity needs to ensure adequate alternative garden land available to landowners who sacrifice garden/commercial crop land for plantations. • Leasing entity needs to keep electronic records of all lands program data and audits should occur on monitoring exercises by external diligence agency with knowledge of PNG agriculture, land, land use and subsistence gardening. • All Project personnel and stakeholders involved in plantations need to be educated about 'land types' that can be used and which cannot be used, and this needs to be in community engagement materials disseminated in English, *tok ples* and *tok pisin*.
Community	19. Increased Project-induced in-migration demands on physical and social infrastructure		• No mitigation required.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Community	20. Increased tension and land disputes due to small-scale in-migration	• Possible disputes from claimant non-resident landowners on land title and indirectly income from rental and crop share • Bride price inflation as Wampar women become attractive to outsiders	• Ensure landowner populace is well-informed about PNG law on land titles. • Ensure affected communities are educated about dispute resolution through courts and alternative dispute resolution processes - recourse to Lands Dispute Settlement Act, Lands Title Commission or Local lands Court can proceed. • Engage independent third-party legal advocate to assist people on land law matters.
Community	21. Increased business activity and new skill sets due to small-scale in-migration	• New business start-ups from entrepreneurs likely • Roadside trade stores increasing • Some increased market participation by landowners and outsiders from other provinces	• No mitigation required.
Agriculture and land	22. Potential loss of subsistence resources	• Loss of food gardens • Loss of potential land • Loss of crop income • Shortage of land/land types • Intergenerational or intra-clan disputes • Loss of woody grassland and secondary regrowth areas • Loss of access to close resource abundant areas	• Ensure robust Land Use Policy & Program are in place which defines maximum land areas and types which can be leased as a ratio of total land holdings of each leaseholder. • Resettlement Policy Framework needs to be in place and reflect formula for land lease. • Resettlement implementation team (RIT) required to undertake leaseholder acreage and usage assessments to ensure no land shortages occur. • Leasing entity needs to ensure adequate alternative garden land available to landowners who sacrifice garden/commercial crop land for plantations. • Leasing entity needs to keep electronic records of all lands program data and audits should occur on monitoring exercises by external diligence agency with knowledge of PNG agriculture, land, land use and subsistence gardening. • All project personnel and stakeholders involved in plantations need to be educated about 'land types' that can be used and which cannot be used, and this needs to be in community engagement materials disseminated in English, *tok ples* and *tok pisin*

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Agriculture and land	23. Inter-cropping increases subsistence and cash crop incomes	• MOU lessors will enjoy opportunity but others may miss out	• Ensure robust Land Use Policy & Program are in place which allows for equitable access to inter-cropping opportunities. • Resettlement Policy Framework needs to be in place and reflect formula for land lease. • Resettlement implementation team (RIT) required to undertake leaseholder acreage and usage assessments to ensure no land shortages occur. • All project personnel and stakeholders involved in plantations need to be educated about 'land types' that can be used and which cannot be used, and this needs to be in Community Engagement materials disseminated in English, *tok ples* and *tok pisin*.
Agriculture and land	24. Diminished wild game due to loss of grassland and secondary forest	• Loss of game (pigs, birds, bandicoot) from changed land use • Loss of recreational enjoyment • Loss of cultural knowledge about hunting because contexts for transmission altered and/or diminished • Potential dietary impacts	• Ensure robust Land Use Policy & Program are in place which defines maximum land areas and types which can be leased as a ratio of total land holdings of each leaseholder. • Monitor community perceptions after 6-12 months concerning hunting frequency and abundance/shortage of game by project environment officers
Agriculture and land	25. Large-scale inter-cropping could oversupply markets and force prices down	• Oversupply of crops in markets leads to waste • Prices crash from unmet demand and over supply • Dampened enthusiasm for inter-cropping	• Smallholders need access to timely information about the volume, type and scheduling of any proposed large-scale local plantings to help them make more informed decisions and medium-term plans. • Ongoing technical advice and support are also required about the most appropriate crops, agricultural technologies and practices for the area, the operation of regional and national markets (including trends), diversification strategies, downstream processing options and product differentiation.
Health **EHA 1**	26. Capacity and services of local health system		• The capacity and quality of health care services is relatively stable. Wampar Health Centre is well staffed, managed and accessible. The major tertiary referral hospital in Lae (Angau) is easily accessible. • Local and emergency transport and referral to Wampar HC and Lae is available. • Construction plans include self-contained Project medical services and emergency planning and transport independent of community services.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Health **EHA 2**	27. TB transmission 28. ARI and other communicable diseases, including measles	• The prevalence of TB is likely high in the PSA • Traditional housing, high occupancy levels, poverty and nutrition play a role in community susceptibility to diseases such as Acute Respiratory Infections (ARIs) and TB • PIIMs overcrowding in camp living quarters can increase transmission risk of communicable diseases	• The Project will have only minimal/modest PIIMs for the construction of the power plant. • Overall camp footprint (including on site living quarters) during the active construction phase will be small and across different locations.
Health **EHA 3**	29. Malaria transmission 30. Transmission of arboviral diseases	• Malaria is present in the PSA • The Project may influence malaria dynamics through changes to the environment and short-term swings in local populations potentially linked to construction of the power plant • Construction activity increases the number of potential breeding sites	• Ecological change, i.e., conversion of grassland to forest plantation, may have an uncertain potential impact on local mosquito biology – which may be neutral or positive. • 'Domesticated' mosquitoes, particularly those associated with dengue transmission often breed in and around campsites where there is new 'habitat' such as jars, barrels, discarded tires, etc. An increased mosquito population will alter the risk of arboviral infection (e.g., dengue) and other vector-related diseases.
Health **EHA 4**	31. Transmission of STIs and HIV	• STIs are prevalent in the PSA • PIIMs during construction increases risk of STI import	• Small workforce across different locations. • HIV rates are extremely low and appear to be stable based on Wampar HC data. • A small, closed camp significantly reduces the likelihood of spreading (imported) STIs. • PIIMs is likely to be small/minimal.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Health **EHA 5**	32. Access to safe drinking water and water related diseases	• Large eucalyptus plantations can potentially impact local ground and surface water availability	• Localized effects only to plantation area. • Sanitation services in the PSA are stable and unlikely to be affected by the Project. • Any work camps will be self-contained in terms of water/sanitation. • The drinking water situation in the PSA appears to be stable. • PACs are relatively distant from formal plantations, so local ground and surface water impact is likely minimal.
Health **EHA 6**	33. Malnutrition and food related diseases	• Loss of cropland, if significant, could impact household and community level food security	• Long-term changes to local gardening practices are not expected. • Food security may improve with greater employment opportunities and a number of other economic variables associated with the Project.
Health **EHA 7**	34. Non-communicable and life style-related diseases		• With improved economic status, a potential change in diet/nutritional practices/behaviours can occur. • Number of households affected is small.
Health **EHA 8**	35. Traffic- and operations-related accidents		• Relatively few trips/vehicles relative to existing Highlands Highway baseline. • With the development of the Project there will be a modest/minimal change in the overall level of traffic relative to the current baseline. • Port of Lae impacts are inconsequential.
Health **EHA 9**	36. Exposure to pesticides/fertilizers	• Use of pesticides as part of the plantation development • Long-term exposure to pesticides/fertilizers to workers	• Provide worksite control and worker education. • Project driven community exposure to hazardous materials is restricted to only potential (indirect) exposure to pesticides/fertilizers.
Health **EHA 10**	37. Health inequalities	• Change in social-determinants (positive and/or negative) may not be equally distributed across the communities in the PSA, which may result in potential health inequalities	• Various social-determinants (e.g., employment and income) will be modestly impacted by the development. • Number of households affected is small.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Health **EHA 11**	38. Zoonotic diseases	• The burden of zoonotic diseases is unknown in the PSA • Uncertain if significant changes to mammal population will occur	• The environmental/ecologic change from grassland to forest could change the mix and movement of small mammals.
Health **EHA 12**	39. Shift to traditional medicine and informal health sector	• Change in cultural health practices	• Cultural health practices within the PSA are not expected to be impacted.
Gender	40. Lack of gender diversity in (business) representation 41. Inequitable distribution of land lease and crop share benefits 42. Increased income levels for women	• Lack of representation of women (plus female elders, youth, children and persons with a disability) on landowner groups, business entities, and forums for discussions relating to land lease-leaseback arrangements; business organisation and investment strategies • Inequitable distribution of land lease and crop share benefits to women, elders, youth, children and persons with a disability • Inequitable distribution of benefits to landless outsiders and children of inter-ethnic, transcultural marriages	• Ensure women's rights and those of members of socially vulnerable groups are enshrined in all relevant company plans, policies and meetings. • Ensure robust Gender Impact Management Plan is in place that: ○ identifies mechanisms for operationalising PNG national conventions and laws relating to the human rights of women and members of socially vulnerable groups; ○ confirms an equitable quota of female representation on all Lancos, ILGs and Landowner Groups and in discussions relating to land, land use, compensation streams and crop share payments. • Ensure robust Land Use Policy & Program are in place which recognise and register the use/ownership rights of women and members of socially vulnerable groups to land and water resources. • Ensure Resettlement Policy Framework reflects women's and members' of socially vulnerable groups' interests and needs. • Ensure community affairs (CA) and resettlement implementation team (RIT) are trained in: ○ gender sensitivity and the human rights of members of socially vulnerable groups; ○ competence to engage in gender-sensitive information sharing and capacity building among a range of stakeholders and rights-holders including women, men, village and community leaders, local bureaucracy and company personnel. • Monitor perceptions of female members of local communities, and members of socially vulnerable groups, after 6-12 months and ongoing throughout life of project to assess emerging and ongoing issues.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Gender	43. Increased family disharmony 44. Increased demand for female transactional sex workers 45. Increased gender-based violence 46. Increased workforce absenteeism due to gender-based violence	• Cashed up males marrying more wives • Women and girls driven into transactional sex work in order to meet their need for cash • Higher incomes by women in cash cropping and wage labour enterprises with refusals to share with men. • Cashed up males increased resort to drugs, sex workers and alcohol • GBV may pose a problem for employer, and work relationships with other co-workers	• Ensure GBV impacts are managed where associated with or relevant to the Project and that labour laws are in place work with managers trained in gender issues. • Consider providing a counselling capacity for workplace victims of GBV and/or access to support via relevant communications technology such as an accessible 24/7 telephone hotline. • Provide elementary income and business development and financial planning advice/workshops for employees to better manage wages. • Workplace induction should address GBV impacts and FSV issues via an appropriately-trained Gender Officer so that co-workers are aware of problems and there is a reporting mechanism and care-giver attitude.
Gender	47. Increased family burdens on younger female adolescents	• Increased burdens due to income/wage-earning absentee parents	• Appropriately-trained Business Development Officer or Gender Officer/gender relations representative to be made available for consultation.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Gender	48. Inequitable gender rights to land usage and resources 49. Inequitable gender impacts of resource loss	• Disregard of women's / girls' use rights to land through the exclusion of women's representation in consultation and meetings about land, and cash compensation payments made to all-male landowner groups • Loss of land resources of importance to women, resulting in women's loss of access to and use of productive ecosystems; and loss of potential income collection of forest resources, firewood etc. Increased strain on subsistence and anxiety levels amongst women	• Ensure women's rights and those of members of socially vulnerable groups are enshrined in all relevant company plans, policies and meetings. • Ensure robust Gender Impact Management Plan is in place that: ○ identifies mechanisms for operationalising PNG national conventions and laws relating to the human rights of women and members of socially vulnerable groups; ○ confirms an equitable quota of female representation on all Lancos, ILGs and Landowner Groups and in discussions relating to land, land use, compensation streams and crop share payments. • Ensure robust Land Use Policy & Program are in place which recognise and register the use rights of women and members of socially vulnerable groups to land and water resources. • Ensure Resettlement Policy Framework reflects women's and members' of socially vulnerable groups' interests and needs. • Ensure community affairs (CA) and resettlement implementation team (RIT) are trained in: ○ gender sensitivity and the human rights of members of socially vulnerable groups; ○ competence to engage in gender-sensitive information sharing and capacity building among a range of stakeholders and rights-holders including women, men, village and community leaders, local bureaucracy and company personnel.
Gender	50. Loss of cultural and indigenous knowledge 51. Increased family pressures lead to higher school drop-out rates	• Loss of elder women's knowledge of land and lore if grassy woodland areas and hunting wild game diminishes. Change in contexts for transmission of cultural knowledge will impact indigenous knowledge sustainability • Increased pressure on female adolescents to work at home or marry leads to higher drop-out rates at school	• Incorporate awareness of the issue in income and investment workshops to employees.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors

Gender	52. Absence of gender-sensitive stakeholder engagement	• No gender-sensitive initial engagement and on-going consultation with women and other socially vulnerable groups; information flow only through men	• Ensure FPIC process incorporates concerns of women.
			• Ensure stakeholder and consultation programmes reach women and women's groups.
			• Ensure project has an appropriately-trained Gender Officer on the community affairs (CA) staff.
			• Ensure community affairs (CA) and resettlement implementation team (RIT) are trained in:
			  ○ gender sensitivity and the human rights of members of socially vulnerable groups;
			  ○ competence to engage in gender-sensitive information sharing and capacity building among a range of stakeholders and rights-holders including women, men, village and community leaders, local bureaucracy and company personnel.

Human rights	53. Increased safety and security concerns	• Increased risk of safety and security concerns for women, girls and children outside village, walking along Highlands Highway and proposed road route(s). • Potential for increased male-on-male tension due to conflict over land and income streams. • Potential threat to the safety and security of children due to in-migration to the area of outside males seeking employment or in-marriage.	• Ensure safe travel for workers where perceived risks occur.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Human rights	54. Increased social pressure on women to take up employment	• Women exposed to male-to-male pressure to take up employment and income earning opportunities increases pressures on women to become wage-earners. • Increased burden on young adolescents to fill-in for absentee mothers.	• Offer awareness training.
Human rights	55. Increased domestic disputes leading to GBV and FSV	• Increased domestic disputes about income distribution and land in combination with increased use of drugs and alcohol can lead to increases in Gender-Based Violence (GBV) and Family and Sexual Violence (FSV)	• Workplace workshops on income and investment strategies to include education about family income streams and decision-making. • Gender Officer to be installed in Project and Business entity employer. • Include GBV awareness in inductions for all workers.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Human rights	56. Disregard of socially vulnerable persons' rights and opportunities	• Access to opportunities for receipt of financial compensation and business funding may not be well understood by some women • Lack of recognition of women and socially vulnerable persons before the law could lead to deprivation of liberty, and failure to realise potential and opportunities. • Lack of gender-sensitivity amongst contractors and security personnel. • Women's potential for employment could be curtailed by local male politics or ignorance of their civil and constitutional rights • Cultural blueprints for marginalization of female participation persist.	• Instigate legal advocate program for PAPs on PNG law and rights. • Project Gender Officer to engage with these agencies on a regular basis for situation monitoring and discussions of problems and issues. • Ensure socially vulnerable are reached by ICP programs. • Ensure Resettlement program captures socially vulnerable and undertakes awareness of property rights under PNG and International law. • Ensure FPIC and ICP programs are robust. • Proactive attempts to draw socially vulnerable into project. • Monitor contractor and security personnel behaviour towards socially vulnerable persons.
Human rights	57. Misunderstanding of employment rights and obligations	• Failure to educate workers in all aspects of employment conditions, engagement, rights, redress options and laws can lead to 'misconceptions and understandings'.	• Offer education/training for workers in all aspects of employment conditions, engagement, rights, redress options and laws.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Human rights	58. Limited stakeholder consultation with women and vulnerable social groups	• Limited consultation with women and vulnerable social groups, in a language that they understand, relating to all aspects of the project. • Inadequate reporting of EA/SIA findings to women, and other PAPs. • Lack of gender-sensitivity amongst government personnel to recognise and manage the disadvantages of women and socially vulnerable persons. • Abuse of FPIC processes and inadequate ICP. • Socially vulnerable at risk of having their vote, voice or wishes overridden by others or elites if not properly consulted. • Minorities who have located to Wampar territory may not be offered the opportunities that are available to them as community members.	• Ensure FPIC and ICP programs are robust. • Proactive attempts to draw socially vulnerable into Project. • Ensure Gender Officer liaises with outside agencies. • Ensure Business entity set up with female representation and voting rights, and share-holding opportunities. • Instigate legal advocate program for PAPs on PNG law and rights.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Cultural heritage	59. Disturbance to spirit sites 60. Disturbance to former settlement sites 61. Disturbance to burial/cemetery sites 62. Disturbance to skull house sites 63. Disturbance to historic sites 64. Disturbance to archaeological sites		• Establish specific clan landowner protocols for activities that have spatial proximity to known spirit sites. • Establish and maintain appropriate buffer zones around known cultural heritage sites. • Develop a Cultural Heritage Management Plan (CHMP) including a cultural heritage induction programme for Project staff/contractors. • Develop a Chance Finds Protocol (CFP) (as part of the CHMP) to mitigate against the disturbance and discovery of archaeological sites in surface and subsurface sediments during Project construction and operational activities.
Ecosystem services	65. Loss of subsistence, income, and recreational resources due to conversion of grasslands and secondary forest areas	• Loss of foraging land and forest resources impact women • Loss of gardens or potential garden land for poorer framers • Decrease in populations of hunting prey diminishes recreational enjoyment and contribution of game to income, diet and subsistence • Potential for land disputes both intergenerational and intra-clan	• Ensure robust Land Use Policy & Program are in place which defines maximum land areas and types which can be leased as a ratio of total land holdings of each leaseholder. • Resettlement Policy Framework needs to be in place and reflect formula for land lease. • Resettlement implementation team (RIT) required to undertake leaseholder acreage and usage assessments to ensure no land shortages occur. • Leasing entity needs to ensure adequate alternative garden land available to landowners who sacrifice garden/commercial crop land for plantations. • Leasing entity needs to keep electronic records of all lands program data and audits should occur on monitoring exercises by external diligence agency with knowledge of PNG agriculture, land, land use and subsistence gardening. • All Project personnel and stakeholders involved in plantations need to be educated about ‘land types’ that can be used and which cannot be used, and this needs to be in community engagement materials disseminated in English, *tok ples* and *tok pisin*.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Ecosystem services (also see Agriculture: impact 22. Potential loss of subsistence resources)	66. Decreased ecosystem provisioning of gardens and crop cultivation	• Loss of food gardens • Loss of potential land • Loss of crop income • Shortage of land/land types • Inter-generational and intra-clan disputes	• Ensure robust Land Use Policy & Program are in place which define maximum land areas and types which can be leased as a ratio of total land holdings of each leaseholder. • Resettlement Policy Framework needs to be in place and reflect formula for land lease. • Resettlement implementation team (RIT) required to undertake leaseholder acreage and usage assessments to ensure no land shortages occur. • Leasing entity needs to ensure adequate alternative garden land available to landowners who sacrifice garden/commercial crop land for plantations. • Leasing entity needs to keep electronic records of all lands program data and audits should occur on monitoring exercises by external diligence agency with knowledge of PNG agriculture, land, land use and subsistence gardening. • All Project personnel and stakeholders involved in plantations need to be educated about 'land types' that can be used and which cannot be used, and this needs to be in community engagement materials disseminated in English, *tok ples* and *tok pisin*.
Ecosystem services	67. Decreased ecosystem provisioning of wild game and animal products and reduced cultural services	• Loss of game (pigs, birds, bandicoot) from changed land use • Loss of recreational enjoyment • Loss of cultural knowledge about hunting because contexts for transmission altered and/or diminished	• Ensure robust Land Use Policy & Program are in place which define maximum land areas and types which can be leased as a ratio of total land holdings of each leaseholder. • Monitor community perceptions after 6-12 months concerning hunting frequency and abundance/shortage of game by Project environment officers.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Ecosystem services	68. Decreased ecosystem provisioning of wild foods	• Loss of woody grassland and secondary regrowth areas • Loss of foraging resources	• Ensure robust Land Use Policy & Program are in place which define maximum land areas and types which can be leased as a ratio of total land holdings of each leaseholder. • Resettlement Policy Framework needs to be in place and reflect formula for land lease. • Resettlement implementation team (RIT) required to undertake leaseholder acreage and usage assessments to ensure no land shortages occur. • All project personnel and stakeholders involved in plantations need to be educated about 'land types' that can be used and which cannot be used, and this needs to be in community engagement materials disseminated in English, tok ples and tok pisin.
Ecosystem services	69. Decreased ecosystem provisioning of building materials, fibres and resins	• Loss of woody grassland and secondary regrowth areas • Loss of access to close resource abundant areas	• Ensure robust Land Use Policy & Program are in place which define maximum land areas and types which can be leased as a ratio of total land holdings of each leaseholder. • All Project personnel and stakeholders involved in plantations need to be educated about 'land types' that can be used and which cannot be used, and this needs to be in community engagement materials disseminated in English, tok ples and tok pisin.
Ecosystem services	70. Decreased ecosystem provisioning of natural medicine resources	• Loss of woody grassland and secondary regrowth areas • Loss of access to close resource abundant areas	• Ensure robust Land Use Policy & Program are in place which define maximum land areas and types which can be leased as a ratio of total land holdings of each leaseholder. • All project personnel and stakeholders involved in plantations need to be educated about 'land types' that can be used and which cannot be used, and this needs to be in community engagement materials disseminated in English, tok ples and tok pisin.
Ecosystem services	71. Decreased ecosystem provisioning of biomass fuel	• Loss of woody grassland and secondary regrowth areas • Loss of access to close resource abundant areas	• Ensure robust Land Use Policy & Program are in place which define maximum land areas and types which can be leased as a ratio of total land holdings of each leaseholder. • All Project personnel and stakeholders involved in plantations need to be educated about 'land types' that can be used and which cannot be used, and this needs to be in community engagement materials disseminated in English, tok ples and tok pisin.

Sector	Impacts	Risks	Mitigation and enhancement strategies and factors
Ecosystem services	72. Decreased ecosystem provisioning of livestock grazing land		• Provide opportunities and guidelines for grazing on plantations.

6.4. Residual impacts

In the residual impacts matrix (Table 20), the 'impact assessment' columns display the identified valence, magnitude and likelihood of every impact prior to the implementation of Project-specific mitigation strategies and management measures. The 'residual impact' columns show the anticipated effect of mitigation strategies and management measures on the valence, magnitude and likelihood of every impact.

For instance, for impacts identified during the assessment to have a positive valence, the application of mitigation strategies and management measures will maintain or increase the levels of magnitude and/or likelihood of the expected positive impacts. On the contrary, for impacts identified during the assessment to have a negative valence, the application or mitigation strategies and management measures will aim to decrease the levels of magnitude and/or likelihood of the expected negative impacts.

Table 20: Residual impacts after mitigation and/or management

RESIDUAL IMPACTS MATRIX		Impact assessment			Residual impact		
Sector	Impact	Valence	Magnitude	Likelihood	Valence	Magnitude	Likelihood
Monetary economy	1. Higher income levels due to project employment	Positive	Medium	Confident	Positive	High	Confident
Monetary economy	2. Higher income levels due to the payment of crop share and land rental benefits	Positive / Negative	Medium	Confident	Positive	High	Confident
Monetary economy	3. Higher income levels due to increased business activity arising from direct Project business opportunities	Positive	Medium	Probable	Positive	High	Probable
Monetary economy	4. Increased employment and income levels as a result of landowner company or business group activities	Positive	Medium	Probable	Positive	High	Probable
Monetary economy	5. Increased expenditure on housing, store foods, recreational pursuits	Positive / Negative	Low	Confident	Positive	Low	Confident
Monetary	6. Discontent due to limited post-	Negative	Medium	Probable	Negative	Low	Probable

RESIDUAL IMPACTS MATRIX		Impact assessment			Residual impact		
Sector	Impact	Valence	Magnitude	Likelihood	Valence	Magnitude	Likelihood
economy	construction employment opportunities at power plant						
Monetary economy	7. Inflation of food prices at markets	Negative	Low	Confident	Negative	Low	Confident
Economic infrastructure	8. Improvements to local road networks and service infrastructure	Positive	Low	Probable	Positive	Low	Probable
Economic infrastructure	9. Increased demand for recreation and entertainment	Negative	Low	Uncertain	Negative	Low	Probable
Economic infrastructure	10. Increased demands on public health and social order service infrastructure	Negative	Low	Uncertain	Negative	Low	Probable
Education and training	11. Increased school enrolment as education costs become less prohibitive	Positive	Low	Probable	Positive	Low	Probable
Education and training	12. Increased skills as local workers are trained and employed by the Project	Positive	Low	Uncertain	Positive	Low	Confident
Benefit streams	13. Increased business awareness and financial literacy	Positive	Low	Probable	Positive	Low	Confident
Benefit streams	14. Increased entrepreneurship and small-scale business activity	Positive	Medium	Probable	Positive	Medium	Confident
Benefit streams	15. Real or perceived business inequities or disadvantages	Negative	Low	Uncertain	Negative	Low	Uncertain
Community	16. Increased levels of land dispute	Negative	Medium	Confident	Negative	Low	Confident

RESIDUAL IMPACTS MATRIX		Impact assessment			Residual impact		
Sector	Impact	Valence	Magnitude	Likelihood	Valence	Magnitude	Likelihood
Community	17. Economic displacement due to restricted land usage discretion and long-term lease periods	Negative	High	Uncertain	Negative	Low	Uncertain
Community	18. Land shortage due to over commitment to the Project	Negative	Low	Uncertain	Negative	Low	Uncertain
Community	19. Increased Project-induced in-migration demands on infrastructure	Negative	Low	Uncertain	Negative	Low	Uncertain
Community	20. Increased tension and land disputes due to small-scale in-migration	Negative	Low	Confident	Negative	Low	Uncertain
Community	21. Increased business activity and new skill sets due to small-scale in-migration	Positive	Low	Confident	Positive	Low	Confident
Agriculture and land	22. Potential loss of subsistence resources	Negative	Low	Uncertain	Negative	Low	Uncertain
Agriculture and land	23. Inter-cropping increases subsistence and cash crop incomes	Positive	Medium	Probable	Positive	Low	Confident
Agriculture and land	24. Diminished wild game due to loss of grassland and secondary forest	Negative	Low	Probable	Negative	Low	Probable
Agriculture and land	25. Large-scale inter-cropping could oversupply markets and force prices down	Negative	Medium	Uncertain	Negative	Low	Confident
Gender	40. Lack of gender diversity in (business) representation	Negative	High	Probable	Negative	Low	Low

RESIDUAL IMPACTS MATRIX		Impact assessment			Residual impact		
Sector	Impact	Valence	Magnitude	Likelihood	Valence	Magnitude	Likelihood
Gender	41. Inequitable distribution of land lease and crop share	Negative	High	Probable	Negative	Low	Low
Gender	42. Increased income levels for women	Positive	Medium	Confident	Positive	Medium	Confident
Gender	43. Increased family disharmony	Negative	Low	Uncertain	Negative	Low	Low
Gender	44. Increased demand for female transactional sex workers	Negative	Medium	Probable	Negative	Low	Low
Gender	45. Increased gender-based violence	Negative	Medium	Probable	Negative	Low	Low
Gender	46. Increased workforce absenteeism due to gender-based violence	Negative	Low	Uncertain	Negative	Low	Low
Gender	47. Increased family burdens on younger female adolescents	Negative	Medium	Probable	Negative	Low	Low
Gender	48. Inequitable gender rights to land usage and resources	Negative	Medium	Probable	Negative	Low	Low
Gender	49. Inequitable gender impacts of resource loss	Negative	Medium	Probable	Negative	Low	Low
Gender	50. Loss of cultural and indigenous knowledge	Negative	Low	Probable	Negative	Low	Low
Gender	51. Increased family pressures lead to higher school drop-out rates	Negative	Medium	Probable	Negative	Low	Low
Gender	52. Absence of gender-sensitive stakeholder engagement	Negative	Medium	Probable	Negative	Low	Low

RESIDUAL IMPACTS MATRIX		Impact assessment			Residual impact		
Sector	Impact	Valence	Magnitude	Likelihood	Valence	Magnitude	Likelihood
Human rights	53. Increased safety and security concerns	Negative	Medium	Confident	Negative	Low	Confident
Human rights	54. Increased social pressure on women to take up employment	Negative	Low	Uncertain	Negative	Low	Uncertain
Human rights	55. Increased domestic disputes leading to GBV and FSV	Negative	Medium	Probable	Negative	Medium	Probable
Human rights	56. Disregard of socially vulnerable persons' rights and opportunities	Negative	Medium	Probable	Negative	Low	Probable
Human rights	57. Misunderstanding of employment rights and obligations	Negative	Low	Uncertain	Negative	Low	Uncertain
Human rights	58. Limited stakeholder consultation with women and vulnerable social groups	Negative	Low	Uncertain	Negative	Low	Uncertain
Cultural heritage	59. Disturbance to spirit sites	Negative	High	Uncertain	Negative	Minimal	Low
Cultural heritage	60. Disturbance to former settlement sites	Negative	High	Rare	Negative	Minimal	Rare
Cultural heritage	61. Disturbance to burial/cemetery sites	Negative	High	Rare	Negative	Minimal	Rare
Cultural heritage	62. Disturbance to skull house sites	Negative	High	Rare	Negative	Minimal	Rare
Cultural heritage	63. Disturbance to historic sites	Negative	High	Rare	Negative	Minimal	Rare

RESIDUAL IMPACTS MATRIX		Impact assessment			Residual impact		
Sector	Impact	Valence	Magnitude	Likelihood	Valence	Magnitude	Likelihood
Cultural heritage	64. Disturbance to archaeological sites	Negative	High	Probable	Negative	Minimal	Low
Ecosystem services	65. Loss of subsistence, income, and recreational resources due to conversion of grasslands and secondary forest areas	Negative	Low	Probable	Negative	Low	Probable
Ecosystem services	66. Decreased ecosystem provisioning of gardens and crop cultivation	Negative	High	Probable	Negative	Low	Probable
Ecosystem services	67. Decreased ecosystem provisioning of wild game and animal products and reduced cultural services	Negative	Low	Probable	Negative	Low	Probable
Ecosystem services	68. Decreased ecosystem provisioning of wild foods	Negative	Low	Probable	Negative	Low	Confident
Ecosystem services	69. Decreased ecosystem provisioning of building materials, fibres and resins	Negative	Low	Confident	Negative	Low	Confident
Ecosystem services	70. Decreased ecosystem provisioning of natural medicine resources	Negative	Low	Confident	Negative	Low	Confident
Ecosystem services	71. Decreased ecosystem provisioning of biomass fuel	Negative	Medium	Confident	Negative	Low	Confident
Ecosystem services	72. Decreased ecosystem provisioning of livestock grazing land	Negative	Low	Uncertain	Negative	Low	Uncertain

RESIDUAL IMPACTS MATRIX		Impact assessment			Residual impact		
Sector	Impact	Consequence	Probability	Risk rating	Consequence	Probability	Risk rating
Health EHA 1.1	26. Capacity and services of local health system	I – Critical	E	2	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 2.1	27. TB transmission	I – Critical	D	2	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 2.2	28. ARI and other communicable diseases, including measles	III – Moderate	B	2	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 3.1	29. Malaria transmission	I – Critical	D	2	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 3.2	30. Transmission of arboviral diseases	I – Critical	C	1	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 4.1	31. Transmission of HIV/AIDS	I – Critical	C	1	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 5.1	32. Access to safe drinking water and water related diseases	I – Critical	D	2	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 6.1	33. Malnutrition and food related diseases	I – Critical II – High	D	2	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 7.1	34. Non-communicable and life style-related diseases	I – Critical	D	2	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 8.1	35. Traffic- and operations-related accidents	I – Critical	B	1	The overall likelihood of significant, observable		

RESIDUAL IMPACTS MATRIX		Impact assessment			Residual impact		
Sector	Impact	Consequence	Probability	Risk rating	Consequence	Probability	Risk rating
					health impacts is considered to be low.		
Health EHA 9.1	36. Exposure to pesticides/fertilizers	I – Critical	C	1	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 10.1	37. Health inequalities	I – Critical	C	1	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 11.1	38. Zoonotic diseases	I – Critical	C	1	The overall likelihood of significant, observable health impacts is considered to be low.		
Health EHA 12.1	39. Shift to traditional medicine and informal health sector	IV – Low	E	3	The overall likelihood of significant, observable health impacts is considered to be low.		

7. Social Management Plans

7.1. Livelihood restoration plan

The Livelihood Restoration Plan will establish the entitlements of affected persons and/or communities and will ensure that these are provided in a transparent, consistent, and equitable manner. The mitigation of economic displacement will be considered complete when affected persons or communities have received compensation and other assistance according to the requirements of the Livelihood Restoration Plan under Performance Standard 5 and are deemed to have been provided with adequate opportunity to re-establish their livelihoods.

The Project's Livelihood Restoration Plan will address the full range of impacts to livelihoods as a result of Project land acquisition or restrictions to land use and identify the affected persons and provide a detailed plan for compensation and livelihood restoration. In accordance with Guidance Note 56, the Plan will at a minimum provide the following information: (i) an introduction to the Project; (ii) summary of Project impacts; (iii) summary of the social baseline; (iv) regulatory framework; (v) results of stakeholder engagement; (vi) eligibility criteria; (vii) entitlement matrix; (viii) timeframe for implementation; (ix) organizational capacity; (x) monitoring, evaluation, and reporting; and (xi) budget and resources.

For persons whose livelihoods are natural resource-based and where Project-related restrictions on access to physical and/or economic resources results in displacement from the land-related transactions (as envisaged in PS5(5)) implementation of measures will be made to either allow continued access to affected resources or provide access to alternative resources with equivalent livelihood-earning potential and accessibility.

In accordance with GN62, and where possible, the Project will allow local communities to exercise pre-existing access or usage rights to Project-controlled land. The exercise of such rights, however, is subject to reasonable measures by MVB to maintain a safe and healthy working environment for workers under Performance Standard 2, safeguards for community health, safety and security under Performance Standard 4, and reasonable operating requirements.

7.2. Stakeholder engagement plan

The requirements for the Stakeholder Engagement Plan (SEP) are defined in Performance Standard 1. The intent of the Project's SEP is to describe the stakeholder environment; regulatory requirements applicable to the Project; the types of, methods for, and schedule for information disclosure and engagement that the Project will employ (including special considerations required under PS 7 Indigenous peoples, as required); and the organisational structure of, and resources for undertaking, information dissemination and engagement.

The Project's existing SEP will be updated to ensure it includes the following elements:

- Regulatory (PNG government), lender (IFC/EP), FSC, proponent, and any other requirements for consultation and disclosure.
- Identification and prioritisation of key stakeholder groups.
- Information and engagement activities that have occurred to date and their results and responses.
- Information dissemination to, and engagement with, stakeholder groups that has already taken place and the outcomes of engagement.

- Strategy (types of engagement, frequency, methods suitable to characteristics of group members, etc.) and timetable for sharing information and consulting with each of these groups.
- Organisational structure, resources (staffing), and responsibilities for implementing stakeholder engagement activities and how stakeholder engagement activities will be incorporated into the Project's management system.

7.3. Community development plan

The Community Development Plan incorporates aims to promote livelihood and enterprise development that will enable both affected and host communities to derive development benefits from the Project. These programs are aimed at promoting sustainable economic growth, environmental protection, education, skills building and the health and welfare of the Project's Affected Communities.

7.4. Land acquisition plan

The Land Acquisition Plan (LAP) aims to ensure that all communities affected by land acquisition for the Project are compensated for their land and assets, which will enable them to attain a standard of living similar to and, if possible, better than the existing one. The LAP has been developed to prevent and mitigate the negative impacts of land acquisition and displacement and to set out the entitlements of the different categories of affected communities.

7.5. Community Grievance mechanism

A Community Grievance Mechanism (CGM) to address affected communities' concerns and complaints is an important pillar of the stakeholder engagement process, since it creates opportunities for companies and communities to identify problems and discover solutions together. The Project's CGM therefore aims to prevent, defuse and resolve community complaints and disputes. Its main objectives include:

- Establishing a prompt and consistent mechanism for receiving, investigating and responding to complaints or grievances from local community and other stakeholders.
- Ensuring proper documentation of complaints or grievances and any corrective actions are taken.
- Contributing towards continuous improvement in performance through the analysis of trends and lessons learned.

7.6. Cultural heritage management plan

The Cultural Heritage Management Plan (CHMP) outlines the procedures that will be implemented to ensure that cultural resources are identified, impacts are mitigated and resources are preserved. The specific objectives include the following:

- Ensuring that statutory and legal requirements are observed and met.
- Describe mitigation measures to be implemented during all phases of the Project.
- Utilise the listing of all potential cultural heritage or archaeological assets identified through archaeological and anthropological heritage surveys to establish areas where special management procedures are required.
- Outline a Chance Finds Protocol to manage the discovery of Chance Finds during the construction phase.

- Establish an appropriate Cultural Heritage Training Program for Project management and staff.
- Define the roles and responsibilities for implementing the above management and mitigation measures.
- Manage and minimize the disturbance to environments that are of cultural or archaeological significance.
- Preserve cultural or archaeological assets for future generations.

7.7. Labour and working conditions management plan

The Labour and Working Conditions Management Plan describes the requirements and expectations in terms of compliance, reporting, roles, supervision and training with respect to labour and working conditions, including camp accommodation.

The objectives of this Plan are to:

- Promote fair and equitable labour practices for the fair treatment, non-discrimination and equal opportunity of workers.
- Establish, manage and promote a healthy management-worker relationship.
- Protect workers' rights including those of migrant and third party workers.
- Promote healthy, safe, secure and comfortable accommodation that does not impact negatively on the communities in the surrounding area.

7.8. In-migration management plan

The In-Migration Management Plan (IMMP) will provide a clear set of actions and responsibilities for the control of impacts linked to PIIM within the Project's area of influence. The objectives of the IMMP are to:

- Monitor the scale of PIIM into the Project Area and specific in-migration 'hotspots'.
- Avoid unplanned and unmanaged in-migration into the PSA.
- Mitigate and manage any negative impacts and enhance and promote any positive impact related to PIIM.

7.9. Community health, safety and security plan

The purpose of the Community Health, Safety and Security Plan (CHSSMP) is to provide a clear set of actions and responsibilities for the control of impacts affecting the health and safety of the communities within the PSA.

The objectives of the CHSSMP are to:

- Continuously identify, evaluate and prioritise the risks and impacts of Project activities on the health, safety and security of local communities;
- Proactively prevent and avoid impacts to community health safety and security, and enhance any positive impacts related to community health, safety and security;

- Identify strategies that provide adequate health related information and prevention measures through which communities can manage their own health and safety in an optimum manner; and
- Implement security that protects Project employees, assets and business continuity in a manner that adheres to PNG legislation, and is consistent with the Voluntary Principles on Security and Human Rights.

8. Benefits

8.1. Project benefit streams

This section of the report contains an estimate of the benefits of the Project and the allocation of these benefits, based on production, price and other forecasts. Understanding the quantum and allocation of benefits is crucial to predicting potential socio-economic impacts.

8.1.1. National Government benefits

Company tax income

The Project will pay company tax as well as salary and wages tax to the National Government. With regard to company tax it has been projected that operations will not be profitable and hence not liable for company tax for the first several years of operation. Company tax is expected to be payable from approximately 2026 onward,

The Project is projected to pay over PGK740 million in company tax based on its anticipated lifespan.

Affordable and sustainable energy

At a macro level the Project will produce electricity, initially 15MW and later an additional 15MW, into the 132kV Ramu Grid at a price that is immune from any variation in the world price of fossil fuels. This is of substantial long-term benefit to the power production and reticulation planning of the State agency, PNG Power, which still relies to a large extent on electricity generation by heavy fuel oil, diesel and gas-fired power stations.

The Project will be consistent with additional key State policy objectives, including the National Climate Change Compatible Development Management Policy. It will provide material economic, social and sustainability benefits for local communities particularly in the Markham Valley, creating approximately 500 ongoing direct jobs in power plant and plantation operations, and a greater multiple of this nationally.

The Project demonstrates strong support of, and compliance with, PNG Government Policy for creating rural employment, increasing rural prosperity and improving the agricultural sector. The Project also strongly supports three of the seven pillars set out in the PNG Vision 2050:

- Environmental Sustainability and Climate Change.
- Human Capital Development, Gender, Youth and People Empowerment.
- Wealth Creation.

The Project will make a significant contribution to generating capacity to assist the PNG Government's electrification goal of increasing its electricity consumer base to 70 per cent by 2030. The Project should also secure verified carbon credits related to afforestation and fossil fuel displacement of over five million tonnes of carbon dioxide over the Project life.

Apart from replacement of imported diesel with local renewable energy sources, the Project’s investments in plantations and a power station in this rural area provide significant local employment. There will be a major flow-on effect from employment and economic impacts of construction; the Project will use lower valued or under-utilized land for commercial enterprise, transferring best

practice international plantation forestry skills to a local rural setting as well as an increase in government taxation payments.

The Project will not generate any direct financial benefits to the provincial, district or local-level governments. However, it will be a catalyst for significant increases in local market garden vegetable production and possibly other local business development.

8.1.2. Provincial and Local-Level Government benefits

There are no direct provincial or LLG revenue entitlements derived from the Project development. However, any other income that these levels of government might receive, combined with possible tax credit projects, could be dove-tailed with other development plans of the LLG to result in integrated infrastructure and other development in their areas.

8.1.3. Landowner benefits

Financial income streams

The economic benefits of the Project's various income streams, almost all accrue to affected landowners. The benefits to landowners of the power plant site are relatively straightforward, peaking during construction and then plateauing during operations; including land damage compensation and land rentals, along with employment and local business development opportunities.

Assessing the income streams for landowners of prospective plantation land is somewhat more complex and the formula that will be applied to calculate the actual financial payments by the Project to participating landowners is not yet finalised. During FEED, MVBL will discuss with affected plantation area landowners a formula for the payment of benefits, principally comprising land rental and crop share components. Crop share would be paid on the basis of the volume of cubic metres of timber cut or bone dry tonnes of power plant feed stock (approximately 2.5 cubic metres = 1 bone dry tonne).

The Project is considering a number of different options with regard to the formula for landowner benefit payments, some of which include some landowner equity participation in the plantation vehicle in addition to land rental and crop share payments. The option currently being negotiated with landowners is land rental PGK90 per hectare for planted land (with trees) + crop share of AUD$7 per dry tonne of biomass. This 'Rental + Crop share' model provides landowners cash flow and benefits from the start.

In addition to these rental and crop share benefits from biomass plantation operations, and regardless of the formula or option established with plantation landowners, Project affected landowners will also benefit significantly from employment, local business opportunities and their own use of plantation land for inter-cropping with market garden vegetables or grazing cattle as discussed in previous chapters.

While exact predictions of landowner benefits are not possible at present, the following sections describe in more detail the various income streams: land damage compensation, land rental, crop share, and (possibly) equity dividends.

Land damage compensation

Land damage compensation is a one-off compensation for damage to land and economic agricultural assets (i.e., trees and gardens) as a result of plant construction activities and erection of temporary and more permanent Project facilities. The rates paid are based on rates published by the PNG

Valuer-General's Office[15] whilst payment for the extraction of gravel from any quarries developed is based on Department of Works' rates schedules. At present, quarry rates paid are 70 toea per cubic metre of extracted material. Payments are made directly to representatives of those clans or sub-clans identified as owning particular parcels of land, after assessment by the Project Lands Officers.

Land rental

Land rentals are payments for the use of land on a longer-term operations phase basis; they are paid directly to representatives of those clans, sub-clans or lessor groups identified as owning particular parcels of land, whose use they have been deprived of because of the presence of permanent Project facilities.

The quantum of initial land damage compensation payments along with subsequent land rental payments for the power plant site area of 15–25 hectares will not be considerable, but since the land for the plant will be inaccessible to landowners for a longer time a commensurately higher annual land rental rate may be negotiated for the power plant site.

From the time of the clearing of land for planting, landowners will receive an annual land rental payment of PGK100–200 per hectare, the exact rate depending on the formula negotiated with landowners during FEED, which will be a combination of land rental and crop share. At a rate of PGK100 per hectare this would involve the payment of PGK1.5 million annually to landowners once the project was actively managing the 16,000 hectares required to service two 15MW power stations.

Crop share

Crop share payments are a proportion of the crop harvest paid to the land owner as compensation for exploitation of the rented land. Crop share payments are harvest-based and measured in green metric tonnes (GMT) – which are the net weight of cut-down trees without bark (crop share payments will also apply to any sale of bark). Harvested trees are weighted on a truck over a weigh bridge. For every green metric tonne of trees, landowners will be paid at the end of rotation.

Employment

The main phase of Project construction is the erection of the first unit in the power plant and the preparation of the various identified land blocks for tree planting. Preliminary expressions of interest have been tendered to construction contractors in Lae and Port Moresby for the power plant construction.

Preliminary estimates indicate that the power plant construction will employ about 400 people (Table 21) whilst the plantation establishment would require engagement of another 593 people. Wage payments to these almost 1,000 staff during the construction phase has been estimated to total PGK37 million.

It is likely that many of the plant construction workers will be tradesmen and most will be national. In the absence of a skills survey it is difficult to assess how many of these workers would come from the immediate PSA. However, the majority of national horticultural labour and semi-skilled personnel required during the plantation establishment will be recruited from the local project area.

[15] If the project adheres to IFC protocols then payments made are at full replacement values (ie market value) which may vary from PNG Valuer General rates of compensation. Which calculus will be used is unknown at this juncture.

Table 21: Estimated Peak Workforce in Construction (Economics Consulting Services 2012)

Employee category	Plantation #	Power plant #
Expatriate	11	71
PNG managerial / high skill	40	5
PNG clerical / support	67	15
PNG skilled - trade	25	164
PNG skilled - horticultural	25	-
PNG local semi-skilled	425	145
Total	**593**	**400**

During the operations phase there will be considerably less employment, an estimated 487 full-time positions, of which about 70 per cent are likely to be people from the Project area or nearby, as detailed in Table 22 below. During operations most recurrent expenditure will relate to the maintenance, development and harvesting of the plantation areas.

The total wages spend for the Project during operations phase has been estimated to be just over PGK9 million per year; given the likely high number of local employees this represents a considerable injection into the local Project area economy throughout the life of the Project.

Apart from the direct receipt of wages by employees, benefits to landowners and income to local businesses during construction and operations phases, this expenditure will have a multiplier or flow-on effect that will benefit the local area, Morobe Province and PNG in general. It has been estimated that the Project establishment phase could generate a total of PGK225 millions of household income throughout the PNG economy. During the operations phase it has been estimated that Project operations will generate a total of PGK132 million per year in household incomes across PNG.

Table 22: Operations Phase Workforce Estimates (Economics Consulting Services 2012)

Category	Plantation	Power plant #
Expatriate	11	5
PNG managerial / high skill	40	7
PNG clerical / support	62	5
PNG skilled - trade	25	8
PNG skilled - horticultural	-	-
PNG local semi-skilled	297	27
Total	**435**	**52**

Whilst the above employment numbers and projected wages spend on the estimated national construction workforce are available, it is difficult to predict more exactly what proportion of these construction positions could be filled by Project area landowners. It is likely that only unskilled labourers and semi-skilled positions will be filled by people from the immediate PSA. If this is the case, then there are potential flow-on impacts in respect to hosted influx of workers hired by the

proposed business entity to fill other skilled positions. Without a skills survey it is not possible to estimate these numbers, however, even if it were at 25 per cent (i.e., approximately 100 persons) this would not overwhelm existing support systems.

Landowners will be aware that in other resource developments their landowner counterparts received training and/or employment as labourers, drivers, security guards and a range of other semi-skilled, trades, professional and managerial positions. These precedents could drive local aspirations for similar opportunities and this will have to be actively addressed by the Project.

Landowner business opportunities

One of the most significant community inputs and by implication impacts, of resource development projects carried out to date in PNG has been the award of various service and other contract activities to representative local landowner companies. These businesses are a visible demonstration of landowners involvement in project development, mitigating potential perceptions of being 'observers in their own land', whilst also showing that they are capable of undertaking contract work in a manner consistent with Western business practice, generating a profit and distributing dividends to their village-level shareholders.

The precedents established by resource developments to date, including the PNG LNG Project construction activities, are that many activities, particularly those carried out during the construction phase, can be carried out by established landowner companies on a stand-alone basis or in joint venture with other parties.

Activities typically include catering, camp management and maintenance, civil construction and road maintenance, plant and light vehicle hire, casual and technical labour supply, road transport and security services. Landowners will be well aware of such precedents and may expect to be involved in spin-off business opportunities that result from the construction and operation of the Project.

Elsewhere in Morobe Province, supply expenditure by MMJV in 2016 within the province was US$50.6 million on goods and services. Contracts were awarded by MMJV to local landowner companies for catering, fuel haulage, general freight, plant hire, security, labour hire, cleaning, rehabilitation and bus services. In line with Hidden Valley's current memorandum of agreement, MMJV continues to offer business development opportunities to landowners. These opportunities will increase with the proposed development of the Wafi-Golpu project.

Biomass construction opportunities

Any estimation of the possible quantum of the gross contract value of construction contracts that are likely to be awarded to local landowner companies is difficult without fully understanding construction costs for various infrastructure, which will not be available until FEED is complete. Equally, one would require an understanding of any discretionary expenditure proposals the proponent has that might also create opportunities.

Markham Valley Biomass predicts that the Project spend would be approximately PGK57 million on plantation establishment and PGK33 million on power plant construction and it would not be unreasonable to assume that local landowner company contracts could constitute a significant percentage of these total costs.

Based on a breakdown of costs provided to independent economic consultants it has been estimated that 20 per cent of the capital expenditure for the Project will be spent with local businesses, that is companies operating in Morobe Province, as detailed in the following Table 23.

Table 23: Local Business Involvement Construction Phase (source: ECS, 2012)

Category (Capital costs)	Local business involvement (by value)
FEED	15%
Land acquisition	100%
Land clearing	80%
Land harvest	80%
Land preparation	85%
Grass clearing	85%
Facilities organisation	10%
Plantation roads	70%
Biomass Power Plant	10%
Total (weighted average)	20+%

Local business development is an important benefit since it provides an income stream to all ages, genders and skill levels in the affected communities through payment of dividends to shareholders, employment for a certain number of individuals and sub-contracts to smaller more localised landowner companies, business groups and entrepreneurs.

Biomass operations phase opportunities

These opportunities relate to field activities in the plantation areas, since it is assumed that power plant maintenance, given its critical nature, will be carried out by an in-house specialist technical team. Activities that have been identified as possible for local enterprises to be involved in include:

- Community nurseries.
- Planting
- Herbicide and fertilizer application.
- Land preparation.
- Maintenance of fire breaks and weeding within tree plantations.
- Harvesting.
- Transport and vehicle/plant hire.

As with local employment, the potential for engagement of local companies is much greater during the operations phase, rising to about 64 per cent, as detailed in Table 24 below.

Table 24: Local Business Involvement Operations Phase (source: ECS, 2012)

Category	Output Local %
Plantation wood harvest	100%
Plantation wood haul	100%
Diesel	10%
LO and community benefits (including crop share)	100%
Maintenance	100%
G and A	50%
Fertiliser	10%
Biomass Power Plant	20%
Total (weighted average)	64%

Existing landowner business entities

There are a number of existing small businesses within the Project area, the largest one being the Zifasing Cattle Company. This entity has been in existence for some time and is still involved in the cattle industry.

Apart from the above mentioned landowner company, there are a number of very small family or individually owned business enterprises in the PSA operating trade stores or stalls, for example at 40 Mile and 41 Mile markets. Despite the collapse of the betel nut industry due to disease these markets have continued to be viable outlets.

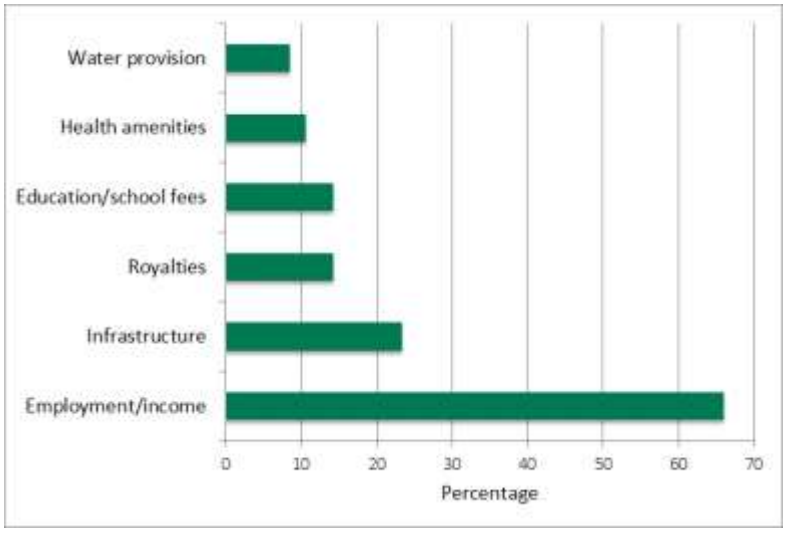
8.2. Perceived project benefits

The perceived project benefits by the community are summarised in

Figure **6** and show that by far the greatest perceived community benefit by Project area households is employment and income earning opportunities. However, improvements (direct or indirect) to other basic necessities, water supply, health and education, are also anticipated.

The answers to Household Survey Question Q:I7 about perceived community benefits were entirely consistent with responses to question Q:I9—perceived personal benefits—with an average 64 per cent across the communities expecting they would obtain employment income, and ranked in order of frequency facilities/services (34 per cent) and crop share (19 per cent).

Figure 6: Responses to Question Q:I7: 'How do you think this community will benefit if the project proceeds?"



8.3. Governance of Biomass Project Benefits

8.3.1. National Government Level

With the exception of the Tax Credit Scheme, managed by Department of National Planning and Monitoring, none of the National Government line agencies are involved in disbursing funds to Project area landowners, since the only revenue accruing to this level of government is company and salary and wages tax.

8.3.2. Provincial and Local Government Level

Although obviously resource operators should not get involved in the business of Government lest they become surrogate agencies, they can play a role in supporting and assisting good governance practices in such institutions in their project-impacted areas.

The Organic Law provides a framework for the operations of a decentralised planning and financial management system from the provincial to the local-level government ward level. In reality, provincial governments and their administrations throughout PNG are able to exercise their complete discretion in how they interpret and apply the Organic Law and the Public Finance Management Act in planning for and disbursing their revenue entitlements.

Under the Organic Law, financial management accountability is centralised under the Department of Finance, but the department does not have the resources to adequately monitor and supervise all the provinces, much less all local-level governments. This impacts the development of programs that aim to build governance and management capacity at the LLG level. Without the existence of functioning LLGs and associated Ward Development Committees (WDCs) with appropriate funding there is no incentive for these tiers of government to address sustainable development in their own constituencies.

In Morobe Province the provincial government, although not ranked by National Economic and Fiscal Commission (NEFC) as one of the better run in the country, is still operational with staff, vehicles and other resources. The Huon Gulf District has a small staff and intends to implement its integrated development plan whilst the Wampar LLG meets regularly and has a small group of field staff. All of these levels of government are therefore present and able, as far as their resources allow, to cooperate with the Project in community development initiatives.

8.3.3. Community and Village Level

The main financial beneficiaries of the Project are landowners and to a certain extent their representative bodies. The Project is likely to have no management of, and very little influence over, income flows to landowners once disbursed to them or their representative bodies, who in general may perceive Project generated income as funds to be used for consumption rather than contributing to personal savings or apply to improving domestic situations. The Project could institute the provision of village-level awareness training or workshops by appropriate civil society groups or NGOs on financial literacy, thrift, savings and sustainable livelihoods to try and change current attitudes.

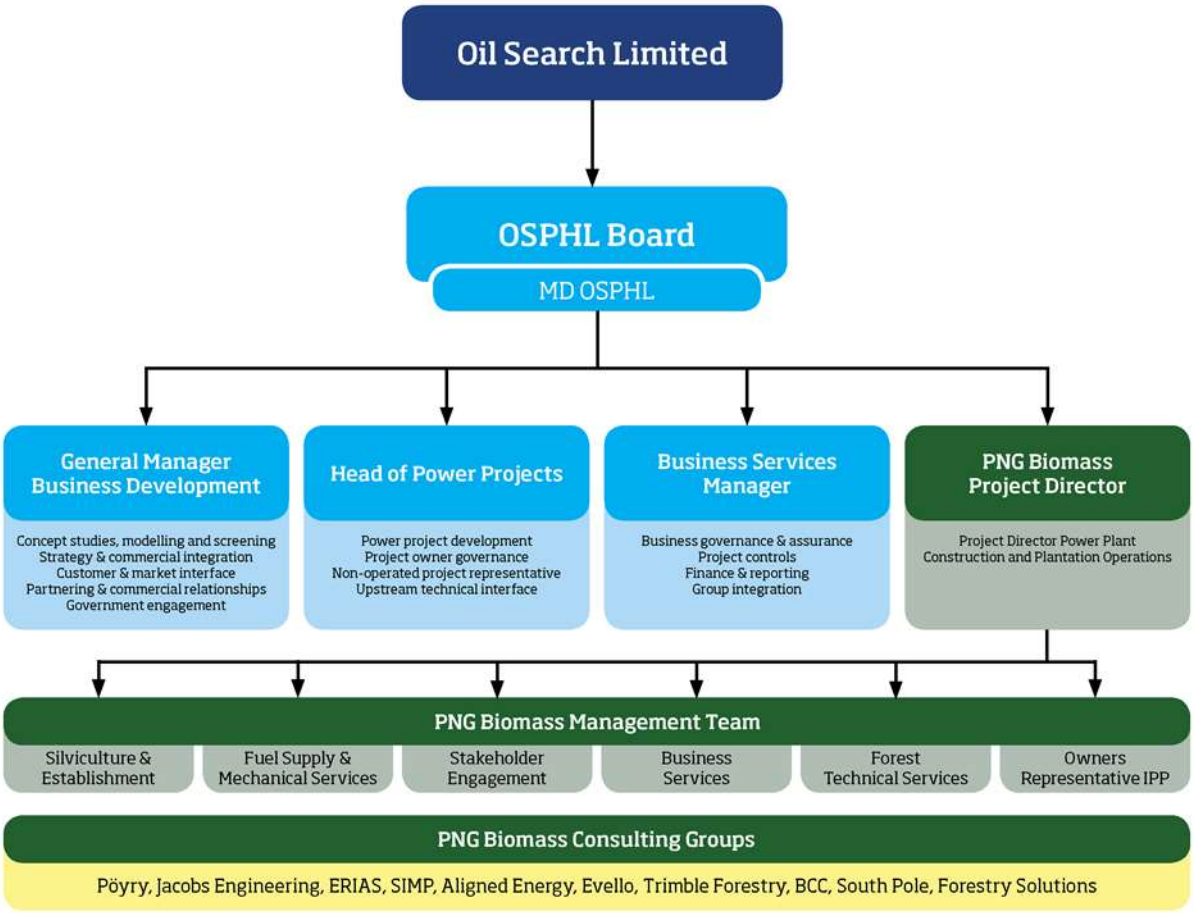
9. Governance

9.1. Project governance and organisation structure

In terms of governance, Oil Search has positioned the Project under its subsidiary Oil Search Power Holdings Limited (OSPHL). As such, the Project reports to the Managing Director of OSPHL and is governed by the OSPHL board (Figure 7).

Organisationally, the Project is managed by a Project Director who oversees a management team in the areas of silviculture and establishment, fuel supply and mechanical services, stakeholder engagement, business services, forest technical services, and owner's representative for the IPP (Power Plant). Furthermore, various expert consulting groups are utilised to provide technical advice.

Figure 7: Project organisational and governance structure



9.2. Community representation

There are a variety of entities that affected Project area landowners could incorporate to collectively represent their interests and manage the benefits arising from the Project.

9.2.1. Business groups

Business groups are incorporated entities established under the *Business Groups Incorporation Act (1974)* which is administered by the Registrar of Business Groups in the Investment Promotion Authority (IPA). Business groups provide a legal mechanism for customary groups to incorporate and pursue economic activities using sound principles in the management of business. Business groups aim to foster easier entry and greater participation by local people in the national economy.

The formal structure of business groups uses simple rules for regulation and control, contains effective dispute settlement mechanisms, and provides basic protection for business group members and persons dealing with those groups. Business Group incorporation requires nomination of a dispute resolution authority and requires only a minimal level of documented detail for statutory annual returns.

The Project encourages clans who have committed land through MOUs to form a business group, which could serve as their representative landownership vehicle for the Project to deal with.

9.2.2. Incorporated land groups

Incorporated Land Groups (ILGs) have been the principal mechanism for distribution of landowner benefits for almost all forestry, oil and gas developments since 1992. ILGs are legal entities incorporated under the *Lands Group Incorporation Act (1974)*, administered by the Registrar of Land Groups in the Department of Lands & Physical Planning and empowered to manage the use of land resources, mirroring traditional landownership clan and sub-clan structures. ILGs are the foremost vehicle in PNG for State recognised impacted landowners to receive statutory benefits, principally crop share and equity dividends.

The intention of the Lands Group Act was that ILGs should regulate their internal affairs and disputes in a manner deemed acceptable by them and in accordance with ‘custom’. Since the adoption of ILGs as the landowner benefits vehicle in the *Oil and Gas Act (1998/2000)* and the *Forestry Act (1991)*, their performance in this role has been less than satisfactory.

The Lands Group Act recognizes the corporate nature of customary groups and allows them to hold, manage and deal with the land in their customary names. Accordingly, a customary group can register with the Register of Incorporated Land Groups and once registered, the rights and liabilities of the customary group become rights and liabilities of the ILG. An Amendment from 2009 – which only became law in 2013 -- has tightened the registration requirements and created a more complex and time consuming set of processes, including the requirement of birth certificates for all members and land boundaries to be certified by a District Administrator.

The *Land Registration (Customary Land) (Amendment) Act 2009* provides a system of registration of those portions of customary land which the customary landowners through their ILG, decide to register to use for economic development activity. Such voluntary customary land registration only follows after an ILG has been incorporated. The Director of Customary Land Registration oversees the registration process and is responsible for receiving and verifying applications for customary land registration to ensure compliance with all requirements under the Land Registration Act.

It is the long-term intention of the Project to have all land utilised for tree plantations under lease-lease back arrangements with ILGs representing clan landowners. This involves the PNG State through the Minister for Lands entering into a lease with the ILG that represents customary landowners, in accordance with Section 11 of the Land Act 1996. The State then grants back to the ILG an Agricultural and Special Purpose Lease in accordance with Section 102 of the Land Act 1996

The maximum term for these leases is 99 years. Once granted these leases form a secure and registrable interest in the land for the specified lease term. An Agricultural and Special Purpose Lease can be used by an ILG or a Business Group as collateral for a mortgage or to enter into a sub-lease with a third party ("Sub-Lease"). As the Sub-Lease is granted by the incorporated entity representing traditional owners that is the holder of a long-term statutory lease from the PNG State, it is considered to be a secure title.

The SIA Household Survey questions in Section J, K and L (see SIA Study) sought to understand membership levels to ILGs, Lancos, and Landowner Associations. Only 9 per cent of households surveyed stated that they were members of an ILG, 80 per cent were not whilst 11 per cent were unsure. This would indicate that the local population has little understanding of how such organisations are formed, what they are or how they operate.

9.2.3. Landowner associations

Landowner Associations (LA) are self-registered organisations, incorporated under the *Associations Incorporation Act 1966*, to collectively represent local landowners who may also have formed themselves into ILGs or Agencies in a resource area.

A Landowner Association is supposedly vested with authority to represent landowners in negotiations that may affect their social and economic welfare. Although they are not formally recognised by, or alluded to in resource legislation, Landowner Associations have established themselves as representatives of the communities/ILGs in petroleum licence areas in the hope that they could participate in negotiating development agreements between landowners and the State. There is no mandatory requirement for a developer or Government agency to deal with Landowner Associations.

In areas where there is not a strong link between beneficiary entities such as ILGs and the supposedly representative organisations, these entities tend to be dominated by particular individuals and act as local political bodies. As such, Landowner Associations have tended to be run by well-educated individuals who write and speak both *tok pisin* and English. To some extent, others in the community who do not have these language skills are willing for these individuals to take a lead role in negotiating agreements on their behalf.

The SIA Household Survey (see SIA Study) indicated that only 6 per cent of households were members of a Landowner Association, 80 per cent were not whilst 14 per cent were uncertain. This would indicate that the local population has little understanding of how such organisations operate.

9.2.4. Clan agents

Clan Agents are clan/sub-clan representatives who receive benefits on behalf of, and subsequently distribute these benefits to, their particular constituencies. The 'agency' system is currently used by Oil Search in their gas-to-electricity operations in the Hides licence area of PDL1. Past practice has been that landowner payments have been irregularly made in cash to the nominated clan agents in public ceremonies in the license area communities. This has operated reasonably well since clan

landownership was known, undisputed, and community clan/sub-clan leaders were known and accepted.

9.2.5. Special agricultural business leases

Special Agriculture Business Leases (SABLs) are intended, as their name suggests, to facilitate large-scale agricultural development on customary land that has been leased by the traditional owners to the Government which then sub-leases to the developer. More than 400 SABLs have been issued in PNG in the past. However, serious allegations and protests over the activity in several SABLs led to the establishment of a Commission of Inquiry into SABLs on 21 July 2011. The Commission of Inquiry investigated 25 SABLs in seven provinces and concluded:

- Existing legislation fails to ensure an appropriate level of consultation when considering and issuing an SABL.
- The land investigation process has been technically abused.
- Provincial Lands Officers have generally not been aware of their roles and responsibilities and lack the capacity to fulfil their roles and responsibilities.
- The proposed developers generally completed the land investigations, which compromised the integrity and independence required.
- Customary rights (hunting, fishing, burial and sacred sites) were not preserved.
- Landowner companies failed to consult with their shareholders before entering into contracts with developers.
- The Department of Lands and Physical Planning failed to consider objections raised by landowners and had no mediation process.

9.2.6. Landowner companies

It is common in PNG for local landowners to incorporate representative companies under the *Companies Act (1997)* in order to participate in commercial business opportunities associated with particular development opportunities.

It has been the practice in mining and petroleum resource areas for affected landowners to form representative Landowner Companies (Lancos) which adopt a customised constitution which clearly specifies who is eligible to become a shareholder, directorship, regularity of statutory meetings, and similar provisions. Importantly, the constitution can set in place a share class structure to ensure that all shareholder groups, which could be clans, each get a representative director no matter how large any one shareholder group or class is.

Such incorporated companies are obliged to submit annual returns to IPA and Internal Revenue Commission (IRC) as well as abide by other tax and labour legislation. This level of compliance usually means that within the Landowner Company there is a suitably qualified officer to prepare and submit such returns.

The Project encourages the affected landowner clans to incorporate a Landowner Company with an agreed constitutional shareholding structure. Based on the Household Survey, PSA communities report that only 7.4 per cent is currently a member of a Landowner Company.

9.2.7. Village liaison committee

In the extractive resource industries some companies facilitate the formation of a Village Liaison Committee (VLC) of prominent individuals representing clans impacted by the particular development. In these instances the VLC holds meetings on a monthly basis to discuss matters of mutual interest to the community and can be involved in selecting possible local employees or contractors.

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Appendix

A. Oil Search Limited, Health, Safety, Environment & Security Policy, EMS-POL-000006, 16 February 2017

Oil Search

Health, Safety, Environment & Security Policy

Oil Search is committed to achieving incident free operations through the provision of effective Health, Safety, Environmental and Security (HSES) Management across all of its operations and worksites for the benefit of employees, contractors and the community.

The Company is committed to:

- Promoting HSES objectives, leadership, responsibilities and behaviour as an integral part of the duties of management and all employees;
- Complying with applicable laws and other obligations and requirements that the company subscribes to, and where adequate laws do not exist, adopting and applying standards that reflect Oil Search's commitment to HSES outlined in this policy;
- Reporting and evaluating risks, threats, hazards and impacts to company operations that have the potential to adversely affect the environment or the health and safety of employees, contractors or the community;
- Implementing appropriate control and contingency measures to prevent pollution and minimise and manage these risks, threats, hazards and impacts to an acceptable level;
- Establishing and ensuring that standards are followed and effective practices promoted to ensure that the environment, people, property and information are protected from harm;
- Selecting and engaging contractors whose management systems are acceptable to Oil Search and whose commitment to this policy is clearly and continuously demonstrated;
- Providing competent human resources to manage relevant aspects of health, safety, environment or security;
- Communicating openly with all stakeholders on HSES related issues;
- Providing training, instruction and supervision to personnel to enable them to attain the knowledge and skill levels necessary to perform their work incident free;
- Maintaining appropriate contingency arrangements;
- Continually monitoring, reviewing and improving HSES performance and associated management systems so that our activities can continue without interruption;
- Ensuring that oversight of accident, incident and near miss investigations is assumed by the appropriate executive manager and that those investigations are conducted to a level of detail that is appropriate to the event's actual and potential severity, and;
- Ensuring a consistent and equitable approach to the prevention of HIV among employees, families and their communities; the management of the consequences of HIV including the care and support of employees and their families; and protecting the rights of employees living with HIV from discrimination, victimisation or harassment.

Every employee and contractor working for the Company has a responsibility to promote a culture whereby their actions and those of their colleagues are consistent with this Policy.

Richard Lee
Chairman

Peter Botten
Managing Director

EMS-PRO-000006

Updated: 16 February 2017

B. Oil Search Limited, Social Responsibility Policy, EMS-POL-000009, 11 April 2017

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Oil Search

Social Responsibility Policy

With operations in environmentally, culturally and socially sensitive locations, Oil Search's commitment to social responsibility stems from a culture that strives for high ethical, social and moral values and a desire to be recognised as delivering "excellence in socially responsible oil and gas exploration and production". We set ourselves apart from our peers by our sustainable development approach and our ability to contribute positively and creatively to the growth and development of communities in which we operate.

The Company is committed to:

- Operating with integrity at all times as well as adopting and advocating for principles, practices and standards that respect diversity, local culture, human rights, labour rights, women's protection and empowerment, and the environment, and which contribute towards combatting corruption;
- Generating shared value by ensuring positive, sustainable outcomes for the communities in which we operate, while at the same time ensuring secure and continued operations and being mindful of our responsibility to shareholders and other stakeholders;
- Maintaining and enhancing our social licence to operate through high levels of stakeholder engagement; establishing and maintaining strong and mutually beneficial community relationships; leaving a long-term positive social development legacy; and monitoring the impact of our activities on our project area communities;
- Continuous performance improvement by continuing to grow and leverage our social responsibility capability; seeking ways to enhance our approach; and improving measurement and reporting of performance.
- Seeking ways to manage natural resources responsibly by minimising our environmental impact and operating in an environmentally sustainable way by adoption of the precautionary principle and giving consideration to effective and efficient use and re-use of resources and;
- Upholding the Ten Principles of the UN Global Compact, the Voluntary Principles for Security & Human Rights, and contributing to the progress of the Sustainable Development Goals in its countries of operation.

To achieve this commitment, Oil Search will:

- Ensure governance systems are in place to oversee, monitor, measure, report and drive social responsibility performance and decision making including social responsibility objectives and leadership responsibilities.
- Comply with all social and environmental laws, regulations and obligations and, where these do not exist adopt and apply standards that are in alignment with the intent of this policy and internationally accepted norms of behaviour.
- Proactively identify, evaluate, transparently report and manage any risks, threats or impacts related to our operating context that have the potential to adversely affect the environment, including climate change, the well-being of the local community or our social licence to operate. Appropriate control and contingency measures will be adopted to minimise and manage concerns and opportunities.
- Use our sphere of influence to advocate for the commitments contained in this policy, including but not limited to our supply chain and local content.

Every employee and contractor working for the Company has a responsibility to promote a culture whereby their actions and those of their colleagues are consistent with this Policy.

Richard Lee
Chairman

Peter Botten
Managing Director

EMS-POL-000009 Approved: 11 April 2017