



Chapter 18

Socioeconomic Impact Assessment

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The EIS has been prepared by, for and on behalf of Wafi Mining Limited and Newcrest PNG 2 Limited (together the “**WGJV Participants**”), being the participants in the Wafi-Golpu Joint Venture (“**WGJV**”) and the registered holders of exploration licences EL 440 and EL1105, for the sole purpose of an application (the “**Permit Application**”) by them for environmental approval under the Environment Act 2000 (the “**Act**”) for the proposed construction, operation and (ultimately) closure of an underground copper-gold mine and associated ore processing, concentrate transport and handling, power generation, water and tailings management, and related support facilities and services (the “**Project**”) in Morobe Province, Independent State of Papua New Guinea. The EIS was prepared with input from consultants engaged by the WGJV Participants and/or their related bodies corporate (“**Consultants**”).

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Competent Person's Statement

The information in the EIS that relates to Golpu Ore Reserves is based on information compiled by the Competent Person, Mr Pasqualino Manca, who is a member of The Australasian Institute of Mining and Metallurgy. Mr Pasqualino Manca, is a full-time employee of Newcrest Mining Limited or its relevant subsidiaries, holds options and/or shares in Newcrest Mining Limited and is entitled to participate in Newcrest's executive equity long term incentive plan, details of which are included in Newcrest's 2017 Remuneration Report. Ore Reserve growth is one of the performance measures under recent long term incentive plans. Mr Pasqualino Manca has sufficient experience which is relevant to the styles of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the JORC Code 2012. Mr Pasqualino Manca consents to the inclusion of material of the matters based on his information in the form and context in which it appears.

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Competent Person's Statement

The Wafi-Golpu Joint Venture is an unincorporated joint venture between a wholly-owned subsidiary of Harmony Gold Mining Company Limited and a wholly-owned subsidiary of Newcrest Mining Limited.

The information in the EIS that relates to Golpu Ore Reserves is based on information compiled by the Competent Person, Mr Pasqualino Manca, who is a member of The Australasian Institute of Mining and Metallurgy. Mr Pasqualino Manca, is a full-time employee of Newcrest Mining Limited or its relevant subsidiaries, holds options and/or shares in Newcrest Mining Limited and is entitled to participate in Newcrest's executive equity long term incentive plan, details of which are included in Newcrest's 2017 Remuneration Report. Ore Reserve growth is one of the performance measures under recent long term incentive plans. Mr Pasqualino Manca has sufficient experience which is relevant to the styles of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the JORC Code 2012. Mr Pasqualino Manca consents to the inclusion of material of the matters based on his information in the form and context in which it appears.

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18. SOCIOECONOMIC IMPACT ASSESSMENT

The principal objective of a socioeconomic impact assessment (SEIA) is to provide an assessment of potential socioeconomic impacts (both positive and negative) arising from project activities, and to identify measures to manage such impacts. This chapter documents the SEIA for the Wafi-Golpu Project (the Project). This SEIA identifies and assesses socioeconomic impacts on the basis of the Project description presented in Chapter 6, Project Description, and its interaction with the socioeconomic environment described in Chapter 12, Socioeconomic Environment Characterisation. It also considers the assessment of impacts to the terrestrial, freshwater, nearshore marine and offshore marine biophysical environments described in chapters 14, 15, 16 and 17 respectively, and how these may influence socioeconomic impacts.

In this chapter, the impact assessment method is described, and potential impacts are identified. Section 18.2 contextualises the potential socioeconomic impact of the Project on Morobe Province and the Independent State of Papua New Guinea (PNG) more broadly. Subsequently, a detailed impact assessment is conducted for each of the four study areas described in Chapter 12, Socioeconomic Environment Characterisation (see Figure 12.1):

- Study Area 1: Mine Area, surrounds and access corridors (Section 18.3)
- Study Area 2: Infrastructure Corridor from Zifasing to Lae (Section 18.4)
- Study Area 3: Lae (Section 18.5)
- Study Area 4: Wagang and Yanga villages (Section 18.6)

Taken together, the four study areas encompass the three geographic areas of the Project (Mine Area, Infrastructure Corridor and Coastal Area). The study areas are not limited strictly to these geographic areas, however, as communities outside but in proximity to the Project Area may experience impacts arising from the Project. Separating the assessment across the study areas reflects the different Project activities in each study area and how the nature of impacts and the significance of impacts differs across these areas.

For each study area, an initial assessment of the significance of impacts is conducted. Management measures are subsequently proposed. Management measures are actions to avoid, minimise and/or manage adverse socioeconomic impacts, or, in the case of positive impacts, to assist Project stakeholders to utilise opportunities arising from development of the Project. A residual assessment of potential socioeconomic impacts is then conducted, to indicate the significance of socioeconomic impacts after the application of management measures (referred to as 'residual significance').

Section 18.7 explains how the management measures proposed in this chapter will be implemented through the Wafi-Golpu Project Environmental and Social Management Framework, and in particular the Wafi-Golpu Project Social Management Plan (Attachment 4). Cumulative impacts are addressed in Chapter 22, Cumulative Impact Assessment.

18.1. Approach to Impact Assessment

18.1.1. Objectives

The objectives of the SEIA are to:

- Identify potential socioeconomic impacts (beneficial or adverse) related to the Project and determine their level of significance

- Recommend measures, where possible, to enhance beneficial impacts and effectively avoid or, where avoidance is not possible, minimise and manage adverse impacts

18.1.2. Impact Assessment Process

The steps in the SEIA process are shown in Figure 18.1. Each step is described in this section. Findings from other impact assessment chapters in this EIS (chapters 14 to 17, 19 to 20) have informed this SEIA.

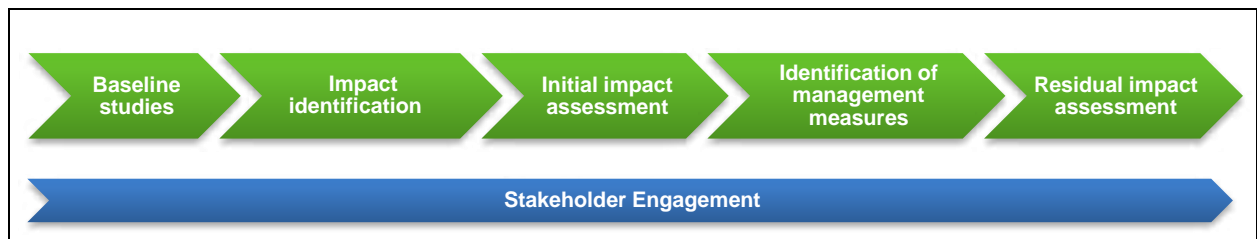


Figure 18.1: SEIA process

18.1.2.1. Baseline studies

Baseline studies were undertaken to collect socioeconomic information that characterises communities potentially affected by the Project. These studies are detailed in Chapter 12, Socioeconomic Environment Characterisation.

The SEIA also utilises the results of the following assessments which were prepared as part of the EIS and are presented as the following EIS appendices:

- A Air Quality and Greenhouse Gas Impact Assessment
- B Noise and Vibration Impact Assessment
- F Groundwater Management and Modelling of Inflows to Golpu Underground Mine
- G Surface Water and Freshwater Aquatic Ecology Characterisation - Mine Area to Markham River
- H Surface Water and Freshwater Aquatic Ecology Characterisation - Yalu to Wagang
- I Catchment and Receiving Water Quality Modelling
- J Density Current, Plume Dispersion and Hydrodynamic Modelling
- N Assessment of Metal Bioaccumulation and Biomagnification from DSTP in the Huon Gulf
- P Deep-slope and Pelagic Fish Characterisation
- Q Zooplankton and Micronekton Characterisation
- R Nearshore Marine Characterisation
- S Fisheries and Marine Resource Use Characterisation
- T Socioeconomic Baseline
- U Cultural Heritage Baseline and Impact Assessment
- W Human Health Risk Assessment
- X Assessment of Closure Conditions and Water Management Options for the Wafi-Golpu Block Cave and Subsidence Zone

18.1.2.2. Impact Identification

Impact identification was undertaken through consideration of the Project Description (see Chapter 6), and an assessment of how Project activities and infrastructure may affect individuals and communities within the study areas. Socioeconomic impacts at provincial and national levels were also considered. Socioeconomic impacts were identified through:

- Analysis of socioeconomic baseline data, and other relevant baseline information including stakeholder feedback
- Consultation with technical experts on the Project design and potential impacts
- Review of the socioeconomic impacts of other mining projects in PNG

Socioeconomic impacts were grouped into the following nine categories:

- Employment, procurement, Project payments and the local economy
- In-migration
- Physical and economic displacement (resettlement)
- Land and water resources (including land- and water-based livelihoods)
- Community health and safety
- Education
- Community cohesion and law and order
- Tradition and culture
- Traffic

These categories were developed and refined iteratively during the course of impact identification. The purpose of categorisation is to provide a structure to the impact assessment. The categories are not intended to be rigid or mutually exclusive – some impacts fall within multiple categories, in which case they are grouped within the most relevant category.

18.1.2.3. Initial Impact Assessment

The initial impact assessment assigns a level of significance to each of the potential socioeconomic impacts identified. This assessment considers the unmitigated significance of impacts – that is, their significance prior to the application of management measures which may reduce or mitigate their effect. The purpose of the assessment is to guide the formulation of management measures by highlighting the most significant impacts. Significance is determined by considering the likelihood of an impact occurring, and the anticipated (most likely) consequence of the impact if it were to occur.

Likelihood (the probability of the impact occurring) is expressed in qualitative terms, as presented in Table 18.1. The five levels of likelihood presented constitute a spectrum of probability from remote to almost certain.

Table 18.1: Levels of likelihood adopted for the assessing significance

Likelihood	Description
Almost certain	The impact commonly occurs in similar circumstances and/or is expected to occur on this Project.
Likely	The impact has occurred in similar circumstances and/or will more likely than not occur on this Project.
Possible	The impact might occur on this Project and/or there have been some instances in similar circumstances.

Likelihood	Description
Unlikely	The impact is not expected but there is a slight possibility that it may occur.
Remote	The impact is rare or practically impossible; it may occur in exceptional circumstances.

Table 18.2 presents five levels of consequence and a description of each. Separate descriptors for adverse and positive impacts are provided, although they mirror each other in structure. The consequences of impacts are described with reference to the degree to which social wellbeing (including health) may be impaired (for adverse impacts), or enhanced (for positive impacts). Social wellbeing is a broad, multi-dimensional term, and encompasses aspects of material wellbeing (e.g., food, housing, income and services), relational wellbeing (e.g., family connections, community cohesion and social institutions), and subjective wellbeing (e.g., self-perceived wellbeing and personal fulfilment) (Coulthard, 2012; see also Aucamp et al., 2011). Within this SEIA, the multiple dimensions of social wellbeing are captured by the categories of socioeconomic impact as listed above in Section 18.1.2.2, Impact Identification.

For each impact, the consequence rating was derived after considering:

- The potential temporal and spatial scale of an impact (i.e., the intensity or severity of the impact and how long the impact will last and the area it will affect)
- The capacity of impacted people to adapt to change and the vulnerability of impacted people to the impact

Table 18.2: Levels of consequence adopted for the assessing significance

Consequence	Description (adverse impacts)	Description (positive impacts)
Extreme	Severe and irremediable impairment of social wellbeing for the majority of one or more communities within the study area. Serious, irremediable and unmanageable health effects including fatalities and serious injury and / or illness.	Extensive and long-term enhancement of social wellbeing for the majority of one or more communities within the study area.
Major	Severe and irremediable impairment of social wellbeing for a substantial subgroup (but not necessarily a majority) within communities of the study area. Serious but manageable cases of injury or illness.	Extensive and long-term enhancement of social wellbeing for a substantial subgroup (but not necessarily a majority) within communities of the study area.
Moderate	Substantial impairment of social wellbeing for an individual or a group of individuals. Moderate and manageable cases of injury or illness.	Substantial enhancement social wellbeing for an individual or group of individuals within the study area.
Minor	Impairment of social wellbeing that will have small effects on individual and community well-being. Minor cases of injury, illness or general deleterious effects on physical or mental wellbeing falling short of identifiable injury or illness.	Enhancement of social wellbeing having a small but appreciable positive effect on individual or community well-being.
Negligible	Little or no impairment of social wellbeing. Negligible effect on physical or mental health.	A small enhancement of social wellbeing for some individuals.

In assigning levels of likelihood and consequence, the assessment draws on available baseline information, experience from other projects in PNG, and the expectations of local stakeholders (as expressed to the WGJV – see Chapter 5, Stakeholder Engagement).

Table 18.3 presents levels of significance as determined by levels of consequence and likelihood (see Vanclay et al., 2015: 49). The significance of both positive and adverse impacts was assessed. Adverse impacts are colour-coded to indicate levels of significance. Positive impacts are shown only in blue shading to distinguish them from adverse impacts, and to recognise that realising a benefit often requires action not only on behalf of the WGJV, but also on behalf of the affected individuals and, in some cases, the relevant Local Level Governments (LLGs), the Morobe Provincial Government and the State of PNG. For this reason, a single blue colour (as opposed to shades of blue) has been used to represent opportunities that may require further work to realise.

Table 18.3: Assessment matrix for determining significance of potential socioeconomic impacts

		Consequence				
		Negligible	Minor	Moderate	Major	Extreme
Likelihood	Level					
	Almost certain					
	Likely					
	Possible					
	Unlikely					
Remote						
Legend (levels of significance)						
Adverse impacts		Low	Moderate	High	Very High	
Positive impacts		Low				

18.1.2.4. Identification of Management Measures

Management measures are proposed to enhance the positive impacts of the Project and to avoid or reduce adverse impacts. The management measures were identified giving consideration to:

- Experience from current practices in the Project Area
- Experience from other mining projects in PNG
- Learnings and outcomes from similar mining projects in other countries
- Input provided and views expressed during consultation activities with study area communities
- Discussions with WGJV personnel

The management measures were developed iteratively between the SEIA and the Wafi-Golpu Environmental and Social Management Framework (see Section 18.7). That is, management measures were derived from earlier iterations of the framework, which in turn was based on earlier SEIAs conducted for the Project. An iterative approach represents an ongoing process of refinement.

Management measures are listed in Section 18.3.3, Management Measures.

18.1.2.5. Residual Impact Assessment

Following the identification of management measures, the impact assessment was re-assessed assuming effective implementation of the proposed management measures to arrive at the residual significance of the impact. Comparing the initial impact assessment with the residual impact assessment indicates the effect of the management measures in reducing adverse impacts and enhancing positive impacts and illustrates the anticipated impact of the Project.

18.2. Socioeconomic Impacts at Provincial and National Levels

The Project, if developed, will be built at an estimated initial capital cost of USD2.8 billion and is likely to expend a total of USD5.4 billion in capital over the life of the mine. For comparison, the Gross Domestic Product of PNG was USD21.2 billion in 2016 (World Bank, 2017).

Overall, the progressive development of the Project means that substantial expenditure is expected over an extended period. The level of procurement spend during construction and operations is expected to make a material positive contribution to Morobe Province, as well as PNG more broadly. This will provide business entities within Morobe Province and PNG with a long-term opportunity to supply goods and services (potentially leading to improved business capacities), and provide long-term employment opportunities for residents from Morobe Province and elsewhere in PNG. It is expected to strengthen the status of Lae as a key service centre for PNG's mining industry.

Further, expenditure occurring in Morobe Province (and PNG more broadly) will represent income for other individuals or entities. Any subsequent income generated from the initial Project benefits is considered an indirect impact (commonly called the multiplier effect).

This section contextualises the impact of the Project as a whole on Morobe Province and PNG. Employment, procurement and direct financial benefits are discussed as key categories of provincial and national socioeconomic impacts.

18.2.1. Employment

Development of the Project will generate employment opportunities. In the construction phase, the estimated workforce will peak at about 1,700 full time equivalent (FTE) workers for the Mine Area, 400 FTE workers for the Infrastructure Corridor, 200 FTE for the Port Facilities Area and 200 FTE workers for the Outfall Area. These estimates include WGJV employees as well as contractors.

The average construction workforce is likely to be 75-85% of the peak workforce. The WGJV has set a target of fulfilling 70% of its average construction workforce with PNG citizens. If this target is met, approximately 950–1,200 PNG citizens will be employed during the construction phase (approximately 6 years, although workforce requirements will fluctuate within that period).

During operations, it is estimated that a workforce of 850 FTE workers will be required, predominantly at the Mine Area, with some required at the Port Facilities Area who will also support operation of the Outfall System which will be inspected regularly by staff based at the Port Facilities Area (the Outfall System operates remotely and so there is no requirement for permanent employees to be situated there). The WGJV has set a target of 85% of the full-time operations workforce roles to be filled by PNG citizens, within five years of the start of operations.

Under State of PNG labour laws, some occupations are reserved for citizens of PNG, and some occupations must be advertised locally before a non-citizen worker may be engaged.

The WGJV will comply, and will require its contractors to comply, with the State of PNG's legal requirements in relation to employment. While PNG citizens will receive priority for all roles (recruitment preferences are discussed below), some senior and specialist roles are expected to be sourced outside of PNG due to availability constraints within PNG.

Roles most likely to be filled by PNG citizens include:

- Human resources, finance, administration, and supply and logistics support roles
- Tradespeople, including fitters, electricians, carpenters, scaffolders, and plumbers
- Trades assistants
- Earthworks equipment operators (surface)
- General labourers
- Safety officers (surface)
- Medical personnel
- Security personnel
- Catering, camp and maintenance
- Environment officers
- Community liaison officers

The WGJV will also apply recruitment preferences, with highest to lowest priority as follows:

- Hengambu, Babuaf and Yanta landowners (i.e., Study Area 1, Tier 1)
- Other communities affected by the Project, as defined by WGJV
- Other PNG citizens from Morobe Province
- PNG citizens from outside Morobe Province but domiciled within PNG
- Expatriates (including PNG citizens) domiciled outside of PNG

Recruitment preferences will support sustainable development of employment skills and capacity within Morobe Province and PNG more broadly.

18.2.2. Procurement

Procurement will generate income-earning opportunities for businesses. The WGJV has set a target to procure 20% of all goods and services required during the construction phase from local businesses (an estimated value of approximately USD500 million). The WGJV defines local business as:

- Any State-owned business
- Any PNG citizen-owned company
- Any business incorporating a domestic firm or localised foreign-owned enterprise that maintains a registered and permanently established operational office in PNG
- Any joint venture formed between a foreign company and a local company where the local company holds a minimum shareholding of 25% in the joint venture company
- Any foreign business or company that contributes value to the PNG economy through the purchase of national goods and services, and pays appropriate taxes in PNG

Where the goods or services offered are competitive in quality and price, and subject to compliance with WGJV's standards for safety and commercial management, the WGJV will give procurement preference to (from highest to lowest preference):

- Businesses based within the Mine Area (Hengambu, Yanta and Babuaf businesses)
- Businesses otherwise based in proximity to the Project Area
- Business based in other parts of Morobe Province, including Lae
- Businesses based elsewhere in PNG

Preference will also be given according to ultimate ownership as follows, from highest to lowest:

- Businesses wholly owned by PNG citizen stakeholders
- Businesses with majority PNG citizen stakeholders but with part foreign ownership
- Businesses with majority foreign ownership but with part-ownership by PNG citizens
- Businesses wholly foreign-owned but located in PNG

Table 18.4 sets out the types of goods and services the Project is likely to require during the construction and operations phase.

Procurement preferences mentioned above will therefore aim to support, as far as practicable, the establishment of local businesses that are sustainable in the longer term and that contribute to the development of a sustainable regional economy.

Table 18.4 Potential opportunities for local businesses

Potential Opportunities	Construction	Operations
Building and construction	Yes	-
Catering	Yes	Yes
Chemical supplies	-	Yes
Cleaning services	Yes	Yes
Earth moving	Yes	Yes
Fencing (including maintenance)	Yes	Yes
Food (bulk) supplies	Yes	Yes
Fuel supplies	Yes	Yes
Gabion making	Yes	-
Gardens/grounds maintenance	Yes	Yes
Grass cutting	Yes	Yes
Labour hire (local)	Yes	Yes
Road maintenance	Yes	Yes
Rubbish removal	Yes	Yes
Sand/aggregate supply	Yes	Yes
Security	Yes	Yes
Steel fabrication	Yes	-

Potential Opportunities	Construction	Operations
Tree felling	Yes	-
Transport (heavy/long distance)	Yes	Yes
Transport (personnel/local)	Yes	Yes
Uniform/work wear manufacture	Yes	Yes
Vegetable/fruit supply	Yes	Yes

18.2.3. Direct Financial Benefits

The Project is expected to generate direct financial benefits, including:

- Royalties (allocation to be agreed between the State of PNG, Morobe Provincial Government and local stakeholders)
- Special support grants allocated by the State of PNG to the provincial government as budget support for infrastructure development
- Company taxes payable by WGJV to the State of PNG

The actual value of direct financial payments will be determined by such factors as production, prices and exchange rates. The distribution of benefits will be agreed by WGJV, landowners and local, provincial and the national governments under the Project Memorandum of Agreement (MOA).

Through the disbursement of such financial benefits, the Project has the potential to indirectly contribute to an increase in the level of support available to infrastructure and services, a significant increase in Provincial Government revenue, and an increase in revenue to impacted LLGs.

18.3. Impact Assessment for Study Area 1 (Mine Area, surrounds and access corridors)

As the proposed mine would be located within this study area, Study Area 1 will experience the bulk of Project activity. This includes clearing and construction at the portal terrace and process plant terrace, development of the block-caving infrastructure, power generation, ore processing and waste rock management.

In addition, several new roads are proposed in this study area:

- Northern Access Road from the Highlands Highway to a location near Bavaga
- Watut Access Road west of the Watut River and infrastructure corridor
- Two community access roads (Watut Services Road and Resettlement Road)

The beginning of the proposed concentrate, fuel and terrestrial tailings pipelines will also be installed within this study area (namely, the segment from the Mine Area to Zifasing).

This section presents the socioeconomic impact assessment for Study Area 1. A summary of the socioeconomic context is provided, followed by initial impact assessment, identification of management measures, and residual impact assessment.

18.3.1. Socioeconomic Context

As described in Chapter 12, Socioeconomic Environment Characterisation, this study area comprises 28 villages, located within and around the Mine Area, along the Demakwa Access Road, and along the proposed Northern Access Road. Villages within this study

area are further divided into two tiers, Tier 1 (those in closest proximity to the Mine Area) and Tier 2 (more distant from the Mine Area, located on the west side of the Lower Watut River or along proposed or existing access routes).

Tier 1 comprises 16 villages inhabited by people of the Hengambu, Yanta and Babuaf cultural groups. These villages have been categorised as Tier 1 within this study area due to their proximity to and ownership of land on which mining and associated activities would be conducted. Tier 1 villages and corresponding cultural groups are:

- Hengambu cultural group: Hekeng, Fly Camp, Bavaga and Gingen
- Yanta cultural group: Venembele, Nambonga, Pekumbe, Pokwaluma, Pokwana and Zilani
- Babuaf cultural group: Madzim, Wori, Wongkins, Kapunung, Papas and Ziriruk

Tier 2 villages are those situated along or near the Demakwa Access Road and proposed Northern Access Road, and those located on the west side of the Lower Watut River (villages located on the east side of the Lower Watut River are within Tier 1). Tier 2 villages include owners of land through which access routes pass, as well as villages in proximity to the Lower Watut River whose residents have the ability to utilise these access routes (the proposed Northern Access Road in particular, which would be located in the section of the Infrastructure Corridor proposed to run north from the Mine Area to the village of Zifasing on the Highlands Highway).

Thirteen villages were identified as Tier 2 villages within Study Area 1:

- Villages along/near the Northern Access Road: Kokok, Chiatz, Ngarubuarung, Chaunon and Mafanazo
- Villages along/near the Demakwa Access Road: Timini, Dengea, Zimake
- Other villages located on the west bank of the Lower Watut River: Uruf, Wampan, Bencheng, Maralina, Goraris

18.3.2. Impact Identification and Initial Impact Assessment

The potential socioeconomic impacts resulting from the Project for this study area, prior to the application of any management measures, are described below. Impacts are grouped by the categories listed in Section 18.1.2.2. For each category, the discussion includes a description of the Project as relevant to that category, followed by impacts identified, and an assessment of their significance. A summary table of impacts appears at the conclusion of the discussion for each category. As noted in Section 18.1.2.2, an impact falling within multiple categories is grouped within the most relevant category. To avoid duplication, such impacts will be recorded in the summary table for their primary category only.

18.3.2.1. Employment, Procurement, Project Payments and the Local Economy

This category focuses on largely economic impacts generated by the Project. Employment and procurement are discussed as subcategories of impact, recognising that employment and procurement impacts are not purely financial, but can encompass a range of other impacts, such as improved capacity to find further employment and engage in the cash economy. Project payments include royalties, benefits involving the disbursement of monies, and compensation. The distinction between these are explained below.

Employment, procurement and Project payments will lead to increased access to cash for recipients and potentially their households and extended families. Potential economic effects of increased availability of cash are also discussed.

18.3.2.1.1. Employment

Employment will provide opportunities not only to increase income, but also to build skills, experience and capabilities for future employment and to provide additional entry points into the cash economy. These benefits may have greater consequences for women who find employment, as far fewer women than men had ever been employed (e.g., in Tier 1, 7.8% of the female population had been employed, compared to 52.2% of men).

The status of being employed is also associated with improved self-esteem, especially for women (Hinton and Earnest, 2010). The loss of employment can bring about a corresponding diminution in self-esteem (Kanaparo, 2010, in the context of the Porgera Gold Mine).

The WGJV intends to maximise job opportunities where practicable for communities directly impacted by the Project. Highest recruitment preference for jobs at the Mine Area will be granted to the Hengambu, Babuaf and Yanta landowners (i.e., Tier 1 villages within this study area), subject to candidates being appropriately qualified for the role. Further detail on recruitment preferences is provided in Section 18.2.1, Employment (Provincial and National Levels).

Within Study Area 1, employment opportunities are more likely to flow to residents of Tier 1 villages compared to Tier 2, because of the WGJV's recruitment preferences. Moreover, individuals from Tier 1 villages tend to have greater employment experience than those from Tier 2 villages. According to socioeconomic surveys in 2014 and 2015, 24.4% of the Tier 1 population above 15 years of age had been employed previously, compared to 7.4% of the analogous Tier 2 population.

The number of persons employed from Tier 1 and Tier 2 villages can be estimated based on population demographics. In 2017, Tier 1 villages had a collective population of approximately 3,869 persons, of whom 58% were between 15 and 65 years of age – about 2,300 persons. Similarly, Tier 2 villages had about 6,067 persons in 2017, of whom approximately 3,500 were between 15 and 65 years of age. While not all persons seeking employment would seek employment with the Project (some may be unavailable due to existing employment, or otherwise unavailable or unwilling), it appears that the available labour force from this study area would be much larger than the Project workforce required.

Therefore, persons from this study area are likely to occupy most unskilled positions. Generally low levels of education suggest that few people from Tiers 1 and 2 villages would be suitable for skilled roles.

The WGJV will apply gender-neutral hiring practices. However, men are more likely to be recruited than women, due to comparatively higher levels of education and past employment experience. Surveys in 2014 and 2015 indicated that, within Tier 1, 52.2% of the male population over 15 years of age had been previously employed, compared to 7.8% of women. Employment opportunities are therefore more likely to directly benefit men than women.

At the end of the construction phase, and upon mine closure, employment opportunities with the Project will fall, leading to a reduction in income levels for those people who do not obtain ongoing or alternate employment.

18.3.2.1.2. Procurement

Development of the Project may bring procurement opportunities to the study area. Businesses within Study Area 1 tend to be small-scale businesses. The most commonly reported businesses were the operation of village trade stores and market stalls, and, in the case of Tier 2, businesses providing river transport. Trading in cocoa, timber, fuel, pigs and

clothing were other, less common business activities. Only several households indicated raising chickens on a commercial basis, and some also traded gold. Cash crops (predominantly cocoa) were also maintained.

Of the types of goods and services the Project is likely to require (see Table 18.4), the supply of vegetables and fruit is the most likely procurement opportunity based on current businesses in the study area. However, new businesses are likely to be established; services required could include gardens/grounds maintenance, grass cutting, local labour hire, rubbish removal and tree felling.

The WGJV has assisted in establishing a landowner company ('Lanco') for each of the Hengambu, Yanta and Babuaf Tier 1 landowner communities. These Lancos cooperate through a representative company ('Repc'), known as the Golpu Wafi Development Corporation, which is a corporate structure owned jointly by the Lancos. The Repco is expected to manage the business functions of the Lancos, and provide quality, cost-competitive goods and services to the Project. The WGJV will help to establish a Lanco owned and managed by women. It is envisaged that such a Lanco may provide camp services (cleaning, canteens, laundry and camp administration), in order to directly provide economic opportunities to local women. These initiatives will enhance Study Area 1 villages' ability to benefit from procurement opportunities.

At the end of the construction phase, and upon mine closure, procurement opportunities with the Project will fall, leading to a reduction in income levels for those businesses unable to obtain ongoing contracts with the Project or other business elsewhere.

18.3.2.1.3. Project Payments

'Project payments' is used in this chapter to refer to payments made, directly or indirectly, by the WGJV to individuals or communities within the study area (other than income from employment and procurement). Three types of project payment are discussed:

- Royalties
- Project benefits
- Compensation

Royalties are payments by the WGJV to the State of PNG, under the provisions of the *Mining Act 1992*. The State of PNG may choose to retain royalties, or disburse them to the relevant provincial government (in this case, Morobe Province) and landowners of the land where mining occurs (DMPGM, 2014). If royalties are disbursed, then landowners are entitled to a minimum of 20% of the total royalties paid to the State (DMPGM, 2014). It is anticipated that Study Area 1, Tier 1 villages would receive a greater share of royalties than those in Tier 2, due to their ownership of the land within SML 10.

Royalties may be a source of income for study area villages. The precise amount and form of such payments would be discussed at the Development Forum. The Development Forum is a meeting convened by the Minister for Mining prior to the grant of a special mining lease (under section 3 of the *Mining Act 1992*). The forum is attended by representatives of the State of PNG, the Provincial Government, and affected landowners. The Development Forum will culminate in a MOA between the parties, setting out the responsibilities, obligations and benefit sharing agreed at the forum.

'Project benefits' is a non-technical term used in this chapter to refer to contributions by the WGJV for relevant provincial and local community development projects across the health, education, sustainable livelihoods, environment and other program areas. The purposes of Project benefits are to enable the maintenance and enhancement of WGJV's social licence to operate, and to mitigate potential socioeconomic impacts associated with Project

development and operations. Project benefits can constitute funding for the implementation of development projects (e.g., health and education programs), to be implemented as appropriate by non-government organisations, the WGJV and/or for-profit organisations.

‘Compensation’ refers to payments made under the *Mining Act 1992* or the *Environment Act 2000* for loss of or damage to an interest in land. This could include damages to improvements including crops, trees, structures, and cultural heritage sites as well as social inconvenience from lack of ongoing access to portions of their land. The *Mining Act 1992* further states that compensation is payable to landowners for ‘social disruption’.

Both the *Mining Act 1992* (Part VII) and the *Environment Act 2000* (Part VII, Division 3) provide for compensation paid to landowners, as well as lawful occupants on land owned by the State of PNG. The *Environment Act 2000* also provides for compensation to a broader set of claimants: ‘owners and occupiers of, and any person with customary rights in, any private land in relation to their several interests’. The WGJV would make compensation agreements with landowners prior to entering onto or occupying the land, pursuant to section 155 of the *Mining Act 1992*.

Compensation is not an income source per se, because it is paid to remedy loss or damage. However, it may monetise assets (e.g., where cash is paid to remedy damage to gardens), which increases the liquidity of the recipient, similarly to cash income.

Project payments are likely to drive economic impacts either because they result in increased income (royalties and some forms of Project benefits) or because they increase the liquidity of the recipient (compensation).

18.3.2.1.4. Local Economy

Employment, local business opportunities and the payment of royalties would increase income within the study area. In general, this would be a positive impact because it increases the capacity of individuals and communities to improve their standard of living, for example, by:

- Increasing participation in the cash economy (e.g., creating opportunities to establish or extend business opportunities; ability to purchase items which had previously been unavailable or unaffordable)
- Accessing more advanced levels of education (e.g., university or vocational education), and making transport to educational institutions more affordable (especially to high schools located in Lae or Salamaua)
- Purchasing more and a greater range of food from stores and markets
- Obtaining better and/or more frequent healthcare
- Traveling further and/or more frequently for services.

In the summary table of impacts below (Table 18.5), these potential positive impacts are not listed as distinct line items, because they rely on individual choice to realise them.

Conversely, increased income may also bring negative impacts, such as:

- Increased incidence of communicable diseases (STIs) associated with an increase in unsafe sexual practices that may occur from increased disposable income
- Increased incidence of non-communicable diseases through consumption of alcohol, tobacco and unhealthy food that is afforded by an increased disposable income
- Increased gambling activities and the consumption of alcohol and drugs due to higher incomes, with consequent impacts on health and social cohesion

These potential negative impacts are listed as separate impacts under their respective categories (e.g., community health and safety).

Despite not being a form of income, the increased liquidity associated with compensation similarly provides individuals with opportunities to choose how to spend money. Similar impacts, both positive and negative, may arise.

Expenditure occurring in the study area will constitute income for other individuals or businesses, thereby distributing cash more generally throughout the community (sometimes known as the 'multiplier effect'). Operators of village trade stores and stalls are among those who would benefit from this redistribution of wealth. A stimulated economy may also encourage the development of businesses within this study area (e.g., trade stores and agribusinesses).

Economic benefits may be enhanced by the construction of the proposed Watut Services Road, Northern Access Road and Resettlement Road. The construction of these roads is expected to reduce travel times to Zifasing and Lae for approximately 7,500 residents in Tier 1 and 2 villages. It will also greatly reduce travel time and costs associated with the transport of cocoa, vegetables and other products to markets along the Highlands Highway or in Lae, and store goods from Lae to study area villages.

However, a stimulated local economy could also lead to local inflation of the price of goods and services. While a potential positive impact for providers of goods and services, people whose incomes do not increase proportionally to inflation will find themselves less able to afford store-bought foods, transport costs, and fuel and batteries. Negative consequences of inflation may include, for some households, a reduced ability to afford store-bought protein sources (e.g., tinned fish), and a reduced ability to travel to markets to buy or sell produce.

Inflationary effects may be felt not only in material transactions for goods and services, but also on cultural exchanges involving gifts or payments (see Jorgensen, 2006). In this study area, for example, inflation may affect the cost of bride price (monetary and non-monetary). The payment of bride price was identified as being practiced in Tier 1 villages in 2012; no comparable data was available for Tier 2 villages. Inflated bride prices could impact men who become less able to marry (as documented by Jorgensen, 2006, in relation to the Ok Tedi mine). It could also impact women who, in seeking to leave an unsuitable marriage, are unable to raise sufficient funds to repay the initial bride price.

Table 18.5 summarises the impacts related to employment, procurement, Project payments and the local economy.

Table 18.5: Potential impacts related to employment, procurement, Project payments and the local economy (Study Area 1)

Note: blue shading indicates positive impact

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S1	Increase in local employment during construction	Tier 1 and young men in particular	Construction	Possible	Major	Very High
S8	Increased or ongoing local employment during operations	Tier 1 and young men in particular	Operations	Possible	Moderate	High
S101	Increased income and liquidity from Project payments	Landowners – particularly Tier 1	Life of Mine	Almost certain	Major	Very High
S11	Increase in incomes as a result of improved road access to produce and cash crop markets in Zifasing and Lae	Communities near the proposed Northern Access, Watut Services and Resettlement roads	Life of Mine	Possible	Moderate	High
S13	Increase in village business income (trade stores, agribusinesses, etc.) as a result of higher local income levels	Small business operators	Life of Mine	Likely	Moderate	High
S112	Increase in local procurement during Project construction	Businesses and employees of businesses within study area; Tier 1 Lancos in particular	Construction	Possible	Moderate	High
S114	Increased or ongoing local procurement during Project operations	Businesses and employees of businesses within study area; Tier 1 Lancos in particular	Operations	Unlikely	Minor	Low
S17	Inflated cost of goods sold in trade stores and markets in local villages making it more difficult to afford store-bought foods, fuel and batteries, particularly for those not receiving income as a result of the Project	Across study area - especially those where highest income is expected (Tier 1) and those with improved road access (Tiers 1 and 2).	Life of Mine	Likely	Moderate	High
S18	Reduction in income levels as Project employment falls at the end of the construction phase	Tier 1 and young men in particular	Construction	Almost certain	Moderate	Very High

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S19	Reduction in income levels as Project employment falls upon mine closure	Tier 1 and young men in particular	Closure	Almost certain	Minor	High
S103	Reduction in income levels as procurement requirements fall at the end of construction	Businesses and employees of businesses within study area; Tier 1 Lancos in particular	Construction	Likely	Moderate	High
S104	Increased cost in cultural exchanges (e.g., bride price) making it difficult to participate; in the case of marriage, also making it difficult to exit a marriage.	People not experiencing increased incomes from the Project; women.	Life of Mine	Possible	Moderate	High

18.3.2.2. In-migration

In-migration refers to the movement of people into an area, often in anticipation of economic opportunities stimulated by the development of a project. Such opportunities include employment and business prospects. In PNG, in-migration occurs primarily due to personal motivation to access economic opportunity and has occurred at numerous mining projects in the country, often leading to population growth far exceeding increases in birth rates (Bainton et al., 2017; Filer and Le Meur, 2017).

This section provides an assessment of in-migration that may occur within this study area. The drivers, location and extent of potential in-migration are discussed. However, only one impact (population growth) is identified as falling within this category; other impacts arising from in-migration are captured within other categories. For example, population growth from in-migration may lead to increased demand for subsistence resources; such an impact is discussed within Section 18.3.2.4, Land and Water Resources. The discussion in this section highlights in-migration as a driver of a range of potential socioeconomic impacts.

Previously, in-migration to and within this study area appears to have largely occurred through marriage. Experience from other large-scale mines in PNG (Bainton et al., 2017; IFC, 2009a) suggests it is likely that outsiders will migrate to the study area in search of employment, business opportunities and/or alluvial gold. While many in-migrants will be friends and/or family of those currently residing in the study area, some in-migration is also expected from other parts of PNG who have no affiliation with the local area. In-migration between villages within the study area is also expected, as people seek to be closer to the Mine Area. In particular, in-migration to Pekumbe is anticipated (as it has occurred in the past), and to villages close to the proposed Northern Access and Watut Services roads.

Individuals usually migrate to an area first, often establishing relationships and agreements with landowners who allow them to stay. Over time they are joined by friends and relatives, who sometimes benefit from 'wantok' cultural obligations to provide and share accommodation, food and belongings among others of a cultural group. As in-migrants' numbers grow, they may become more assertive and more difficult for local leaders to control. Although the arrival of the first migrants heralds a seemingly harmless change to the community, experience elsewhere in PNG indicates that resource projects lead to substantial in-migration and subsequently, a range of adverse socioeconomic impacts including increased demand for land and other resources and community disputes, as discussed in sections 18.3.2.4.1, Land-based Resources, and 18.3.2.7, Community Cohesion and Law and Order.

The magnitude of population growth from in-migration is difficult to predict. The population near the Porgera Gold Mine was estimated to have doubled to 10,000 people between 1980 and 1990, reaching 12,000 people in 1993 (Filer, 2012: 3–5). This growth equates to an annual growth rate of approximately 7% per annum. Within Morobe Province, in-migration has been observed near the Hidden Valley Gold Mine.

Within this study area, an estimate is made based on similar growth rates and baseline information on population growth drivers. The socioeconomic baseline found that population growth is mixed across Tier 1 villages, with low (less than 2% per annum) or negative population growth between 2004 and 2015 for Pokwana, Zilani and Pokwaluma. Discussions within Yanta villages suggest that this observation is due to residents from these villages relocating to Pekumbe or Venembele. However, population growth exceeds 4% per annum in all other villages (including the two Tier 2 villages for which population growth data is available, Dengea and Zimake). This high growth rate, surpassing the annual growth rate of 2% for Morobe Province between 2000 and 2011 (NSO, 2011), suggests that

Tier 1 and 2 communities have experienced a moderate level of in-migration over the past decade.

Should the population of Project-affected communities grow at 5% per annum in the future, the population of the Hengambu, Yanta and Babuaf villages will double to more than 7,000 within 15 years. If the population growth rate increased to 7.5% per annum, the population would double in less than 10 years. Such population growth is recorded as a standalone impact because it would affect the community functions and identities. As noted above, in-migration would also drive a wide range of other impacts, including those relating to land and water resources, community health and safety, community cohesion and law and order, and tradition and culture. These impacts are addressed in their respective categories.

In addition to an increase in the population of the Hengambu, Yanta and Babuaf villages, it is likely that villages along the access roads will also experience strong population growth. This includes Timini, Dengea, Zimake, Zifasing, Goraris, Chiatz and potentially Chaunon. Goraris, which consists of people originally from the Sepik, is also expected to experience high levels of in-migration. In-migration is also expected along the Demakwa Access Road from those customary landowners who currently reside in Zenag, Gurakor or other villages to the south. The proposed Watut Services Road to the west of the proposed Northern Access Road may also stimulate in-migration in Tier 2 villages such as Uruf, Wampan, Bencheng and Maralina.

Table 18.6 presents population growth as a standalone impact, with flow-on effects of in-migration addressed under other categories.

Table 18.6: Potential impacts related to in-migration (Study Area 1)

Ref	Impact	Population affected	Phase	Likelihood	Consequence	Significance (initial)
S105	Population growth from in-migration	Particularly Tier 1, and Tier 2 villages along access roads	Life of Mine	Almost certain	Major	Very High

18.3.2.3. Physical and Economic Displacement (Resettlement)

This category relates to impacts arising from physical and/or economic displacement. Displacement refers to 'physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use' (IFC, 2012). Resettlement is defined in this EIS as a process of planning and implementing activities that manage the effects of displacement (adapted from DFAT, 2015; see also Vanclay, 2017).¹

¹ By contrast, the IFC Performance Standard 5 (Land Acquisition and Involuntary Resettlement) (IFC, 2012) defines 'involuntary resettlement' as synonymous with displacement. Processes for managing the effects of displacement are referred to variously as 'resettlement activities', 'resettlement planning and implementation', and 'resettlement planning, implementation, and monitoring'. This EIS distinguishes between 'displacement' (as an impact or driver of impacts) and 'resettlement' (as a management measure or set of management measure) to align with the impact assessment process (section 18.1.2), which separates the identification and assessment of potential impacts from the identification of management measures.

This EIS considers only involuntary displacement, which arises when

affected persons or communities do not have the right to refuse land acquisition or restrictions on land use that result in physical or economic displacement. This occurs in cases of (i) lawful expropriation or temporary or permanent restrictions on land use and (ii) negotiated settlements in which the buyer can resort to expropriation or impose legal restrictions on land use if negotiations with the seller fail. (IFC, 2012)

Voluntary displacement (e.g., market-based land transactions or voluntary donations of land) are not subject to resettlement.

Current planning indicates that village-scale displacement may be required for Hekeng, Venembele and Nambonga, which are currently located within the proposed SML 10. Approximately 800 individuals in 130 households would be relocated. However, the scale of displacement is subject to the final extent of tenement boundaries and Project impacts. Determination of tenement boundaries will involve considering long-term Project land access requirements, which are subject to discussion and agreement with the Mineral Resources Authority. The principal factors influencing the need for displacement include:

- Proximity of households and/or economic assets to construction or operational activities for the mine and supporting infrastructure. Safety or amenity issues may arise that are best managed through establishing a buffer zone where there are no residences, potentially resulting in physical or economic displacement.
- Land requirements for future potential mine development. As there is active exploration for satellite mineral deposits close to the Golpu deposit, securing this area is warranted to avoid resettlement in the future when populations may have increased significantly (through natural population growth or in-migration).

Consideration will also need to be given to the impacts on village populations that host or are in proximity to resettlement sites. Resettlement sites are envisaged to be located to the south and southeast of SML 10, on sites with security of tenure, adequate land and water resources, and access to Project employment opportunities. (Employment opportunities would be available independent of any agreement with resettled villages and individuals, but ability to access such opportunities is a consideration for determining the suitability of resettlement sites.) Preliminary options for resettlement sites have been identified for each of the villages: Venembele potentially to be relocated to Nongokwa, Nambonga potentially to Kwepkwep/Tivgi, and Hekeng potentially to Old Hengambu (see Section 6.18, Resettlement).

Villages that are relocated will experience a change in land and water resources, and the productivity of these resources is likely to be lower immediately after relocation as gardens, plantations, and hunting, fishing and gathering areas need to be re-established. Because some of these resources are sold for cash, income may also be affected.

Uncertainty as to the future after relocation may impact health and wellbeing, depending on the effectiveness of community engagement prior to, during and after relocation. Some people may experience disruptions to family and friendship connections, cultural associations, traditions and sense of place connected to the existing village locations.

As discussed in Chapter 6, Project Description, initial resettlement planning and discussions with Nambonga, Hekeng and Venembele identified the need to provide road access to resettled villages. The proposed Watut Services Road and Resettlement Road would provide road access from the proposed location of the resettled villages to Zifasing and the Highlands Highway. These roads were proposed after initial resettlement planning and discussions with Nambonga, Hekeng and Venembele villages, during which the need for

road access to resettled villages was identified as a priority. As discussed in Section 18.3.2.1.4, Local Economy, these roads may allow easier access to services, as well as larger and more lucrative markets in Zifasing and Lae. These roads may also encourage in-migration (often at the invitation of landowners), with consequential pressures on land and water resources as discussed in Section 18.3.2.2, In-migration.

With respect to the Infrastructure Corridor and the proposed access roads within this study area, no physical displacement is anticipated (except if a residence is located directly on the pipeline route, and the route cannot be adjusted). Some economic displacement is expected, as gardens and individually owned trees will likely be within the Infrastructure Corridor and road corridors. In such cases, gardens could be re-established once construction is completed. Trees would be replanted, provided they are not above the pipelines or on the road (in which case they would be replanted several metres away).

The WGJV has prepared a Resettlement Policy Framework, which describes the terminology, objectives, policies, principles, practice measures and organisational arrangements that will govern land access and resettlement activities in relation to the Project. The Resettlement Policy Framework is consistent with IFC performance standards (IFC PS5), and sets out principles that will guide negotiations with communities and households and the preparation of Resettlement Action Plans (RAPs) when tenement boundaries are finalised.

Table 18.7 presents the impacts falling primarily within the category of physical and economic displacement (resettlement) for Study Area 1.

18.3.2.4. Land and Water Resources

The majority of communities in Study Area 1 depend on natural resources for subsistence and livelihoods. Within this study area, land-based resources include those harvested for food (in gardens or from forests), housing materials, medicines, cultural uses and other products. It also includes cash crops, which in this study area is predominantly cocoa, as well as peanuts, bananas and taro. Water-based resources include water for drinking and domestic uses, fishing, recreation and transportation.

This section describes impacts on the availability and quality of land- and water-based resources, and access to such resources. Potential impacts to subsistence and livelihood uses of natural resources are assessed.

Table 18.7: Potential impacts related to physical and economic displacement (Study Area 1)

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S29	Uncertainty related to future land access, resource usage and community cohesion experienced by those who will or may potentially be resettled.	Hekeng, Venembele and Nambonga	Construction	Possible	Moderate	High
S71	Physical and economic displacement of households and livelihood assets	Hekeng, Venembele and Nambonga	Life of Mine	Likely	Major	Very High
S85	Economic displacement (loss of livelihood assets, including gardens)	People owning gardens, trees and other livelihood assets, where such assets cannot be avoided through detailed design of the Infrastructure Corridor and proposed Watut Services and Resettlement roads	Construction	Possible	Moderate	High

18.3.2.4.1. Land-based Resources

Impacts to land-based resources are likely to be experienced predominantly by Tier 1 villages, due to their proximity to the Mine Area. According to socioeconomic baseline studies in 2012, most households in Tier 1 villages relied on gardens as their primary source of food. Approximately 90% of gardens were recorded within 3km of the village, with survey respondents reporting a 30–120min walk to reach gardens. While a lack of land availability was not explicitly reported by respondents, a short fallow period may indicate a lack of limited suitable agricultural land in the vicinity of villages.

Hunting was practiced by 57% of households in Tier 1 villages, with hunting grounds typically located within 5km of the village, although hunters may hunt further away, with hunting rights determined more by cultural group (Babuaf, Yanta or Hengambu) than by village. Because SML 10 would be situated at the boundary of Babua, Yanta and Hengambu lands, it is unlikely that hunters would need to detour around the SML in order to reach hunting grounds.

Construction, operation and closure of the mine within this study area may lead to a reduction in availability or access to subsistence resources, particularly for Tier 1 villages. Specifically, mine development will result in some land being modified or no longer being accessible, due to the Mt Golpu subsidence zone and the surrounding safety exclusion zone, and land required for Project facilities within the Mine Area (e.g., the Watut Process Plant, portal and decline infrastructure, Fere accommodation facility, quarries and ventilation shafts). In relation to the Mt Golpu subsidence zone, residents of Hekeng and Venembele currently have some food gardens on Mt Golpu. Their access will be restricted due to risks associated with subsidence. This restriction will be permanent; however, resettlement of Hekeng and Venembele would result in new gardens being established in a different location (refer to Section 18.3.2.3, Resettlement). In relation to Project facilities within the Mine Area, the area of disturbance expected within the Mine Area is 214ha.

Noise from mining operations may impact some animals and birds from the area, with secondary impacts on hunting activities. This is likely to affect Ziriruk and Papas, which will be located close to the proposed power generation facilities. Noise from the construction of the Northern Access Road and Infrastructure Corridor, and the Resettlement and Watut Services roads, may temporarily impact hunting activities for Tier 2 villages.

As discussed in Section 18.3.2.2, in-migration may occur. Population growth driven by in-migration would lead to greater demand for land-based resources, leading to an overall reduction in availability.

18.3.2.4.2. Water Resources – Drinking Water

The biophysical impacts of the Project on surface water and ground water are discussed in Chapter 14, Physical and Biological Environment Impact Assessment, and Chapter 15, Freshwater Environment Impact Assessment. This section considers socioeconomic impacts relating to water quality and quantity, and access to water resources.

Drinking water within Tier 1 villages is predominantly sourced from pipes, which convey water from nearby springs or streams at higher elevations to the village. Secondary water sources were reported as creeks and streams. The following creeks were named as secondary sources of drinking water (with villages utilising each listed in parentheses):

- Wigo Creek (Hekeng)
- Wafi Creek (Venembele, Nambonga and Pekumbe)
- Watut River (Kapunung, Ngarubuarung and Goraris)

- Uruf River (Uruf)
- Buvu Creek (Nambonga)
- Buvu Creek (Nambonga)

No village reported collecting water from Boganchong Creek or Womul Creek. No data on drinking water was collected at Zilani, Powaluma and Pokwana was collected, as these villages are upstream and over 5km from the Mine Area.

Groundwater is a source of drinking water for two villages: Wori (where shallow wells throughout the village are the primary source of water), and Wongkins (where groundwater is a secondary source). While there will likely be groundwater impacts to Buvu Creek, Nambonga Creek and the Wafi River (see Section 14.3, Hydrogeology), no impact to groundwater at Wori and Wongkins is anticipated.

Impacts to drinking water quantity are not expected. As discussed in Section 15.4, Residual impacts to surface water, impacts to surface water flow are expected to be localised within Boganchong and Womul creeks, which are not sources of drinking water for villages in this study area.

No impacts to drinking water quality are expected. According to modelling reported in Section 15.4.3.2.5, Residual impacts – water quality, contaminants impacts are predicted to be low, as wastewater will be captured and treated (if required) prior to discharge to the Watut River near Wongkins village. Ambient contaminant criteria are more stringent than drinking water standards; consequently, the modelled 'low' impact will translate to no impact to drinking water. Further discussion is provided in Chapter 19, Health Risk Assessment.

Chapter 15, Freshwater Environment Impact Assessment, discusses potential impacts arising from sedimentation (see Section 15.5.3.1.2, Total Suspended Solids). Construction-derived sediments are expected to enter Nambonga and Buvu creeks during high rainfall-runoff events and be transported downstream along the steep-gradient reaches of the creeks. Where the Nambonga and Buvu creeks enter the Wafi River, construction-derived coarse sediments (e.g., stone and gravels) are expected to accumulate within an existing coarse sediment storage area where the floodplain widens near Nambonga village. Construction-derived coarse sediments are not expected to cause sedimentation impacts on the Wafi River, as subsequent flood flows would resuspend and transport the new coarse sediment downstream to the lower Wafi River and the receiving middle Watut River. Fine sediments derived from construction are expected to be carried to the Wafi River in overland flow from construction areas, and carried downstream as suspended load. Overall, construction-derived sediments entering the Wafi River and its tributaries are not expected to cause significant sedimentation of these creeks and rivers, given their steep gradients and tendency to experience flash flooding during high rainfall-runoff events, as well as their high sediment transport capacities. Sediment loads associated with construction are expected to progressively decline to pre-disturbance levels within 18 months to two years. Further discussion is provided in Chapter 15, Freshwater Environment Impact Assessment.

The assessment of socioeconomic impacts to drinking water assumes that management measures for water quality, and erosion and sediment control, are implemented as described in Section 15.3, Management Measures – Freshwater Environment Impact Assessment.

18.3.2.4.3. Water Resources – Aquatic Ecology

Project impacts to aquatic ecology are assessed in Chapter 15, Freshwater Environment Impact Assessment. This section considers potential socioeconomic impacts that arise from impacts on aquatic ecology.

Freshwater aquatic biota is used in this study area as a source of food, supplementing garden produce and hunting. Eels, catfish, carp, prawns and other fish are caught from nearby rivers, streams and lakes, although fish ponds are also maintained at Pekumbe, Madzim, Chiatz, Goraris, Bencheng and Uruf.

Table 15.5 summarises impacts on freshwater aquatic ecology for this study area. Four impacts were considered:

- Aquatic habitat loss or degradation
- Loss of, or impacts to, aquatic flora
- Loss of, or impacts to, aquatic fauna: Macroinvertebrates
- Loss of, or impacts to, aquatic fauna: Fish

The residual significance was assessed as low for the Watut River (at a regional scale), Womul Creek, Wafi River, Nambonga Creek and Bavaga River. Impacts were assessed as having a moderate significance at Boganchong Creek, which would affect Nambonga at its current location but not upon relocation. These significance ratings are influenced by the naturally high turbidity of watercourses particularly in peak flow events. As such impacts to aquatic ecology as a direct result of the Project are considered negligible. Further information is provided in Section 15.6, Residual Impacts to Freshwater Ecology.

Indirect impacts may arise as a result of in-migration. Population growth within this study area would increase the demand for fish, eels and prawns, diminishing the availability of food.

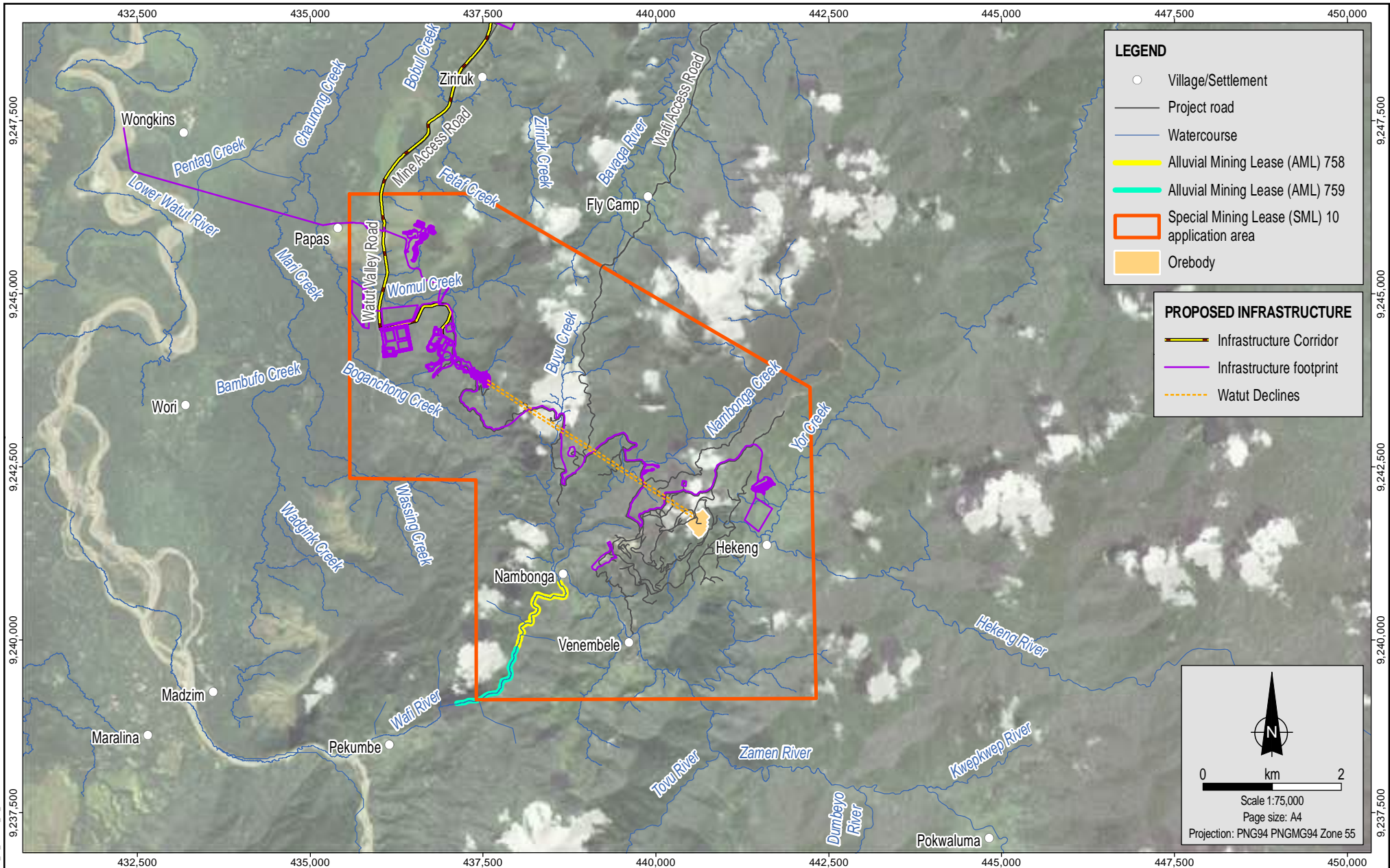
18.3.2.4.4. Water Resources – Alluvial Mining

Socioeconomic surveys undertaken in 2014 and 2015 indicated that alluvial mining was a source of income for the majority of Tier 1 households surveyed, including Kapungung, Bavaga, Madzim, Wori, Zonkins, Ziriruk, Nambonga, Venembele, Pekumbe, Hekeng, Gingen, Bencheng and Uruf. Alluvial mining contributed the highest source of income in Nambonga, Venembele, Pekumbe, Ziriruk and Wori, i.e., communities living along the Wafi and Watut rivers or with access to associated creeks. Residents of Tier 2 villages tend not to engage in alluvial mining.

Areas used for alluvial mining include Bavaga River, Zumadia Creek, Bipu River and Tin Okin Lakes (used by residents of Bavaga); Mari Creek and Watut River (Wori), the Watut River (Wonkins) and the Watut and Wafi rivers (Pekumbe).

Sections of the Wafi River falling within the proposed SML area are used for alluvial mining, and may be valued as such by the community (and particularly the residents of Nambonga, Hekeng, Venembele and Pekumbe). In 2015, WGJV was notified of applications for two 5-hectare alluvial mining leases (AML758 and AML759) on the Wafi River south of Mt Golpu, as shown in Figure 18.2. In January 2016, the WGJV lodged a formal objection to the applications, which have not progressed.

While alluvial mining leases can coexist with exploration licences (section 59 of the *Mining Act 1992*), they cannot co-exist with an SML (section 48(2) of the *Mining Act 1992*) and public access within SML 10 will be strictly controlled. Consequently, residents of Nambonga, Hekeng, Venembele and Pekumbe may need to find new sites for alluvial mining, constituting economic displacement, unless appropriate and acceptable alternative arrangements may be put in place. This will be the subject of further engagement with Tier 1 communities (and particularly the residents of Nambonga, Hekeng, Venembele and Pekumbe) and PNG Government agencies.



MXD Reference: 0520DD_10_GIS075_v01_2

Source:
Watercourses from EnviroGulf and WGJV.
SML, AML and orebody from WGJV.
Villages, infrastructure and project roads from WGJV and Coffey.
Imagery from WGJV (capture date 2016).

coffey
A TETRA TECH COMPANY

Date: 27.04.2018
Project: 754-ENAUABTF100520DD
File Name: 0520DD_10_F18.02_GIS

WAFI-GOLPU
JOINT VENTURE

Wafi-Golpu Project

Proposed alluvial mining leases within and near SML 10

Figure No:
18.2

Increased sediment load downstream of the Mine Area during construction may create a perception that alluvial deposits have diminished. Sediment load is expected to return to baseline conditions after 18 months to two years following construction (see Section 15.5.2, Sediment Transport).

In-migration may lead to an increase in the number of people searching for gold, potentially leading to reduced income for residents in Tier 1 villages as alluvial gold resources may be depleted or shared among more people. This impact would affect particularly Gingen, Bavaga, Fly Camp and Pekumbe. The villages of Hekeng, Venembele and Nambonga would also be affected, as they are expected to continue alluvial mining after relocation.

Table 18.8 presents the impacts related to land and water resources for Study Area 1.

18.3.2.5. Community Health and Safety

This category identifies potential impacts relating to community health and safety within this study area. It adopts as a framework the environmental health areas given by the IFC Good Practice publication, *Introduction to Health Impact Assessment* (IFC, 2009b):

- Vector-related diseases (such as malaria, dengue fever and lymphatic filariasis)
- Respiratory and housing issues (including respiratory effects from housing and overcrowding)
- Veterinary medicine and zoonotic issues (i.e., diseases transmissible from animals to humans)
- Sexually transmitted infections
- Soil- and water-sanitation–related diseases
- Food- and nutrition-related issues
- Accidents and injuries
- Exposure to potentially hazardous materials
- Social determinants of health
- Cultural health practices
- Health services infrastructure and capacity
- Non-communicable diseases (e.g., hypertension, diabetes, stroke, heart disease, cancer and mental health)

In addition, socioeconomic impacts relating to noise and vibration were assessed. Note that occupational health and safety (i.e., safety of the workforce) is beyond the scope of this EIS, except to the extent it could influence community health. Occupational health and safety is addressed separately in the WGJV Health and Safety Management Plan, a periodically updated document last revised in September 2017.

Table 18.8: Potential impacts related to water use and water-based livelihoods (Study Area 1)

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S54	Reduction in availability or access to land- and water-based resources as a result of mine development and/or access restrictions (economic displacement)	Tier 1 villages in proximity to the Mine Area	Life of Mine	Likely	Moderate	High
S57	Increased pressure on the availability of land-based natural resources as a result of in-migration: * Food derived from hunting * Food harvested from naturally occurring plant species * Food from gardens * Trees/other plant species used to make houses * Traditional medicine * Firewood	All villages in study area	Life of Mine	Likely	Moderate	High
S58	Increased pressure on the availability of traditional medicine as a result of in-migration	All villages in study area	Life of Mine	Possible	Moderate	High
S55	Noise from mine operations affecting hunting activities	Tier 1 villages in proximity to the Mine Area (Papas and Ziriruk particularly)	Operations	Likely	Minor	Moderate
S56	Noise from construction of the Northern Access Road and Infrastructure Corridor affecting hunting	Tier 2 villages in proximity to the Northern Access Road and Infrastructure Corridor	Construction	Possible	Minor	Moderate
S59	Increased pressure on the availability of water-based resources as a result of in-migration: * Drinking water * Food derived from fishing and collecting in local waterways	All villages in study area	Life of Mine	Possible	Moderate	High

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S16	Loss of income from alluvial mining due to in-migration (increased number of people searching for gold)	Tier 1 communities, particularly Gingen, Bavaga, Fly Camp, Hekeng, Venembele, Nambonga and Pekumbe	Construction, Operations	Possible	Moderate	High
S15	Loss of income (economic displacement) from alluvial mining due to restricted access imposed by the Project (e.g., within SML 10)	Hekeng, Venembele, Nambonga and Pekumbe	Life of Mine	Almost certain	Moderate	Very High

Vector-related Diseases

The prevalence of mosquito-borne diseases (such as lymphatic filariasis and malaria), may increase as a result of the Project. The 2012 Public Health and Biomedical Survey found that lymphatic filariasis seroprevalence in 1.8% of the population (n=508). This result means that Study Area 1 falls into the World Health Organization's Global Program for the Elimination of Lymphatic Filariasis' 'low endemic' category for lymphatic filariasis. The village of Gingen reported the highest seroprevalence rates of all surveyed villages at 12% (highly endemic) of the surveyed population (Abt JTA, 2013).

Malaria transmission risk around the Wafi-Golpu mine was assessed to be high and occurring all year round. In 2011, malaria was the most commonly recorded presentation at the Wafi health clinic and (Montrose, 2011). In June 2012, the WGJV commissioned Oil Search Health Foundation to develop and implement a five-year Malaria Management Project which sought to decrease the impact of malaria in communities surrounding the Wafi-Golpu Project (Oil Search Health Foundation, 2013).

The Project may increase the risk of mosquito-borne diseases in several ways. The raw water dam and sedimentation dam will provide standing water, which may attract mosquitoes. People who migrate to the study area may be more susceptible to mosquito-borne diseases (or particular strains of diseases) than the current population; conversely, in-migrants may introduce new diseases (or strains of diseases) to the study area, which are then transmitted to current study area population (Guyant et al., 2015; Martens and Hall, 2000; Sutherst, 2004).

Respiratory and Housing Issues

A higher population density (driven by in-migration and potentially a higher birth rate) may contribute to overcrowding. In turn, overcrowding can lead to increased physical contact and heighten the risk of spreading communicable diseases, including tuberculosis (Beggs et al., 2003; Clark et al., 2002).

Overcrowding can also lead to increased respiratory issues from indoor smoke inhalation. As discussed in Section 12.4.6, Housing, Study Area 1, the majority of households within this study area cook on open fires in a *haus kuk* (external kitchen building). According to the World Health Organization (2018), 4.3 million deaths worldwide each year are attributable to household air pollution from solid fuel fires (e.g., wood stoves). Overcrowding within this study area may increase the number of people exposed to indoor smoke. An increased population would also increase the need to cook (e.g., more fires or longer cooking times), which would also increase exposure to indoor smoke.

Increased income within villages may lead to improved housing standards, although as noted in Section 18.3.2.1.4, Local Economy, whether these benefits are realised depend on individuals' spending choices.

Sexually Transmitted Infections

There may be an increase in HIV/AIDS and other sexually transmittable infections (STIs). Increased STIs is associated with increased mobility and income generally (see Aggleton et al., 2014). The resources sector is also singled out as being associated with increased risk of STIs (Westwood and Orenstein, 2016). In PNG, higher incomes (from employment, procurement or project payments) and greater mobility (due to in-migration or the opportunities to travel through employment) can lead to unsafe sexual practices – whether through prostitution or other sexual relationships (Connell and Negin, 2010; Lepani, 2008). Increased incomes and mobility in this Project may lead to elevated risks of STIs in this study area.

Soil- and Water- Sanitation-related Diseases

The Public Health and Biomedical Survey (Abt JTA, 2013) found that pit latrines were the most common type of toilet in this study area (see also Section 12.4.6, Housing, Study Area 1). Fewer than a third of respondents in the survey indicated having facilities for washing hands after going to the toilet (Abt JTA, 2013).

Uncontrolled population growth may overload sanitation infrastructure. Latrines may overflow, and open defecation may be practiced if latrines become unusable or unavailable. Poor personal hygiene and food preparation practices may exacerbate the risk of gastrointestinal diseases.

Food- and Nutrition-related Issues

Depending on individuals' choices, the Project may lead to or exacerbate nutritional issues. Within the study area, gardens are the most important source of food, supplemented by hunting, collecting forest products, fishing and store-bought foods (see Section 12.4.7, Health and Wellbeing, Study Area 1).

The Project is likely to increase income levels (see Section 18.3.2.1, Employment, Procurement, Project Payments and the Local Economy). The consequential increase in purchasing power may enable some people to attain better nutrition. Conversely, increased purchasing power may encourage some people to rely more on store-bought foods. While store-bought foods are not necessarily unhealthy, Pus et al. (2016) suggest that healthy eating practices are not widely observed in PNG generally, and that being overweight carries a cultural connotation of physical strength or political power. These general observations are consistent with the Public Health and Biomedical Survey (Abt JTA, 2013), which found that nearly a tenth of the study area population was underweight, and nearly a quarter overweight or obese. These results indicate some degree of both malnutrition and over-nutrition (Abt JTA, 2013). Combined, these observations suggest that there is potential for increased incomes to be spent on unhealthy foods.

Aside from increasing purchasing power, employment may reduce the time available to undertake subsistence activities, further encouraging reliance on store-bought foods. This impact would affect people who find employment as a result of the Project (more likely to be men than women, notwithstanding that the WGJV will apply gender-neutral hiring practices: see Section 18.3.2.1.1, Employment). Both men and women contribute to subsistence activities (see Section 12.4.9, Subsistence Resources, Study Area 1). The time that would otherwise have been spent gardening, hunting, fishing or collecting food would be spent in employment, requiring store-bought foods to substitute for grown, hunted, fished or collected foods.

Accidents and Injuries

Once built, the Northern Access Road, Resettlement Road and Watut Services Road will be used by the Project and members of the public within this study area. These roads will be situated near villages with no prior experience of being close to a road. This would likely increase the risk of accidents and injuries.

The Project would contribute to traffic along the Northern Access Road. During the construction phase of the mine and supporting facilities, daily truck movements along the Northern Access Road are conservatively estimated to be between 30 and 37 trucks, per traveling direction per day, seven days a week. During the Operations phase of the mine, traffic movements are conservatively estimated as four to ten trucks per travelling direction per day, seven days a week. The traffic load would likely increase the risk of accidents and injuries.

However, the construction of the Northern Access Road should create a safer alternative route to Lae than the current Demakwa Access Road, which has seen multiple fatal road accidents (see Chapter 12, Socioeconomic Environment Characterisation). The proposed Northern Access Road will traverse the Lower Watut River valley and is expected to avoid steep sections of the road or sharp bends. The design of the Northern Access Road should provide a safer route for employees, contractors and other people to travel between Lae and the Mine Area.

The Northern Access Road is also expected to reduce the need for water travel, leading to a reduction in canoe/raft accidents. Surveys in 2015 indicated that those using the Lower Watut River for travel often did not feel safe, with over a quarter of respondents nominating capsized boats as a reason for feeling unsafe (see Appendix T, Socioeconomic Baseline, Section 5.1.11).

Accidents and injuries may also occur following mine closure, as a result of local residents searching for gold on Mt Golpu and the waste rock dumps. Should this occur, there would be a direct threat to those individuals' health and safety.

Exposure to Potentially Hazardous Materials

The Air Quality and Greenhouse Gas Impact Assessment (Appendix A) undertaken for the Project indicated the main air pollutants that may be produced by the Project include dust and exhaust emissions; i.e., oxides of nitrogen and sulphur dioxide. The assessment included risk-based and quantitative measures (based on modelling) to determine the impact on villages in proximity to proposed activities. Operation of the intermediate fuel oil power generation facilities (when the power plant is operating near maximum capacity which is estimated to occur from year 16 of operations onwards) is predicted to expose residents of Ziriruk and Fly Camp to elevated levels of sulphur dioxide for chronic exposure periods. As discussed in Chapter 19, Health Risk Assessment, such exposure may increase the risk of respiratory diseases (in particular asthma).

Dust from construction activities are expected to have negligible health (or amenity) impacts on all villages other than Ziriruk, as discussed in Section 14.5 (Air Quality). Ziriruk will be located approximately 300m from proposed construction activities; no adverse impacts are expected beyond 350m from construction activities (see Section 14.5.4.1, Construction Impacts, Air Quality). Consequently, the socioeconomic impact at Ziriruk arising from dust during construction is considered of minor consequence.

Air quality impacts to other villages in Tiers 1 and 2 were either assessed as negligible due to the distance between villages and proposed activities or because modelling showed there would be no impact (see Section 19.3.2.1, Air Emissions).

Exposure to mercury from alluvial mining may occur. Although there appears to be a decline in the number of people searching for gold along the lower sections of the Watut River in recent years, new migrants may turn to alluvial mining as a source of income. The use of mercury to extract gold presents health risks, particularly from toxic vapours if the mercury is heated in an area with poor ventilation. Mercury vapour inhalation may cause acute corrosive bronchitis and interstitial pneumonitis, which may be fatal (Abt JTA 2015, p.49).

Noise and Vibration

The assessment of noise and vibration impacts (Section 14.7, Noise and Vibration; see also Appendix B, Noise and Vibration Impact Assessment) predicted negligible impacts from vibration, due to the distances between study area villages and blasting and construction activities.

Noise emissions during construction and operations were modelled (noise emissions during closure are expected to be similar to, and no worse than, during construction). Modelling

considered both neutral and enhanced weather conditions, where enhanced weather conditions represented the worst-case scenario for noise transmission. Predicted emissions were compared against noise criteria as set out in Section 14.7.1.1, Noise.

The daytime noise criterion adopted was 55dBA for all villages in Study Area 1. This criterion is expected to be met at all villages during both construction and operations, under neutral and enhanced conditions.

The night time noise criterion adopted was 45dBA for all villages in Study Area 1. Some exceedances of the night time criterion are predicted during construction for Hekeng and Papas, and during both construction and operations for Ziriruk, as follows:

- **Hekeng:** During construction, noise emissions were predicted to be 47dBA under neutral conditions and 50dBA under enhanced conditions, both of which exceed the night time noise criterion. However, such exceedances would not occur if Hekeng is relocated to Old Hengambu (see Section 6.18, Resettlement).
- **Papas:** During construction, noise emissions were predicted to be 42dBA under neutral conditions and 48dBA under enhanced conditions. Exceedance of the night time noise criterion was predicted under enhanced conditions only.
- **Ziriruk:** During construction, noise emissions were predicted to be 44dBA under neutral conditions and 48dBA under enhanced conditions. Exceedance of the night time noise criterion was predicted under enhanced conditions only. During operation, noise emissions were predicted to be 48dbA under neutral conditions and 51dbA under enhanced conditions, both of which exceed the night time noise criterion.

Noise emissions to other villages in the study area were assessed as negligible either because of the distance between villages and proposed Project activities or because modelling showed there would be no impact.

Social Determinants of Health

This category encompasses a broad range of health issues related to: substance misuse; gender issues; displacement and resettlement; violence, security concerns and changes to social cohesion; education; and income and occupation.

- **Substance misuse** – Increased incomes may lead to greater consumption of tobacco, alcohol, betel nut and marijuana. In-migration may increase exposure to or availability of such substances. Impacts arising from substance misuse would affect the person consuming the substances (e.g., increasing risk of diseases linked to tobacco consumption), and his or her family and community (particularly where substance misuse changes behaviour; e.g., alcohol influencing increased domestic violence).
- **Gender issues** – Women and potentially children may experience an increase in domestic responsibilities, particularly in Tier 1 villages where young men are most likely to be employed on the Project, thereby reducing the number of people able to undertake domestic duties.
- **Displacement and Resettlement** – Residents of Tier 1 villages may experience a disruption to their sense of place due to awareness that mining-related activities have physically disturbed or restricted access to certain places. This would be particularly strong in Hekeng, Venembele and Nambonga, which are likely to be resettled. However, residents of nearby villages may also experience similar disruptions to their sense of place (refer to Section 18.3.2.3, Resettlement).
- **Violence, security concerns and changes to social cohesion** – Impacts falling within this subcategory are discussed in Section 18.3.2.7, Community Cohesion and Law and Order, Study Area 1.

- **Education** – Better education is generally associated with better health; refer to Section 18.3.2.6, Education, Study Area 1, for impacts relating to education.
- **Income and occupation** – Higher incomes can improve capacity to make healthy choices, but this depends on the spending choices of the individual and families. The potential for incomes to be spent on unhealthy foods, alcohol, tobacco, betel nut and marijuana is discussed earlier in this section (under Food- and Nutrition-related Issues, and Substance Misuse). Increased income can also lead to behaviours that increase the risk of sexually transmitted infections, as discussed above (under Sexually Transmitted Infections).

Cultural Health Practices

Socioeconomic studies indicate that traditional medicines are used in this study area. In PNG generally, traditional and western medicine are often seen to coexist; however, the increasing availability of western medicine may lead to a decline in the knowledge of and interest in traditional medicine (Macfarlane, 2009). Such a decline may be experienced in this study area. Impacts falling within this category are discussed in Section 18.3.2.8, Tradition and Culture.

Health Services Infrastructure and Capacity

An increase in the level of development funds, including through any Tax Credit Scheme (TCS) if adopted, should be available as a result of any development of the Project. Some of these funds may be allocated by provincial and local governments to improve the quality of health facilities in the Project Area. Improvements in health facilities by provincial and local governments would likely lead to corresponding improvements in health outcomes, including:

- A higher proportion of fully immunised children
- A higher proportion of women with childbirth deliveries in health facilities
- A higher proportion of people with an illness able to reach a medical facility and treated by a trained medical officer
- Availability of health professionals to treat serious accidents/injuries

Increased household incomes and improved road access will make travel more affordable and easier, contributing to people having greater access to these services.

The prospect of gaining employment with the Project may encourage some health workers to leave positions at health centres, leading to a temporary shortfall in staff and inability of some health centres to keep up with demand for healthcare – Bonnell (1999) records this impact as occurring at the Porgera Gold Mine and surrounds. Population growth due to in-migration could also increase demand for healthcare, leading to overloading of health centres.

Non-communicable Diseases

The risk of non-communicable diseases (such as heart disease, high blood pressure and cancer) may be exacerbated by lifestyle choices (e.g., diet, tobacco, marijuana, alcohol). There is an established association between non-communicable diseases and increased income, particularly in developing countries (Di Cesare et al., 2013; Habib and Saha, 2010; Pi et al., 2018). Consumption of unhealthy food and harmful substances may be driven by increased income – which makes unhealthy store-bought foods and harmful substances (such as tobacco) more affordable.

Table 18.9 presents the impacts related to community health and safety for Study Area 1.

Table 18.9: Potential impacts related to community health and safety (Study Area 1)

Note: blue shading indicates positive impact

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S21	Long term improvements in health levels as a result of improved nutrition and improved access to health services (associated with higher levels of income and improved road access).	All villages in study area	Life of Mine	Possible	Moderate	High
S48	Direct or improved road access provided to villages in the Mine Area improving access to health facilities.	All villages in study area	Life of Mine	Likely	Moderate	High
S49	Increased availability and range of store goods	All villages in study area	Life of Mine	Possible	Minor	Moderate
S51	Reduction in canoe/raft accidents as people travel to/from Lae by road (rather than travelling by river).	All villages in study area, particularly along the lower Watut River, upstream as far as Maralina (where the State-owned road is expected to end)	Life of Mine	Possible	Moderate	High
S110	Increased prevalence of vector-related diseases (such as malaria) as a result of Project infrastructure and/or in-migration.	All villages in study area, particularly Tier 1 and particularly Papas as the closest village to the proposed raw water and sedimentation dams	Life of Mine	Possible	Minor	Moderate
S34	Increase in the incidence of respiratory diseases (including tuberculosis) as a result of higher population densities in villages near the Mine Area.	All villages in study area	Life of Mine	Possible	Moderate	High
S35	Increase in HIV/AIDS and other sexually transmittable infections arising from high-risk behaviour associated with higher levels of disposable income, increased mobility and/or in-migration	Tier 1 and young men in particular; sexual partners of those affected by HIV/AIDS and other sexually transmitted diseases	Life of Mine	Almost certain	Major	Very High

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S38	Increase in gastrointestinal disease due to an influx of people living in unhygienic conditions (e.g., temporary housing with inadequate water supply and/or sanitation).	All villages in study area	Construction, Operations	Possible	Moderate	High
S33	Increase in prevalence of lifestyle diseases (non-communicable diseases) in villages near the Project Area as a result of changing diet and physical activity level	Individuals within Study Area 1 who have higher cash incomes due to employment, royalty or compensation payments and/or business activities	Life of Mine	Likely	Moderate	High
S26	Traffic and pedestrian accidents along the Demakwa Access Road and Wafi Access Road.	Tier 1 and Tier 2 communities, in particular residents of villages located along the Demakwa Access and Wafi Access roads	Construction, Operations	Likely	Major	Very High
S27	Traffic and pedestrian accidents along the proposed Northern Access Road, Watut Services Road and Resettlement Road	Tier 1 and Tier 2 communities, in particular residents of villages located along the Northern Access Road and in the lower Watut River valley	Construction, Operations	Likely	Major	Very High
S41	Injury or potential death as a result of illegal small-scale mining in the subsidence zone or the waste rock dump during mine operations.	Tier 1 communities, particularly Hengambu and Yanta villages and new settlers	Operations	Unlikely	Major	High
S42	Injury or potential death as a result of small-scale mining in the subsidence zone or the waste rock dump following mine closure.	All villages in study area	Life of Mine	Possible	Major	Very High
S22	Impaired amenity (e.g., dust, noise) arising from construction and operation	Hekeng, Papas and Ziriruk.	Construction, Operations	Possible	Minor	Moderate

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S111	Increased prevalence of respiratory diseases (e.g., asthma) due to exposure to sulphur dioxide emissions from operation of the intermediate fuel oil power generation facilities.	Ziriruk and Fly Camp	Operations	Likely	Major	Very High
S39	Increased health problems through greater use of mercury as new settlers revert to alluvial mining as an income source (and use mercury in the recovery process).	In-migrants in villages along the Wafi and Watut rivers	Operations	Unlikely	Moderate	Moderate
S32	Health problems resulting from substance misuse – increased consumption of betel nut, alcohol, tobacco and/or marijuana as a result of an increase in disposable income	Individuals who have higher cash incomes due to employment, royalty or compensation payments and/or business activities; families of people consuming betel nut, alcohol, tobacco and/or marijuana	Life of Mine	Possible	Moderate	High
S31	Increased domestic responsibilities placed on women and potentially children where villages have a high level of male Project employment.	Tier 1 and Tier 2 communities, particularly women from villages with high levels of male Project employment	Construction	Almost certain	Moderate	Very High
S28	Disruption to sense of place due to awareness that mining-related activities have physically disturbed or restricted access to certain places.	Tier 1 communities, particularly Hekeng, Venembele, Nambonga and Babuaf villages of Wori, Wongkins, Madzim, Kapunung, Papas and Ziriruk	Life of Mine	Possible	Moderate	High
S36	Reduction in State's capacity to provide health services due to staff seeking employment at the mine	Across study area	Construction	Possible	Minor	Moderate
S37	Increased pressure on local health facilities due to an increase in population resulting from in-migration.	All villages in study area	Construction	Possible	Minor	Moderate

18.3.2.6. Education

An increase in the level of government funding via distribution of royalties should occur as a result of development of the Project. Some of these funds may be allocated by the provincial and local governments to improve the quality of education facilities in the Project Area and/or broader region. Improved access and higher income levels should also enable a greater proportion of primary school graduates to attend secondary or vocational schools. Such improvements would lead to long-term improvements in literacy and

Should a rapid increase in the population be experienced in villages within this study area (see Section 18.3.2.2, In-migration), schools may experience added pressure to that which is already being experienced (available classrooms, class sizes) following the introduction of the Tuition Fee Free Policy in 2012. In addition, some teachers may seek employment with the Project.

Children from villages without elementary schools need to travel to other villages to attend. Attendance is lower among children from such villages, and those that attend often commence at a later age. Although most Papua New Guineans place a high priority on education, evidence from other large-scale mines in PNG is that school attendance is low among the children of resource landowners. Potentially, the perceived importance of education is diminished as a result of cash payments (such as royalties and compensation) (Gylfason, 2001). Improved employment prospects may similarly diminish the perceived importance of education, particularly for working-age students (who may seek employment instead of progressing their education) and particularly during the construction phase (when employment opportunities are greatest). This impact is tempered by the individual's career aspirations, and would not be applicable where an individual seeks not to work in any job related to the Project.

Table 18.10 presents the key potential impacts associated with education in Study Area 1.

18.3.2.7. Community Cohesion and Law and Order

As a whole, PNG is undergoing substantial change, including changes associated with rapid population growth, increased mobility, urbanisation, vastly improved communications and a greater awareness of western socioeconomic practices, a diminishing observance of traditional leadership practices, and a greater preference for individual wealth. The Project will compound the above changes in Study Area 1 villages that have not had to address changes of this magnitude in the past. This includes:

- Entering into formal agreements between multiple tribes or clans
- Accommodating mining operations on traditional land
- Accommodating an influx of people from other parts of PNG and overseas
- Dealing with large sums of money

These changes alone will likely challenge the traditional leadership within this study area. Baseline results indicate that people in this study area have limited formal education which may result in difficulty understanding the proposed changes and longer-term impacts. Younger men, particularly those that are relatively well educated and speak English, may become increasingly important in engagements with the government, WGJV and other cultural groups/clan groups.

Table 18.10: Potential impacts related to education (Study Area 1)

Note: blue shading indicates positive impact

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S44	Long term improvements in education, literacy levels and vocational training as a result of improved education facilities, improved access to secondary and tertiary schools and workplace training	All villages in study area	Operations	Possible	Moderate	High
S45	Increased pressure on local schools due to an increase in the population resulting from in-migration.	All villages in study area	Life of Mine	Possible	Minor	Moderate
S46	Reduction in State's capacity to provide education services due to staff seeking employment at the mine	Across study area	Construction	Unlikely	Minor	Low
S47	Reduction in school attendance due to a perception that education is not important (due to potential future income from mine employment and/or mine payments)	School-age children (especially older school-age children nearing or at working age). Tier 1 villages particularly.	Life of Mine	Likely	Minor	Moderate

Additionally, within PNG, large-scale projects have often been viewed as an opportunity to advance local economic development. There are strong community expectations that any large-scale project will provide substantial project benefits to local communities. Project benefits for this Project include contributions by the WGJV for provincial and local community development projects across the health, education, sustainable livelihoods, environment and other program areas.

The Project has the potential to contribute to a decline in community cohesion and a rise in law and order problems as a result of:

- Disputes over the identification of Project landowners due to the importance attached to clan land boundaries in determining the financial beneficiaries of the Project, and/or Project benefit entitlements
- Disputes over the allocation and/or management of Project benefits
- Resentment and disputes over perceived fairness of recruitment process and/or procurement decisions
- Pressures on family relationships (possibly including domestic violence) arising from adultery (suspected or actual), uneven distribution of domestic responsibilities placed on family members, or employment-related separation between family members for extended periods of time
- Higher income levels, which may lead to increased consumption of alcohol, which has clear linkage with the prevalence of criminal activity including theft, assault and domestic violence
- Increased consumption of betel nut, tobacco, drugs (e.g., marijuana) and increased gambling
- Dissatisfaction that local workers are not provided with camp accommodation, which provides food, hot showers and a peaceful sleeping environment
- Increased community tension during demobilisations of workforce, arising from individuals having unfulfilled expectations of long-term employment and/or unpreparedness over being demobilised
- Environmental damage (or claims of environmental damage) leading to community tensions
- Damage to or destruction of sites of cultural significance (or claims of damage to sites of cultural significance)
- Accidents and/or fatalities in the workplace or along the access roads and the Highlands Highway

In addition, some community members may expect the benefit of increased employment and procurement, or royalties and compensation payments, to be distributed in a particular manner. The range of potential expectations is very broad and idiosyncratic. Where expectations are not met (whatever the reason), tensions may arise to the detriment of social cohesion. Perceived unfairness may escalate into law and order issues.

A similar dissatisfaction may arise in those who are employed by the Project. Although securing employment will likely be perceived as a benefit, there may be discontent with low-paid jobs or limited opportunities for promotion. Such discontent is most likely to arise in situations where workers from outside the study area have skills or experience that qualify them for higher-paid jobs. While the WGJV will recruit on merit and apply the recruitment preferences as outlined in Section 18.3.2.1.1, Employment, perceived unfairness may lead to discontent. Traditional leaders have limited experience and/or limited responsibilities in dealing with many of the above factors, which may exacerbate law and order problems outlined above.

The main law and order impacts expected to result as a consequence of Project development relate to land disputes and socioeconomic problems associated with rising income levels. Land disputes may be significant because of the importance attached to clan land boundaries in determining the financial beneficiaries of the Project. Rising income levels are likely to be associated with increased consumption of alcohol, which is associated with a range of crimes, including stealing, fighting and domestic violence (Dinnen, 2001, p. 56).

Project-induced in-migration also has the potential to contribute to law and order problems. This may arise due to conflict over subsistence resource access and disrespect and/or lack of knowledge regarding local customs. It can also be difficult to address law and order problems involving outsiders who may not speak the local languages or who may not acknowledge traditional leaders. Some of the adverse socioeconomic impacts resulting from in-migration and affecting community cohesion may include:

- Conflict over subsistence resource use and access (including gardening areas, forest products, hunting, fishing and potentially alluvial gold) and over cultural norms
- Disruption of cultural values and traditions
- Exacerbation of law and order issues as a result of illegal activities by in-migrants seeking opportunities to earn income, find housing, or meet subsistence needs
- Increased incidence of communicable diseases (STIs) associated with unsafe sexual practices that may occur from in-migrants seeking opportunities in prostitution

The interaction between law and order personnel and Project-affected communities may also give rise to adverse impacts. A risk of physical harm, violations of legal rights or associated stress may materialise if police authority, deployed in connection with the Project, is exercised with unwarranted or disproportionate force. Corresponding risks may also arise in relation to the use of force by Project security personnel, although the WGJV can influence the behaviour of Project security personnel as Project security personnel will be engaged by and report to the WGJV.

Table 18.11 presents impacts related to community cohesion and law and order.

18.3.2.8. Tradition and Culture

As discussed in Section 12.4.10, Traditions and Culture, Study Area 1, customary practices continue to be a part of village life within this study area, although respondents to surveys in 2014 indicated that these practices are not as prevalent as they once were. Practices identified include sing-sings with neighbouring villages, oral traditions (i.e., traditional storytelling), dancing, physical separation of women while pregnant to a separate house or area, rituals with respect to the productivity of gardens (particularly when establishing new gardens), medicinal practices, drinking and eating customs and respect for elders.

The Project will expose Tier 1 and, in some cases, Tier 2 communities to new experiences and economic opportunities, which may challenge or otherwise bring about changes to tradition and culture.

Baseline results indicated that people in the Project-affected communities have limited formal education which may pose difficulty in understanding the proposed changes, agreements and longer-term impacts associated with the proposed mine development. Younger men (particularly those that are relatively well educated and speak English) are likely to become increasingly important in negotiating agreements with the government, proponent and other tribes/clan groups. This may lead to changes to the traditional leadership of villages and within cultural groups.

Table 18.11: Potential impacts related to community cohesion and law and order (Study Area 1)

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S73	Reduction in social cohesion as a result of Project benefit expectations not met	All villages within study area, but Tier 1 villages in particular	Life of Mine	Possible	Moderate	High
S75	Disputes over land ownership due to the importance attached to clan land boundaries in determining entitlement to direct compensation and/or the allocation of Project benefits.	All villages within study area, but Tier 1 villages in particular	Construction, Operations	Likely	Major	Very High
S76	Law and order problems as a result of perceived unfairness in the distribution of royalties, compensation, and/or employment/procurement opportunities.	All villages within study area, but Tier 1 villages in particular	Life of Mine	Possible	Moderate	High
S77	Community tensions as stimulated cash economy leads to shift in social and leadership structures	Across study area but Tier 1 villages particularly	Life of Mine	Likely	Major	Very High
S78	Community tensions and disputes arising from in-migration (e.g., over subsistence resources, disorderly behaviour and disregard for local landowner authority)	Tier 1 and Tier 2 communities in particular and new settlers	Life of Mine	Likely	Moderate	High
S79	Discontent with low paid jobs and lack of promotion opportunities for locals	Across study area but Tier 1 villages particularly	Life of Mine	Possible	Moderate	High
S81	Concerns over environmental damage resulting in stop work protests, damage to Project infrastructure, threats/assault of Project employees, and other law and order problems	All villages within study area, but Tier 1 villages in particular	Construction, Operations	Possible	Moderate	High
S82	Disruption of community cohesion resulting from: * Increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income * Disputes arising from increased gambling as a result of higher income levels.	All villages within study area, but Tier 1 villages in particular	Life of Mine	Likely	Minor	Moderate
S83	Inappropriate use of force by public security personnel deployed in connection with the Project	All villages within study area, but particularly in-migrants and settlers within study area	Construction, Operations	Possible	Moderate	High
S84	Inappropriate use of force by private security personnel deployed in connection with the Project	All villages within study area, but particularly in-migrants and settlers within study area	Construction, Operations	Possible	Moderate	High

Involvement in the Project may also lead to some traditional practices and cultural norms receiving less attention. A potential decline in local languages (*tok ples*) may result as English and Tok Pisin become the language used to interact with the Project, migrants and other businesses. Villagers who gain Project employment may have less time to attend practices, events or to assist community organisations that may provide support for sick, disabled or other vulnerable groups.

The Project may therefore contribute to a decline in time allocated to traditional and cultural practices, and potentially, a decline in the importance attached to these practices.

A number of oral tradition sites of contemporary importance to the local people may also be directly or indirectly impacted as a result of Project development. With respect to direct impacts, the Project will implement culturally and legally sanctioned management measures to conserve this heritage with the agreement of the relevant owners of the stories. Specific impacts on cultural heritage sites are discussed in Chapter 20, Cultural Heritage Impact Assessment. Table 18.12 presents impacts related to tradition and culture.

18.3.2.9. Traffic

Potential impacts associated with Project use of roads in this study area are discussed in this section. Impacts relating to an increased risk of traffic accidents are discussed in Section 18.3.2.5, Community Health and Safety.

As discussed above, during the construction phase, daily truck movements along the Northern Access Road and Highlands Highway are conservatively estimated to be between 30 and 37 trucks, per traveling direction per day, seven days a week. The Highlands Highway is currently a busy roadway, with weekday vehicle traffic loads of approximately 800 per day, and weekday traffic of over 500 vehicles per day. Baseline traffic surveys conducted in 2014 and 2015 estimated that an average of 40 trucks travelled the Highlands Highway per day – equivalent to a 40% increase in truck traffic and a 4% increase in total traffic during construction.

During the Operations phase of the mine, traffic movements are conservatively estimated as four to ten trucks per travelling direction per day, seven days a week, resulting in a negligible impact to traffic movements on the Highlands Highway.

The Demakwa Access Road may need to be upgraded during the early stage of construction to improve the safety of the road while the Northern Access Road is being constructed. Temporary disruptions to traffic may arising due to these upgrade works. Following the construction of the Northern Access Road as the main access route to the Mine Area, WGJV staff and contractor use of the Demakwa Access Road is expected to reduce.

The construction of the Northern Access Road, Watut Services Road and Resettlement Road would improve the ability of residents of the Lower Watut Valley to access services, markets and other destinations along the Highlands Highway and in Lae (see Section 18.3.2.1.4, Local Economy).

Table 18.13 presents population growth as a standalone impact, with flow-on effects of in-migration addressed under other categories.

18.3.3. Proposed Management Measures

Table 18.4 presents the management measures proposed for this SEIA. As a step in the impact assessment process (see Section 18.1.2, Impact Assessment Process), the identification of management measures was undertaken iteratively with impact identification, and initial and residual impact assessment. The management measures proposed are drawn together into a number of management plans within the WGJV Environmental and Social Management Framework. This framework is discussed further in Section 18.8.

Table 18.12: Potential impacts related to tradition and culture (Study Area 1)

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S72	Disruption to existing cultural ties, traditions, language and sense of place as a result of Project development.	Particularly Tier 1	Life of Mine	Possible	Moderate	High
S102	Less time available to participate in traditional and cultural practices, including diminished ability to care for sick, disabled or other vulnerable persons	Particularly Tier 1	Construction, Operations	Possible	Moderate	High

Table 18.13: Potential impacts related to traffic (Study Area 1)

Ref	Impact	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S106	Disruptions to traffic as a result of: * Project truck movements * Upgrade to Demakwa Access Road	Tier 1 and Tier 2 villages, particularly individuals who frequently use the Highlands Highway, and the villages of Bavaga, Gingen, Dengea, Zimake and Timini which are proximate to the Demakwa Access Road	Construction	Likely	Minor	Moderate

Table 18.14: Proposed management measures for socioeconomic impacts

ID	Title	Description
Proposed Social Management Measures (SMM) contained within the Project Social Management Plan		
SMM1	Health Awareness Program (communities)	In partnership with government and non-government agencies, implement a Health Awareness Program in Project-affected communities addressing key issues of: diet and lifestyle change; lifestyle risk management; preventative health; village hygiene; and risks associated with the use of mercury for alluvial mining.
SMM2	Facilitate public health service delivery	In partnership with government and non-government health agencies, facilitate the effective operations of clinic and aid post operations in Project-affected villages.
SMM3	Village water and sanitation improvement	In partnership with local-level government and other relevant agencies and organisations, facilitate the improvement of water (reliability, quality, quantity) and sanitation facilities (hygienic disposal) in Project-affected villages.
SMM4	Environmental Management Plan	Implement the Environmental Management Plan (Attachment 3). Management measures of particular relevance to the management of socioeconomic impacts include those relating to: <ul style="list-style-type: none"> • Informing villagers in areas potentially affected by dust generation of upcoming work with the possibility to generate dust that may affect them. • Applying dust suppression measures, such as spraying exposed surfaces with water; spraying down water during dry conditions and peak working hours, or if dust becomes a potential nuisance or hazard. • If all available methods of dust prevention and suppression fail to suppress dust, and if unacceptable impacts on sensitive locations become evident, temporarily halting construction activities until dust-generating conditions subside. • Providing advanced notice of high-noise activities and the respite periods that will be employed for all activities located in the vicinity of sensitive receptors and, where practicable, scheduling during periods of the day that will result in the least disturbance. • Minimising the number of vehicles passing through villages. • Where practicable, limiting the hours of operation of noisy/vibratory equipment or activities, vehicles, plant and equipment operating near to community areas; limiting night works, as much as practicable.
SMM5	Health monitoring	Work with government to establish a health baseline for Tier 1 and 2 villages and undertake regular monitoring of public health in order to detect emerging issues early.
SMM6	Safety Awareness and Behaviour Program	Deliver a program to Project-affected communities including schools in Project-affected communities to raise awareness of risks to safety posed by Project activities, and personal behaviours which can reduce risk and improve safety.
SMM7	Work site safety plan to manage site incursions by local villagers	Work sites to actively monitor and restrict incursions of non-workers onto or across work sites, particularly if the sites are unfenced. Establish a checkpoint on roads to monitor traffic and admit authorised vehicles only.
SMM8	Workforce Code of Conduct	Develop, implement and monitor compliance with a workforce code of conduct that governs internal workforce interaction and interaction between the workforce and Project-affected communities.

ID	Title	Description
SMM10	Location of business activity to discourage development of informal settlements	Work with communities and LLGs to discourage the development of informal settlements along Project access routes and in the vicinity of Project facilities by appropriately locating markets and other businesses.
SMM11	Facilitate the development of local-level law and order institutions	In partnership with local level governments and other relevant agencies and organisations – facilitate the development of local law and order institutions (e.g., village courts and local police).
SMM12	Facilitate local organisations to implement activities aimed at building social capital	In partnership with local level governments, NGOs and local churches – facilitate the development of internal capacity within community residents to self-manage issues that have the potential to induce social conflict and tension.
SMM13	Resettlement management	<p>Develop and implement the Resettlement Management Plan, in accordance with the Resettlement Policy Framework approved by the WGJV Participants and lending institutions. Resettlement management will include, as appropriate:</p> <ul style="list-style-type: none"> • Compensation for loss of assets at replacement cost • Provision of adequate replacement housing with security of tenure • Improving or maintaining the livelihoods and standards of living of displaced persons • Assistance to quickly and sustainably re-establish livelihoods and standards of living (e.g., by establishing gardens at new locations before the previous garden is lost through displacement) <p>Displaced communities will be engaged in resettlement planning and implementation, in a thorough, fair, equitable and transparent manner that fosters their full participation and respects human rights.</p>
SMM14	In-migration management	<p>Develop, negotiate and implement in-migration management measures in collaboration with local communities and government, as captured within the In-migration Management Plan (see the Project Social Management Plan, Attachment 4). In particular, as per the In-Migration Management Plan, manage in-migration by:</p> <ul style="list-style-type: none"> • Limiting site access e.g., through development of SML land use, access and management protocols, engagement with local authorities and landowners to actively monitor and enforce a policy of moving illegal occupants from informal settlement locations and controlling Project access roads • Limiting land availability for informal settlements to be established • Communicating and establishing a no-gate hire policy with contractors and establish an employment office remote from the mine area • Establishing closed accommodation facilities for all non-local workers with restricted interaction between camp residents • Developing a journey management protocol that reduces the potential for roadside stalls developing in unsafe or unfavourable areas • Working with local authorities to discourage informal settlements along Project roads • Developing and implementing a workforce Code of Conduct which establishes practices for behaviour both in the workplace and when engaging with community members

ID	Title	Description
		<ul style="list-style-type: none"> Working with regulatory authorities and local landowners to secure exclusive local landowner rights to alluvial mining opportunities in or near the Project Area, and develop cooperation protocol to restrict employment on artisanal and small-scale mining sites to existing local residents Developing and implementing stakeholder engagement processes to communicate policies and plans to affected and interested stakeholders Limiting community access to Project facilities (e.g., workforce health centre) to emergencies only In partnership with Morobe Provincial Government, facilitating regional development planning that promotes opportunities and growth throughout the Province to reduce focus on opportunities associated with the Project In partnership with local and provincial governments, facilitating the development of government plans to establish new growth centres that are remote from Project operations Educating key stakeholders, including community members, WGJV staff, government administrators, and service delivery providers on the risks, issues and limited opportunities associated with in-migration Developing a forum for community members to discuss their concerns about in-migration and to jointly develop solutions and community specific assistance for limiting in-migration
SMM16	Public engagement on DSTP	Regular engagement with communities and organisations to disseminate information on DSTP – including regular presentation of monitoring results regarding marine ecosystem health.
SMM17	Consultation to assist women undertaking domestic duties	Consult with communities (women's groups particularly) to discuss and potentially implement, in partnership with communities, local level government and/or Morobe Provincial government, ways to reduce workload of domestic responsibilities (e.g., water collection, cooking, firewood collection).
SMM22	Health Awareness Program (workforce)	Develop a Health Awareness Program for Project employees and contractors addressing key issues of diet and lifestyle change; lifestyle risk management; preventative health; and hygiene.
SMM19	Education promotion program	Develop an education program that promotes education within local communities.
SMM20	Respecting existing local ties, traditions and sense of place	Manage the loss of, or restricted access to land or assets, by conducting land access in a transparent manner that enables landowners the opportunity to relinquish access to an area in a culturally appropriate manner.
SMM21	Transparent and fair land access	Manage the loss of land or assets, which may require relocation of residents, by conducting land access in a manner that promotes transparency and the fair treatment of customary landowners in PNG.
SMM25	Lae pre-construction consultation	Work with local and provincial government to consult with stakeholders in Lae in advance of and during construction of the Infrastructure Corridor, in order to manage traffic and access impacts.

ID	Title	Description
SMM26	Managing the potential increase in spread of tuberculosis	Work with government and health organisations to facilitate a tuberculosis prevention and control program aimed at: <ul style="list-style-type: none"> • Providing education to workers on tuberculosis and its prevention • Seeking accurate diagnosis of tuberculosis before assignment • Providing advice to diagnosed individuals to seek appropriate treatment • Following up with family members of workers diagnosed with tuberculosis • Requiring medical clearance for return to work for all workers diagnosed with tuberculosis • Notifying relevant government agencies of tuberculosis cases
SMM27	Facilitate police training on the Voluntary Principles on Security and Human Rights	Facilitating police training on the Voluntary Principles on Security and Human Rights.
SMM28	Training security personnel in the Voluntary Principles on Security and Human Rights	Provide training in Voluntary Principles on Security and Human Rights to Project security personnel.
SMM29	Control of emissions from power generation facilities	Implement design and management measures as required to comply with adopted air quality criteria. Undertake targeted monitoring of ambient sulphur dioxide at Ziriruk and Fly Camp during the early stages of the operations phase to confirm compliance with the adopted air quality criteria.
Proposed National Content Measures (NCM) contained within the WGJV National Content Plan		
NCM1	Implementation of local hire preference policy	Implement a hiring policy that targets local landowners and residents of communities in proximity to the Project on the basis that it is they who stand to be most impacted by the presence of the Project. Communicate to the community the recruitment process which requires applicants' place of origin to be identified.
NCM2	Workforce remuneration options	Build options into the WGJV workforce remuneration structure to enable workers to direct income to medical, education and savings initiatives.
NCM3	Site accommodation amenity	Give WGJV workers the opportunity to maintain health and fitness-for-work status, site accommodation facilities will be provided with a range of recreational facilities.
NCM4	Employee training and development programs	Implement a range of training and development initiatives that develop WGJV workforce capability both on and off the job. Initiatives will include but not be limited to literacy and numeracy training, trade skill training, tertiary scholarships and cultural awareness.
NCM5	Community workforce preparedness program	As the construction phase of the Project is when the highest demand for labour will occur, undertake community pre-employment training in the pre-construction phase to provide local community residents with opportunities to secure employment.

ID	Title	Description
NCM6	Establish and support the operation of an Enterprise Development Centre	In association with the Lae Business Council and other Government organisations, promote the establishment of an Enterprise Development Centre in Morobe Province. The Enterprise Development Centre will assess and assist local businesses with the potential to supply the Project, identify skills gaps, provide training to help them build business skills and compete more effectively for supply of goods and services to the Project. The Enterprise Centre will establish and operate a Supplier Database to match local suppliers with goods and services required by the Project.
NCM7	Community use of road infrastructure	The Northern Access, Watut Services and Resettlement roads will be public roads. The Mine Access Road will be a private road for the exclusive purposes of the Project.
NCM8	Agricultural development support program	The WGJV will support the development of agriculture in the mine area to diversify income generation and reliance on Project-generated income. This could include the expansion of existing commodities (such as cocoa) and the diversification into alternative commodities or value-adding activity such as food production and processing, or biomass production.
NCM9	Small-scale service provision program	Through the Enterprise Development Centre, assist local community residents to establish small-scale enterprises (transport, retail, mechanical maintenance, food vending, etc.).
NCM10	Local participation in the Project supply chain	The Project procurement strategy will consider options for engaging with local medium scale enterprises for participation in the Project supply chain during construction and operations.
NCM11	Support for Provincial service delivery programs	Work with Provincial and Local Level Governments to support priority initiatives in health, education and law and order service delivery.
NCM12	Individual capability development	In partnership with local-level government, NGOs and local churches, facilitate the delivery of capability development initiatives for village residents in the areas of personal viability, local organisation leadership and targeted female and youth development activity.
NCM13	Community capability development	In partnership with local-level government, NGOs and local churches, facilitate the delivery of capability development initiatives for village leaders and groups, targeting project planning and management, local advocacy, partnership development and conflict resolution.
Proposed Land Access Management Measures (LAMM) contained within the LAMP		
LAMM1	Management of compensation obligations	Develop and implement procedures for the registration of land owners, recording damages and payment of compensation.
LAMM2	Tenement land inspection and management	Implement an on-going program of land management to support compliance with permitted land uses, including measures to manage illegal occupants on tenement land.
Proposed Management Measures drawn from Stakeholder Engagement Management Plan		
SEMP1	Stakeholder Engagement and Management Plan including Concerns,	Communicate with stakeholders; document communication and engagement activities; and maintain a Concerns, Complaints and Grievance Procedure. Include pre-construction stakeholder engagement in Lae, enabling WGJV, and Provincial and local level governments to coordinate in relation to construction of the Infrastructure Corridor within urban areas.

ID	Title	Description
	Complaints and Grievance Procedure	
Proposed Management Measures drawn from Cultural Heritage Management Plan		
CHMP1	Cultural Heritage Management Plan	Implement the Cultural Heritage Management Plan (Attachment 5).
Proposed Management Measures drawn from Traffic Management Plan		
TMP1	Traffic Management Plan	<p>Implement the Traffic Management Plan, which includes measures for the management of road and pedestrian traffic. Implement measures to prevent injuries to road users and damage to public assets in relation to project activities. Road initiatives will include:</p> <ul style="list-style-type: none"> • Checking all WGJV drivers have the relevant level of competency for the vehicle they need to drive • Establishing and enforcing speed limits for WGJV vehicles • Conducting regular vehicle inspections • Requiring drivers to carry relevant licences • Implementing driver fatigue management • Avoiding, where practicable, dangerous routes and times of day e.g., night time driving • Conducting blood pressure and blood glucose monitoring of project drivers • Running safety awareness and education programs for impacted communities, including school programs • Coordinating with emergency responders to provide first aid in the event of accidents
TMP2	Advance warning of changes in traffic conditions	Notify relevant communities as required about of significant changes in traffic conditions (e.g. high project traffic periods or road/ river diversions/ blockages) and the associated hazards with these changes.
Proposed Management Measures drawn from Security Management Plan		
SECMP1	Security Management Plan	<p>Implement a Security Management Plan (or a security component in a broader management plan) that includes the following measures:</p> <ul style="list-style-type: none"> • Implement security controls to protect the safety of Project employees • Investigate to determine whether security personnel have participated in past human rights abuse • Provide training in the use of force and conduct toward workers and the local community for all security workers • Conduct evaluations on the performance of security providers • Conduct community engagement on security arrangements • Investigate credible allegations of unlawful behaviour or acts of abuse by private security personnel and taking action (or urging the appropriate parties to take action) to prevent recurrence

18.3.4. Residual Impact Assessment

The initial impact assessment identified 63 socioeconomic impacts for Study Area 1, of which 50 were adverse impacts and 13 were positive. Of the 50 adverse impacts, prior to the application of management measures, 12 were assessed as being of very high significance, 26 were high, 11 were moderate and 1 was low. Of the 13 positive impacts, 2 were initially assessed as very high, 8 were high, 2 were moderate and 1 was low.

The implementation of the proposed management measures is intended to enhance people's ability to realise opportunities and avoid or reduce potential adverse socioeconomic impacts of the Project. Table 18.15 provides an assessment of socioeconomic impacts for Study Area 1, following the implementation of management measures. Some residual impacts retain the same overall significance rating, notwithstanding a change in the likelihood and/or consequence rating. A summary of those adverse residual impacts that retain a very high or high level of significance is provided below.

18.3.4.1. Very High Residual Impacts for Study Area 1

In summary, five adverse impacts remained of very high significance after the implementation of management measures:

- Population growth from in-migration (S105).
- Road safety: Traffic and pedestrian accidents along the Demakwa Access and Wafi Access roads (S26), and the Northern Access, Watut Services, and Resettlement roads (S27).
- Public health: An increase in HIV/AIDS and other sexually transmittable infections, affecting in particular Tier 1 and Tier 2 communities, arising from high-risk behaviour associated with higher levels of disposable income, increased mobility and/or Project-induced in-migration (S35).
- Law and order: Land ownership disputation due to the importance attached to clan land boundaries in determining entitlement to direct compensation, and/or the allocation of Project benefits (S75).

Experience from other large-scale industrial projects in PNG indicates that population growth from in-migration could be considerable (S105). The In-migration Plan (which is a component of Attachment 4, Project Social Management Plan) is proposed as a management measure (SMM14). Key components of this management measure include working with communities and government to discourage and manage in-migration, establishing recruitment points away from the Mine Area, communicating recruitment preferences, and limiting site access and land availability for settlements.

It is anticipated that landowners will play an active part in managing in-migration by people who are not affiliated with landowners' clans. Land in the Lower Watut River floodplain is also prone to flooding, which may discourage longer-term settlement. However, the proximity of the Mine Area to the Highlands Highway and Lae facilitates in-migration. The potential to sell products derived from land and water resources to Lae (in particular, firewood), or to undertake alluvial mining, would remain powerful attractors for in-migration. Consequently, the residual significance of population growth from in-migration remains very high, even after the implementation of management measures.

Road safety remains an issue of very high significance (S26 and S27). Due to the mountainous conditions, steep gradients, sharp bends and stretches with reduced visibility, speed limits apply on the Demakwa Access and Wafi Access roads. The roads are signed and safety requirements are communicated to WGJV staff and contractors and the villages

that use these roads. While WGJV can enforce and monitor the speed of its staff and contractors, it cannot do so for third-party vehicles. For this reason, the residual impact for the use of these roads remains very high.

The Northern Access and Mine Access roads, by comparison, will serve as a safer transport route to the proposed Mine Area. However, the Northern Access Road will be established in an area which currently does not experience vehicular traffic and road safety awareness, for some villages, is potentially quite poor. Wafi-Golpu Joint Venture will deliver a Safety Awareness Program (SMM6) to villages along the Northern Access Road but, as with the Demakwa Access and Wafi Access roads, it is the responsibility of individual motorists to drive safely. The residual impact assessment for the use of this road remains very high, even though it would bring substantial benefits to Tier 1 and Tier 2 communities in terms of improved access.

With regard to S35, the critical areas experiencing PNG's HIV/AIDS epidemic are closely aligned with the nation's major economic corridors. Communities along the Highlands Highway exhibit high rates of HIV transmission. Higher income may result in incentives for prostitution, or existing widespread 'non-sex work' practices that involve exchanging gifts or money for sex, could nevertheless increase the risk of contracting HIV and other STIs. While WGJV will take steps to alert people to the danger of risky sexual practices, individuals will ultimately make decisions about their health. The residual impact therefore remains very high.

With respect to disputes over land ownership and the allocation of Project benefits (S75), customary land owner boundaries for the proposed Mine Area are not finalised, despite several major court decisions. The impact of these decisions has generated tension between the Yanta, Hengambu and Babuaf in relation to land ownership. While work is ongoing to demarcate land boundaries and communities have largely expressed their support of the Project, relationships between the groups can at times be tense and strained. The residual impact therefore remains very high.

18.3.4.2. High Residual Impacts for Study Area 1

Seven potential impacts retain a significance rating of high following the implementation of management measures.

Two relate to community health and safety:

- Increased domestic responsibilities placed on women and potentially children where villages have a high level of male Project employment (S31). This impact would be exacerbated by predominantly male mine employment, coupled with current social structures that favour men in terms of decision-making. These factors are anticipated to lead to moderate indirect domestic pressures on women being considered likely. The WGJV will implement proactive measures to promote gender equity.
- Injury or potential death as a result of small-scale mining in the subsidence zone or the waste rock dumps following mine closure (S42). Any person who seeks to undertake illegal small-scale mining activity within the subsidence zone or on the waste rock dumps post-closure may risk injury or death. While WGJV will seek to ensure post-mining landforms are stable and that community members understand the risks, the consequence of illegal mining has the potential to be major.

Three relate to physical and economic displacement, and land and water resources:

- Physical and economic displacement of households and livelihood assets (specifically Hekeng, Venembele and Nambonga) (S71)
- Loss of income currently obtained from alluvial mining, due to access restrictions imposed by the Project (S15) – particularly as SML 10 is intended to be closed to public access
- Reduction in availability or access to land- and water-based resources as a result of mine development and/or access restrictions (economic displacement) (S54)

Resettlement management (SMM13) will be guided by the WGJV Resettlement Policy Framework and Resettlement Management Plan (see Attachment 4, Project Social Management Plan). Key principles include the provision of replacement housing with security of tenure, and improving or maintaining the livelihoods and standards of living of those displaced. Compensation of lost or damaged assets would be payable (LMM1).

Two relate to community cohesion and law and order:

- Community tensions as stimulated cash economy leads to shift in social and leadership structures (S77)
- Community tensions and disputes arising from in-migration (e.g., over subsistence resources, disorderly behaviour and disregard for local landowner authority) (S78)

The WGJV will support law and order institutions such as village courts and local policing, as well as service delivery by the Provincial government. Capability development at the community and individual levels will also be promoted.

Table 18.15: Residual impact assessment for Study Area 1
Note: blue shading indicates positive impact

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S1	Increase in local employment during construction	Employment, procurement, Project payments & local economy	Tier 1 and young men in particular	Construction	Possible / Major Very High	NCM1: Implementation of local hire preference policy NCM4: Employee training and development programs NCM5: Community workforce preparedness program	Likely / Major Very High
S101	Increased income and liquidity from Project payments	Employment, procurement, Project payments & local economy	Landowners – particularly Tier 1	Life of Mine	Almost certain / Major Very High	LAMM1: Management of compensation obligations NCM12: Individual capability development NCM13: Community capability development	Almost certain / Major Very High
S11	Increase in incomes as a result of improved road access to produce and cash crop markets in Zifasing and Lae	Employment, procurement, Project payments & local economy	Communities near the proposed Northern Access, Watut Services and Resettlement roads	Life of Mine	Possible / Moderate High	NCM6: Establish and support the operation of an Enterprise Development Centre NCM7: Community use of road infrastructure NCM8: Agricultural development support program NCM9: Small-scale service provision program	Likely / Moderate High

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S112	Increase in local procurement during Project construction	Employment, procurement, Project payments & local economy	Businesses and employees of businesses within study area; Tier 1 Lancos in particular	Construction	Possible / Moderate High	NCM9: Small-scale service provision program NCM10: Local participation in the Project supply chain NCM12: Individual capability development NCM13: Community capability development NCM8: Agricultural development support program	Likely / Moderate High
S114	Increased or ongoing local procurement during Project operations	Employment, procurement, Project payments & local economy	Businesses and employees of businesses within study area; Tier 1 Lancos in particular	Operations	Unlikely / Minor Low	NCM9: Small-scale service provision program NCM10: Local participation in the Project supply chain NCM8: Agricultural development support program	Possible / Minor Moderate
S13	Increase in village business income (trade stores, agribusinesses, etc.) as a result of higher local income levels	Employment, procurement, Project payments & local economy	Small business operators	Life of Mine	Likely / Moderate High	NCM6: Establish and support the operation of an Enterprise Development Centre NCM8: Agricultural development support program NCM9: Small-scale service provision program NCM12: Individual capability development	Almost certain / Moderate Very High
S8	Increased or ongoing local employment during operations	Employment, procurement, Project payments & local economy	Tier 1 and young men in particular	Operations	Possible / Moderate High	NCM1: Implementation of local hire preference policy NCM4: Employee training and development programs NCM5: Community workforce preparedness program	Likely / Moderate High

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S21	Long term improvements in health levels as a result of improved nutrition and improved access to health services (associated with higher levels of income and better road access)	Community health and safety	All villages in study area	Life of Mine	Possible / Moderate High	SMM1: Health Awareness Program (communities) NCM7: Community use of road infrastructure NCM11: Support for Provincial service delivery programs NCM5: Community workforce preparedness program NCM1: Implementation of local hire preference policy	Likely / Moderate High
S48	Direct or improved road access provided to villages in the Mine Area improving access to health facilities	Community health and safety	All villages in study area	Life of Mine	Likely / Moderate High	NCM7: Community use of road infrastructure	Likely / Moderate High
S49	Increased availability and range of store goods	Community health and safety	All villages in study area	Life of Mine	Possible / Minor Moderate	NCM13: Community capability development NCM7: Community use of road infrastructure NCM12: Individual capability development NCM9: Small-scale service provision program	Possible / Minor Moderate
S51	Reduction in canoe/raft accidents as people travel to/from Lae by road (rather than travelling by river)	Community health and safety	All villages in study area, particularly along the lower Watut River, upstream as far as Maralina (where the State-owned road is expected to end)	Life of Mine	Possible / Moderate High	NCM7: Community use of road infrastructure SMM6: Safety Awareness and Behaviour Program	Likely / Moderate High

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S43	Improved education facilities as a result of mine payments made to the provincial or local level governments, or from a Tax Credit Scheme	Education	All villages in study area	Operations	Possible / Minor Moderate	NCM11: Support for Provincial service delivery programs NCM7: Community use of road infrastructure	Likely / Minor Moderate
S44	Long term improvements in education, literacy levels and vocational training as a result of improved education facilities, improved access to secondary and tertiary schools and workplace training	Education	All villages in study area	Operations	Possible / Moderate High	NCM12: Individual capability development NCM13: Community capability development SMM12: Facilitate local organisations to implement activities aimed at building social capital NCM4: Employee training and development programs	Likely / Moderate High
S103	Reduction in income levels as procurement requirements fall at the end of construction	Employment, procurement, Project payments & local economy	Businesses and employees of businesses within study area; Tier 1 Lancos in particular	Construction	Likely / Moderate High	NCM9: Small-scale service provision program NCM10: Local participation in the Project supply chain NCM12: Individual capability development NCM13: Community capability development NCM8: Agricultural development support program	Possible / Minor Moderate
S104	Increased cost in cultural exchanges (e.g., bride price) making it difficult to participate; in the case of marriage, also making it difficult to exit a marriage.	Employment, procurement, Project payments & local economy	People not experiencing increased incomes from the Project; women.	Life of Mine	Possible / Moderate High	NCM12: Individual capability development NCM13: Community capability development	Possible / Minor Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S17	Inflated cost of goods sold in trade stores and markets in local villages making it more difficult to afford store-bought foods, fuel and batteries, particularly for those not receiving income as a result of the Project	Employment, procurement, Project payments & local economy	Across study area - especially those where highest income is expected (Tier 1) and those with improved road access (Tiers 1 and 2).	Life of Mine	Likely / Moderate High	NCM6: Establish and support the operation of an Enterprise Development Centre NCM8: Agricultural development support program NCM9: Small-scale service provision program	Possible / Minor Moderate
S18	Reduction in income levels as Project employment falls at the end of the construction phase	Employment, procurement, Project payments & local economy	Tier 1 and young men in particular	Construction	Almost certain / Moderate Very High	NCM9: Small-scale service provision program NCM12: Individual capability development NCM13: Community capability development NCM4: Employee training and development programs NCM6: Establish and support the operation of an Enterprise Development Centre NCM8: Agricultural development support program	Likely / Minor Moderate
S19	Reduction in income levels as Project employment falls upon mine closure	Employment, procurement, Project payments & local economy	Tier 1 and young men in particular	Closure	Almost certain / Minor High	NCM9: Small-scale service provision program NCM12: Individual capability development NCM13: Community capability development NCM4: Employee training and development programs NCM6: Establish and support the operation of an Enterprise Development Centre NCM8: Agricultural development support program	Likely / Minor Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S105	Population growth from in-migration	In-migration	Particularly Tier 1, and Tier 2 villages along access roads	Life of Mine	Almost certain / Major Very High	SMM14: In-migration management	Almost certain / Moderate Very High
S29	Uncertainty related to future land access, resource usage and community cohesion experienced by those who will or may potentially be resettled.	Physical and economic displacement (Resettlement)	Hekeng, Venembele and Nambonga	Construction	Possible / Moderate High	SMM20: Respecting existing local ties, traditions and sense of place SMM13: Resettlement management	Possible / Minor Moderate
S71	Physical and economic displacement of households and livelihood assets	Physical and economic displacement (Resettlement)	Hekeng, Venembele and Nambonga	Life of Mine	Likely / Major Very High	SMM13: Resettlement management LAMM1: Management of compensation obligations LAMM2: Tenement land inspection and management SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM20: Respecting existing local ties, traditions and sense of place	Likely / Moderate High
S85	Economic displacement (loss of livelihood assets, including gardens)	Physical and economic displacement (Resettlement)	People owning gardens, trees and other livelihood assets, where such assets cannot be avoided through detailed design of the Infrastructure Corridor and proposed Watut Services and Resettlement roads	Construction	Possible / Moderate High	SMM13: Resettlement management LAMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Possible / Minor Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S15	Loss of income (economic displacement) from alluvial mining due to restricted access imposed by the Project (e.g., within SML 10)	Land and water resource use	Tier 1 communities, particularly Gingen, Bavaga, Fly Camp, Hekeng, Venembele, Nambonga and Pekumbe	Life of Mine	Almost certain / Moderate Very High	NCM1: Implementation of local hire preference policy NCM6: Establish and support the operation of an Enterprise Development Centre NCM8: Agricultural development support program SMM13: Resettlement management	Almost certain / Minor High
S16	Loss of income from alluvial mining due to in-migration (increased number of people searching for gold)	Land and water resource use	Tier 1 communities, particularly Gingen, Bavaga, Fly Camp, Hekeng, Venembele, Nambonga and Pekumbe	Construction, Operations	Possible / Moderate High	SMM14: In-migration management	Unlikely / Moderate Moderate
S54	Reduction in availability or access to land- and water-based resources as a result of mine development and/or access restrictions (economic displacement)	Land and water resource use	Tier 1 villages in proximity to the Mine Area	Life of Mine	Likely / Moderate High	SMM13: Resettlement management LAMM1: Management of compensation obligations SMM4: Environmental Management Plan	Possible / Moderate High
S55	Noise from mine operations affecting hunting activities	Land and water resource use	Tier 1 villages in proximity to the Mine Area (Papas and Ziriruk particularly)	Operations	Likely / Minor Moderate	SMM4: Environmental Management Plan SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Possible / Minor Moderate
S56	Noise from construction of the Northern Access Road and Infrastructure Corridor affecting hunting	Land and water resource use	Tier 2 villages in proximity to the Northern Access Road and Infrastructure Corridor	Construction	Possible / Minor Moderate	SMM4: Environmental Management Plan SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Unlikely / Minor Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S57	Increased pressure on the availability of land-based natural resources as a result of in-migration: * Food derived from hunting * Food harvested from naturally occurring plant species * Food from gardens * Trees/other plant species used to make houses * Traditional medicine * Firewood	Land and water resource use	All villages in study area	Life of Mine	Likely / Moderate High	SMM14: In-migration management SMM10: Location of business activity to discourage development of informal settlements	Possible / Minor Moderate
S58	Increased pressure on the availability of traditional medicine as a result of in-migration	Land and water resource use	All villages in study area	Life of Mine	Possible / Moderate High	SMM14: In-migration management	Possible / Minor Moderate
S59	Increased pressure on the availability of water-based resources as a result of in-migration: * Drinking water * Food derived from fishing and collecting in local waterways	Land and water resource use	All villages in study area	Life of Mine	Possible / Moderate High	SMM14: In-migration management SMM10: Location of business activity to discourage development of informal settlements	Unlikely / Moderate Moderate
S110	Increased prevalence of vector-related diseases (such as malaria) as a result of Project infrastructure and/or in-migration.	Community health and safety	All villages in study area, particularly Tier 1 and particularly Papas as the closest village to the proposed raw water and sedimentation dams	Life of Mine	Possible / Minor Moderate	SMM1: Health Awareness Program (communities) SMM2: Facilitate public health service delivery SMM5: Health monitoring	Unlikely / Minor Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S111	Increased prevalence of respiratory diseases (e.g., asthma) due to exposure to sulphur dioxide emissions from operation of the intermediate fuel oil power generation facilities	Community health and safety	Ziriruk and Fly Camp	Life of Mine	Likely / Major Very High	SMM29: Control of emissions from power generation facilities	Remote / Moderate Low
S22	Impaired amenity (e.g., dust, noise) arising from construction and operation	Community health and safety	Hekeng, Papas and Ziriruk	Construction, Operations	Possible / Minor Moderate	SMM4: Environmental Management Plan	Possible / Minor Moderate
S26	Traffic and pedestrian accidents along the Demakwa Access Road and Wafi Access Road	Community health and safety	Tier 1 and Tier 2 communities, in particular residents of villages located along the Demakwa Access and Wafi Access roads	Construction, Operations	Likely / Major Very High	TMP1: Traffic Management Plan TMP2: Advance warning of changes in traffic conditions SMM6: Safety Awareness and Behaviour Program	Possible / Major Very High
S27	Traffic and pedestrian accidents along the Northern Access Road, Watut Services Road and Resettlement Road	Community health and safety	Tier 1 and Tier 2 communities, in particular residents of villages located along the Northern Access Road and in the lower Watut River valley	Construction, Operations	Likely / Major Very High	TMP1: Traffic Management Plan TMP2: Advance warning of changes in traffic conditions SMM6: Safety Awareness and Behaviour Program	Possible / Major Very High
S28	Disruption to sense of place due to awareness that mining-related activities have physically disturbed or restricted access to certain places.	Community health and safety	Tier 1 communities, particularly Hekeng, Venembele, Nambonga and Babuaf villages of Wori, Wongkins, Madzim, Kapunung, Papas and Ziriruk	Life of Mine	Possible / Moderate High	SMM20: Respecting existing local ties, traditions and sense of place SMM21: Transparent and fair land access	Possible / Minor Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S31	Increased domestic responsibilities placed on women and potentially children where villages have a high level of male Project employment.	Community health and safety	Tier 1 and Tier 2 communities, particularly women from villages with high levels of male Project employment	Construction	Almost certain / Moderate Very High	SMM17: Consultation to assist women undertaking domestic duties NCM12: Individual capability development NCM13: Community capability development	Likely / Moderate High
S32	Health problems resulting from substance misuse – increased consumption of betel nut, alcohol, tobacco and/or marijuana as a result of an increase in disposable income	Community health and safety	Individuals who have higher cash incomes due to employment, royalty or compensation payments and/or business activities; families of people consuming betel nut, alcohol, tobacco and/or marijuana	Life of Mine	Possible / Moderate High	SMM22: Health Awareness Program (workforce) SMM1: Health Awareness Program (communities)	Possible / Minor Moderate
S33	Increase in prevalence of lifestyle diseases (non-communicable diseases) in villages near the Project Area as a result of changing diet and physical activity level	Community health and safety	Individuals within Study Area 1 who have higher cash incomes due to employment, royalty or compensation payments and/or business activities	Life of Mine	Likely / Moderate High	NCM3: Site accommodation amenity SMM6: Safety Awareness and Behaviour Program SMM22: Health Awareness Program (workforce)	Likely / Minor Moderate
S34	Increase in the incidence of respiratory diseases (including tuberculosis) as a result of higher population densities in villages near the Mine Area.	Community health and safety	All villages in study area	Life of Mine	Possible / Moderate High	SMM26: Managing the potential increase in spread of tuberculosis SMM1: Health Awareness Program (communities) SMM14: In-migration management	Unlikely / Moderate Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S35	Increase in HIV/AIDS and other sexually transmittable infections arising from high-risk behaviour associated with higher levels of disposable income, increased mobility and/or in-migration	Community health and safety	Tier 1 and young men in particular; sexual partners of those affected by HIV/AIDS and other sexually transmitted diseases	Life of Mine	Almost certain / Major Very High	SMM1: Health Awareness Program (communities) SMM14: In-migration management SMM2: Facilitate public health service delivery NCM11: Support for Provincial service delivery programs SMM22: Health Awareness Program (workforce)	Likely / Major Very High
S36	Reduction in State's capacity to provide health services due to staff seeking employment at the mine	Community health and safety	Across study area	Construction	Possible / Minor Moderate	NCM11: Support for Provincial service delivery programs SMM2: Facilitate public health service delivery	Unlikely / Minor Low
S37	Increased pressure on local health facilities due to an increase in population resulting from in-migration.	Community health and safety	All villages in study area	Construction	Possible / Minor Moderate	NCM11: Support for Provincial service delivery programs SMM14: In-migration management	Possible / Minor Moderate
S38	Increase in gastrointestinal disease due to an influx of people living in unhygienic conditions (e.g., temporary housing with inadequate water supply and/or sanitation).	Community health and safety	All villages in study area	Construction, Operations	Possible / Moderate High	SMM1: Health Awareness Program (communities) SMM3: Village water and sanitation improvement NCM2: Workforce remuneration options SMM14: In-migration management	Unlikely / Minor Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S39	Increased health problems through greater use of mercury as new settlers revert to alluvial mining as an income source (and use mercury in the recovery process).	Community health and safety	In-migrants in villages along the Wafi and Watut rivers	Operations	Unlikely / Moderate Moderate	SMM1: Health Awareness Program (communities) SMM14: In-migration management	Remote / Moderate Low
S41	Injury or potential death to illegal miners as a result of illegal small-scale mining in the subsidence zone or the waste rock dump during mine operations.	Community health and safety	Tier 1 communities, particularly Hengambu and Yanta villages and new settlers	Operations	Unlikely / Major High	SMM7: Work site safety plan scope to manage site incursions by local villagers	Remote / Major Moderate
S42	Injury or potential death to landowners undertaking alluvial mining on their land as a result of small-scale mining in the subsidence zone or the waste rock dump following mine closure.	Community health and safety	All villages in study area	Life of Mine	Possible / Major Very High	SMM7: Work site safety plan scope to manage site incursions by local villagers	Unlikely / Major High
S45	Increased pressure on local schools due to an increase in the population resulting from in-migration.	Education	All villages in study area	Life of Mine	Possible / Minor Moderate	NCM1: Implementation of local hire preference policy NCM11: Support for Provincial service delivery programs SMM14: In-migration management	Unlikely / Minor Low
S46	Reduction in State's capacity to provide education services due to staff seeking employment at the mine	Education	Across study area	Construction	Unlikely / Minor Low	NCM11: Support for Provincial service delivery programs	Unlikely / Minor Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S47	Reduction in school attendance due to a perception that education is not important (due to potential future income from mine employment and/or mine payments)	Education	School-age children (especially older school-age children nearing or at working age). Tier 1 villages particularly.	Life of Mine	Likely / Minor Moderate	NCM11: Support for Provincial service delivery programs SMM19: Education promotion program	Possible / Minor Moderate
S73	Reduction in social cohesion as a result of Project benefit expectations not met	Community cohesion and law and order	All villages within study area, but Tier 1 villages in particular	Life of Mine	Possible / Moderate High	LAMM1: Management of compensation obligations NCM13: Community capability development NCM6: Establish and support the operation of an Enterprise Development Centre SMM12: Facilitate local organisations to implement activities aimed at building social capital SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM12: Facilitate local organisations to implement activities aimed at building social capital	Possible / Minor Moderate
S75	Disputes over land ownership due to the importance attached to clan land boundaries in determining entitlement to direct compensation and/or the allocation of Project benefits.	Community cohesion and law and order	All villages within study area, but Tier 1 villages in particular	Construction, Operations	Likely / Major Very High	LAMM1: Management of compensation obligations SMM11: Facilitate the development of local-level law and order institutions SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Possible / Major Very High

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S76	Law and order problems as a result of perceived unfairness in the distribution of royalties, compensation, and/or employment/procurement opportunities.	Community cohesion and law and order	All villages within study area, but Tier 1 villages in particular	Life of Mine	Possible / Moderate High	NCM1: Implementation of local hire preference policy NCM13: Community capability development SMM12: Facilitate local organisations to implement activities aimed at building social capital LAMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Possible / Minor Moderate
S77	Community tensions as stimulated cash economy leads to shift in social and leadership structures	Community cohesion and law and order	Across study area but Tier 1 villages particularly	Life of Mine	Likely / Major Very High	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure NCM12: Individual capability development SMM11: Facilitate the development of local-level law and order institutions NCM13: Community capability development	Likely / Moderate High
S78	Community tensions and disputes arising from in-migration (e.g., over subsistence resources, disorderly behaviour and disregard for local landowner authority)	Community cohesion and law and order	Tier 1 and Tier 2 communities in particular and new settlers	Life of Mine	Likely / Moderate High	NCM11: Support for Provincial service delivery programs SMM11: Facilitate the development of local-level law and order institutions SMM14: In-migration management SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Possible / Moderate High

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S79	Discontent with low paid jobs and lack of promotion opportunities for locals	Community cohesion and law and order	Across study area but Tier 1 villages particularly	Life of Mine	Possible / Moderate High	NCM1: Implementation of local hire preference policy NCM4: Employee training and development programs NCM5: Community workforce preparedness program SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Possible / Minor Moderate
S81	Concerns over environmental damage resulting in stop work protests, damage to Project infrastructure, threats/assault of Project employees, and other law and order problems	Community cohesion and law and order	All villages within study area, but Tier 1 villages in particular	Construction, Operations	Possible / Moderate High	SMM4: Environmental Management Plan SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM11: Facilitate the development of local-level law and order institutions SECMP1: Security Management Plan	Unlikely / Moderate Moderate
S82	Disruption of community cohesion resulting from: * Increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income * Disputes arising from increased gambling as a result of higher income levels.	Community cohesion and law and order	All villages within study area, but Tier 1 villages in particular	Life of Mine	Likely / Minor Moderate	SMM8: Workforce Code of Conduct NCM12: Individual capability development SMM1: Health Awareness Program (communities) SMM22: Health Awareness Program (workforce) SMM11: Facilitate the development of local-level law and order institutions SMM12: Facilitate local organisations to implement activities aimed at building social capital	Possible / Minor Moderate
S83	Inappropriate use of force by public security personnel deployed in connection with the Project	Community cohesion and law and order	All villages within study area, but particularly in-migrants and settlers within study area	Construction, Operations	Possible / Moderate High	SECMP1: Security Management Plan SMM27: Facilitate police training on the Voluntary Principles on Security and Human Rights NCM11: Support for Provincial service delivery programs	Unlikely / Moderate Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S84	Inappropriate use of force by private security personnel deployed in connection with the Project	Community cohesion and law and order	All villages within study area, but particularly in-migrants and settlers within study area	Construction, Operations	Possible / Moderate High	SECMP1: Security Management Plan SMM8: Workforce Code of Conduct SMM28: Provide training for security personnel in the Voluntary Principles on Security and Human Rights	Unlikely / Minor Low
S102	Less time available to participate in traditional and cultural practices, including diminished ability to care for sick, disabled or other vulnerable persons	Tradition and culture	Particularly Tier 1	Construction, Operations	Possible / Moderate High	SMM17: Consultation to assist women undertaking domestic duties	Unlikely / Moderate Moderate
S72	Disruption to existing cultural ties, traditions, language and sense of place as a result of Project development.	Tradition and culture	Particularly Tier 1	Life of Mine	Possible / Moderate High	SMM20: Respecting existing local ties, traditions and sense of place SMM21: Transparent and fair land access	Unlikely / Moderate Moderate
S106	Disruptions to traffic as a result of: * Project truck movements * Upgrade to Demakwa Access Road	Traffic	Tier 1 and Tier 2 villages, particularly individuals who frequently use the Highlands Highway, and the villages of Bavaga, Gingen, Dengea, Zimake and Timini which are proximate to the Demakwa Access Road	Construction	Likely / Minor Moderate	TMP1: Traffic Management Plan	Likely / Negligible Low

18.4. Impact Assessment for Study Area 2 (Infrastructure Corridor from Zifasing to Lae)

This study area encompasses the Infrastructure Corridor from Zifasing to Lae (excluding Lae). From Zifasing to a location approximately 3km west of Yalu, the Infrastructure Corridor will largely follow (offset yet adjacent to) an existing PNG Power Limited (PPL) transmission line corridor, which is approximately 50m wide. Thereafter, it will traverse southeast to the Port of Lae.

Construction within the Infrastructure Corridor will involve the burial of the concentrate, fuel and terrestrial tailings pipelines. The depth of pipeline burial will conform to contemporary industry practices but will ultimately depend on land use. The typical width of the Infrastructure Corridor right-of-way during construction will be 40m, but will vary depending on land use and terrain. The construction contractor will also clear laydown and turning areas, and potentially extra work spaces, in accordance with agreements negotiated between WGJV and relevant landowners. Where the Infrastructure Corridor crosses watercourses, the concentrate, fuel and terrestrial tailings pipelines will be installed either using an open-cut method, or a trenchless method (tunnelling).

During construction, sections of the Infrastructure Corridor will not generally be crossable, requiring a detour to traverse it. The disruption will be temporary. The WGJV estimates that several hundred metres of the Infrastructure Corridor would be closed to public access at any one time. Within this study area, the construction front is estimated to advance at rates between 150 and 300m/day (see Table 6.9 in Chapter 6, Project Description). Consequently, access will likely be restricted for several days at most, requiring pedestrians to detour several hundred metres around the construction site.

Following construction, access tracks will be maintained between existing roads and tracks and the Infrastructure Corridor to accommodate inspections and maintenance. No structures (e.g., houses, hatcheries) or cultivated land uses (e.g., gardens, plantations) will be permitted to be established or restored over the buried pipelines. Foot traffic will be permitted after construction is complete.

Accommodation for construction personnel will be located in this study area. During construction of the Infrastructure Corridor, Outfall System and Port Facilities Area, Project personnel and contractors will be accommodated at existing accommodation facilities, potentially at 9 Mile and 11 Mile, outside Lae.

This section identifies and assesses socioeconomic impacts for Study Area 2.

18.4.1. Impact Identification and Initial Impact Assessment

The expected socioeconomic impacts resulting from the Project for Study Area 2, prior to the application of any management measures, are described below. Impacts are grouped by the categories listed in Section 18.1.2.2 and at the conclusion of this discussion, a summary of all the impacts relating to this study area is presented in a consolidated table.

18.4.1.1. Employment, Procurement, Project Payments and the Local Economy

18.4.1.1.1. Employment

Employment opportunities for Study Area 2 are expected to arise principally during the construction phase. As Section 18.3.2.1 noted, people from Study Area 1 are expected to be recruited for the majority of unskilled positions at the Mine Area. However, some people from Study Area 2 (especially villages closer to the Mine Area, such as Zifasing) may also be recruited.

There would be opportunities for employment during construction of the Infrastructure Corridor, as it traverses through Study Area 2. Due to the technical nature of the work, a contractor will be engaged for the pipeline's construction for the length of the Infrastructure Corridor. While some individuals from this study area may be sufficiently skilled to obtain work with the pipeline contractor, the majority of workers recruited from the study area are expected to fill unskilled labour positions. Recruitment preferences will apply, potentially with the outcome that a portion of the unskilled workforce will change as the Infrastructure Corridor traverses land owned by different landowners. Potential roles that landowners may fulfil include vegetation clearing, pre-construction surveys, directing traffic around construction works, and post-construction vegetation control and management.

For residents of this study area, work at the Port Facilities Area and Outfall Area is possible but less likely due to recruitment preferences going to landowners and residents in proximity to those areas.

During the operation phase, no workers will be required for the Infrastructure Corridor within the study area. Some residents of this study area may obtain work at the Mine Area; however, recruitment preference will be given first to Hengambu, Babuaf and Yanta villages (i.e., Study Area 1, Tier 1 villages), and opportunities are likely to be limited. As PNG citizens from elsewhere within Morobe Province, residents from Study Area 2 will have secondary preference for work at the Mine Area during operations. Similarly, limited opportunities may be available at the Port Facilities Area during operations.

Overall, employment opportunities for residents of this study area will largely be limited to short-term, unskilled work supporting the construction contractor. The unskilled workforce may be rotated where possible so that landowners have the opportunity to work on construction on their land.

18.4.1.1.2. Procurement

It is not known whether there are businesses based in this study area which would supply any of the goods and services envisaged in Table 18.4. If so, such businesses would be granted procurement preference based on their proximity to the Project and their level of PNG ownership, subject to the business meeting management standards set by the WGJV (see Section 18.3.2.1.2).

Given the largely rural nature of the communities within this study area, it is not expected that procurement by the Project would be a major impact within this study area.

Table 18.5 summarises the impacts related to procurement in Study Area 2.

18.4.1.1.3. Project Payments

Royalties disbursed by the State of PNG to landowners may be an additional source of income (in turn redistributed through spending). However, disbursement of royalties is likely to be concentrated within Study Area 1, rather than Study Area 2, due to the proximity of Study Area 1 to the Mine Area.

Because the Infrastructure Corridor will traverse customary land, compensation will be payable to landowners and occupiers in this study area. As discussed in Section 18.3.2.1.3, compensation is generally paid for loss or damage to land. Within this study area, the majority of compensation would be payable under the *Mining Act 1992* to landowners over whose land the Infrastructure Corridor will traverse. Under the *Environment Act 2000*, formal settlers (i.e., those granted occupancy by the landowner under a customary arrangement) may also be entitled to compensation.

18.4.1.1.4. Local Economy

The increase in cash (whether by compensation, or by income-earning opportunities such as employment, procurement or royalties) may have inflationary effects on goods and services. For most of Study Area 2, any such impact is unlikely material, given that the increase in cash is likely to be limited to a few households during the construction phase.

Inflation may be experienced in Zifasing. As the largest village near the Mine Area, it functions as a local hub, operating a day market and a night market selling a wide range of produce. The proximity of Zifasing to the construction and operation workforces accommodated in the Mine Area means that people with wage incomes will likely buy from the markets in Zifasing, potentially driving up the price of goods.

There may also be a similar inflationary effect in villages near Zifasing (e.g., Ganef), since sellers from neighbouring villages may find selling produce to Project workers and contractors at Zifasing to be more lucrative than selling produce within or near their own village. This would drive up the price of goods within and near their own village.

Cultural exchanges involving gifts or payments (e.g., bride price) may also be inflated (see Jorgensen, 2006), leading to social disruption and potentially changes in aspects of traditional practices.

18.4.1.2. In-migration

In-migration is likely to be concentrated in Study Area 1 villages, but there may be some in-migration experienced in some villages within Study Area 2, particularly Zifasing, as the largest village close to the Mine Area.

In-migrants may arrive to the study area (potentially at the invitation of landowners) to seek employment or indirect income-earning opportunities, such as the opportunity to sell goods in the stimulated local economy at Zifasing, or potentially to undertake domestic tasks for those who obtained employment directly with the Project.

Some in-migrants may also claim landownership near the Infrastructure Corridor, seeking landowner payments. However, as landowner investigations for this study have been completed by the WGJV and the PNG Department of Lands and Physical Planning, opportunities for such claims are limited.

The effect of in-migration within this study area is likely to lead to similar tensions as for Study Area 1 (see Section 18.3.2.2), but to a lesser extent and concentrated in Zifasing. Since Project activities in this study area are temporary and restricted to the Infrastructure Corridor, for most part there are few reasons to migrate to Study Area 2 villages. Moreover, Study Area 2 communities are situated close to the Highlands Highway and relatively close to Lae. Unlike remote villages unaccustomed to new residents, residents within this study area would likely have had some exposure to people from outside their own community already.

18.4.1.3. Physical and Economic Displacement (Resettlement)

As discussed in Section 18.3.2.3, Physical and/or Economic Displacement, Study Area 1, displacement refers to 'physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use' (IFC, 2012). Resettlement is defined in this EIS as a process of planning and implementing activities that manage the effects of displacement (DFAT, 2015).

During the Front End Engineering Design phase and the Detail Design phase, the WGJV will aim to align the Infrastructure Corridor in such a way as to avoid displacement. However, some displacement may be unavoidable.

Physical displacement would occur if an individual or group of individuals are required to move to a new place of residence (e.g., where a house needs to be demolished in the course of construction). Economic displacement would occur if assets are lost or damaged, leading to a loss of income or means of livelihood (e.g., where a garden is destroyed or damaged). In both cases, compensation would likely be payable (see Section 18.4.1.1.4).

Field observations in 2017 indicated that, within or adjacent to the PPL transmission line corridor, there is a range of extant land uses that may result in physical or economic displacement. As reported in Chapter 12, Socioeconomic Environment Characterisation (Section 12.5), the proposed Infrastructure Corridor will run through or near residences and gardens, including at Ganef, Nasuapum, Munum and Yalu. Houses and gardens may be lost or damaged, and may need to be re-established elsewhere as a last resort, should WGJV not find a means for avoidance in the final design of the pipeline alignment. No commercial facilities were observed in the proposed Infrastructure Corridor.

In cases of physical and/or economic displacement, a number of impacts may be experienced by displaced households. Housing may need to be re-established, along with other associated household features, such as gardens, water tanks, livestock enclosures and latrines. There may be diminution of capacity to sustain livelihoods, particularly in cases where newly established gardens require time to reach pre-resettlement levels of productivity (if reachable at all), reducing the produce available for consumption and/or sale. Such considerations would influence compensation, offsetting some, if not all, of the impact.

Because the Infrastructure Corridor is unlikely to exceed 50m in width, any new households or assets would likely be established close to the previous site (although the new location would be determined in consultation with the affected persons). Negligible impact is expected on travel times to gardening, hunting and gathering areas, to services such as schools and health centres, and to transport routes such as the Highlands Highway. There may be minor disruption to community connectedness (e.g., where members of a family living in different households are relocated further away from each other).

The potential to receive compensation may lead to disputes about landownership. While the PNG Department of Lands and Physical Planning has conducted a land investigation study to determine landownership (reducing the likelihood of disputes), there are existing land disputes which compensation negotiations may exacerbate.

18.4.1.4. Land and Water Resources

As described in Section 18.4.1.3, Physical and Economic Displacement (Resettlement), the proposed Infrastructure Corridor could run through or near residences and gardens. Commercial and industrial premises are not located within the Infrastructure Corridor, but some are located nearby. Although the WGJV will aim to avoid physical and economic displacement, where unavoidable, the Project will directly affect land use and land-based livelihoods for which compensation will be payable.

Access to land and water resources may be temporarily restricted during construction. As noted in the introduction to Section 18.4, such restrictions will be temporary, lasting several days and requiring detours of several hundred metres around the construction site. Access to critical resources (e.g., drinking water sources) can be maintained by placing steel plates across construction trenches.

Negligible obstruction to water flow is anticipated. Negligible impact on aquatic biota or water quality is predicted, and consequently negligible impact on fish for consumption is expected.

While fishing (and the gathering of other aquatic resources) was reported as being undertaken by some residents of this study area, the 2017 socioeconomic studies indicated that fish were not generally caught in this study area for commercial purposes. Consequently, negligible impact on water-based resources is anticipated.

18.4.1.5. Community Health and Safety

This category identifies impacts relating to community health and safety within this study area. It adopts the environmental health areas given by the IFC Good Practice publication, Introduction to Health Impact Assessment (IFC, 2009b). Each environmental health area is discussed systematically in this section, although not all will be applicable to Study Area 2.

Community access to active work areas will be strictly controlled to avoid potential injuries related to construction activities.

Vector-related Diseases

In general, the Project is not expected to increase the risk of vector-related diseases within this study area with one possible exception of Zifasing village. The proximity of this village to the Mine Area may lead to in-migration. In-migrants may have less resistance to vector-borne diseases, or may bring new diseases to which the incumbent population has comparatively less resistance (Guyant et al., 2015; Martens and Hall, 2000; Sutherst, 2004).

Respiratory and Housing Issues

If in-migration at Zifasing were to occur, then overcrowding could contribute to respiratory diseases, such as tuberculosis (Beggs et al., 2003; Clark et al., 2002) and diseases from indoor smoke inhalation (as more people are exposed to indoor smoke; see Section 18.3.2.5, Community health and safety, Study Area 1).

Increases in income may also lead to improved housing standards, although whether these are realised depends on individuals' spending choices.

Aside from Zifasing, few impacts relating to respiratory and housing issues are anticipated for people living within this study area but outside of Zifasing. Although some increases in income may be experienced (see Section 18.4.1.1, Employment, procurement, Project payments and local economy), increases are likely to be moderate beyond Zifasing, with correspondingly few impacts.

Veterinary Medicine and Zoonotic Issues

No impacts relating to veterinary medicine and zoonotic issues (i.e., diseases affecting animals that may also affect humans) are expected to arise from the Project.

Sexually Transmitted Infections

There may be an increase in HIV/AIDS and other sexually transmittable infections (STIs). Project personnel and contractors engaged in Infrastructure Corridor construction within this study area will be accommodated at existing accommodation facilities, potentially at 9 Mile and 11 Mile, outside Lae. A temporary construction camp may also be required in the Nadzab area to accommodate pipeline construction workers. A portion of the construction workforce will may interact with communities close to workforce accommodation and, to a lesser extent, close to the Infrastructure Corridor during construction. Such interactions may include prostitution or unsafe sex, heightening the risk of STIs. Camps will be closed to the public.

At the western end of the study area, in-migration and higher incomes at Zifasing may similarly increase the occurrence of unsafe sexual practices. As noted in Section 18.3.2.5, Community health and safety, Study Area 1, mobility and income are associated with increased risk of STIs, due to greater instances of unsafe sexual practices (whether prostitution or other sexual relationships) (Aggleton et al., 2014; Connell and Negin, 2010; Lepani, 2008; Westwood and Orenstein, 2016).

Soil- and Water- Sanitation–related Diseases

At Zifasing, overcrowding (driven by in-migration) may lead to unhygienic conditions and gastrointestinal diseases. Contributing factors would include: poor personal hygiene practices (e.g., washing hands), unhygienic food handling (e.g., not washing food and equipment properly), and overload of sanitation infrastructure (e.g., overflowing latrines; open defecation where latrines are unusable).

Elsewhere within this study area, the Project is not expected to induce increases in diseases relating to soil and water-sanitation, as in-migration is not expected (see Section 18.4.1.2, In-migration, Study Area 2).

Food- and Nutrition-related Issues

Increases in income levels may make unhealthy store-bought foods more affordable. Store operators may respond to increased demand for unhealthy store-bought foods by increasing their availability, making such foods more accessible and exacerbating the likelihood of adverse dietary changes.

Increases in income (and therefore health issues relating to food and nutrition) are expected to be more widespread at Zifasing (see Section 18.4.1.1.4, Local economy). Impacts of this nature are not expected to be significant in other parts of the study area.

Accidents and Injuries

The Project may increase the risk of traffic and pedestrian accidents across the study area. In particular, the Project will transport bulk fuels to the Mine Area along the Highlands Highway (approximately 25 tanker deliveries per week). However, the Highlands Highway at Zifasing experiences daily vehicle loads of over 500 vehicles on weekends, up to nearly 1,000 on weekdays. The Project is expected to contribute only slightly to the likelihood of accidents and injuries along the Highlands Highway, due to the existing high traffic flows on the Highlands Highway.

Exposure to Potentially Hazardous Materials

The potential for pipeline rupture is assessed in Chapter 21, Unplanned Events (Natural Hazards and Accident Events). In summary, pipeline rupture is an extremely unlikely event but could lead to diminished livelihoods, health and safety of affected persons, due to impacts to land and water resources if such a rupture were to occur. The degree of impact of any pipeline rupture will depend on a number of factors, particularly the location at which a rupture occurs, the quantity of material released into the environment, the dispersal pathway of material (i.e., whether the rupture occurs within watercourse or adjacent to terrestrial lands and areas of cropping or habitation), and the duration of exposure. For an assessment of risks and potential impacts, and identification of management measures, refer to Chapter 21, Unplanned Events (Natural Hazards and Accident Events).

Social Determinants of Health

This category considers health issues connected to gender issues and substance misuse. The framework provided in IFC (2009) also lists issues connected to resettlement, violence, education, income, occupation, social class, social cohesion and security concerns. These are not addressed here as standalone considerations because they are captured

respectively in sections 18.4.1.3, Physical and Economic Displacement (Resettlement), 18.4.1.7, Community Cohesion and Law and Order, 18.4.1.6, Education, and 18.4.1.1, Employment, Procurement, Project Payments and the Local Economy.

- **Gender issues** – There is potential for some women to have increased domestic responsibilities, where men gain employment on the Project and become unavailable to share domestic responsibilities. The primary opportunity for work within this study area is supporting the construction of the Infrastructure Corridor, as construction passes through an individual's village. The proximity of Zifasing to the Mine Area may also provide additional opportunities to residents of Zifasing compared to other communities within the study area. As most opportunities will arise during the construction phase, any increase in women's domestic responsibilities is likely to be temporary.
- **Substance misuse** – An increased consumption of betel nut, alcohol, tobacco and/or marijuana may be experienced within this study area. Increased liquidity (either through income or compensation) may make such substances more affordable. This impact is more likely to occur at Zifasing (due to its proximity to the Mine Area) and towards the eastern end of the study area near Lae (where proximity to Lae may make such substances more readily available).

Cultural Health Practices

Highly significant impacts to cultural health practices (such as the use of traditional medicine in the treatment of illness) are not expected to arise in this study area, because impacts are largely restricted to the construction phase and few impacts are anticipated on land and water resources in this study area (see Section 18.4.1.4, Land and Water Resources, Study Area 2).

Health Services Infrastructure and Capacity

The construction of the Infrastructure Corridor will temporarily require people to detour around the construction site to safe crossing locations. With construction expected to advance between 150m to 300m per day (see Table 6.9 in Chapter 6, Project Description) these restrictions will be in place at any given location for several days at most, and will involve detours of several hundred metres. Access to services (e.g., health centres) will be maintained; however, the need to take detours may encourage some individuals to postpone seeking healthcare.

In-migration at Zifasing may place pressure on local health facilities (Zifasing aid post) due to an increase in population. The prospect of employment with the Project may attract health staff away from local health providers. Although Project requirements for healthcare employees are low, health workers are likely to be educated with good English skills, making them competitive for a range of roles.

Non-communicable Diseases

The Project is not expected to have highly significance impacts on the prevalence of non-communicable diseases in this study area. Non-communicable diseases can arise, for example, from the consumption of unhealthy food and/or harmful substances, which are made more affordable by higher incomes.

Except for Zifasing, Project-induced increases in the consumption unhealthy food and/or harmful substances is not expected in study area, as increases in income are expected to be limited (see Section 18.4.1.1, Employment, Procurement, Project Payments and the Local Economy, Study Area 2). In Zifasing, increases in income are more likely than the other communities in the study area. Accordingly, increased prevalence of non-

communicable diseases, arising from the consumption of unhealthy food and/or harmful substances, is considered possible in Zifasing.

18.4.1.6. Education

Baseline studies indicate that students from Yalu, Munum and Gabsongkeg villages will need to cross land within the Infrastructure Corridor to attend school. During construction, for several days, students may need to detour several hundred metres from their usual routes. Some students perceive the need to detour as a temporary reason not to attend school.

The prospect of gaining employment with the Project may encourage teachers to leave positions at schools in favour of work with the Project, leading to a shortfall in staff. However, it is unclear how many teachers would seek work with the Project. Few (if any) education-related jobs would be required for the Project; however, if the prospective employee were willing to change sectors and pursue non-education positions with the Project, then teachers would generally be competitive candidates due to their training and English language skills.

18.4.1.7. Community Cohesion and Law and Order

There are existing disputes over land at Ganef, the border of Munum and Yalu, and on the western outskirts of Lae. The potential to receive compensation may exacerbate these disputes. Disputes may also arise between households or families within villages as to who is entitled to compensation.

There may be discontent where some people expect compensation but do not receive it, or receive a lesser amount than expected.

During construction, the Project workforce may interact with people within this study area, particularly at Zifasing (due to its proximity to the Mine Area) and at Yalu (due to its proximity to accommodation facilities at 9 Mile and 11 Mile outside Lae, and the potential construction camp at Nadzab). Such interactions can threaten community cohesion, as the presence of workers from a range of different cultural backgrounds can be a source of animosity between the workforce and local communities. There may be a perception that 'outsiders' are taking jobs away from local people. If not managed appropriately, such animosity can result in tension, conflict and violence.

Some individuals may seek to establish gardens and/or houses within the Infrastructure Corridor right-of-way after construction. Private and/or public security personnel may use excessive force to remove such individuals if they do not comply with initial requests to desist.

18.4.1.8. Tradition and Culture

Impacts to cultural heritage are discussed in Chapter 20, Cultural Heritage Impact Assessment. Beyond those impacts, few impacts relating to tradition and culture are anticipated for this study area as a whole.

Closer to the Mine Area (particularly at Zifasing), the influx of the Project workforce and the stimulation of the cash economy may lead to shifts in traditional social structures. For example, young men (who are more likely to be educated) may be better able to engage with the Project and government agencies, and consequently become more important to their communities. Young men are also likely to earn more income through employment, and may experience a boost in social standing. In both instances, changes in traditional social structures may result. Employment with the Project operating businesses that supply the Project, or generally participating in a stimulated cash economy may mean less time

allocated to traditional and cultural practices (such as hunting for traditional occasions and telling stories of cultural importance), potentially leading to a decline in their importance. However, changes of this nature are likely to be part of social change more broadly in PNG already.

18.4.1.9. Traffic

No impacts to traffic are expected for this study area. While the Infrastructure Corridor will cross the Highlands Highway twice (near Gabsongkeg and Nasuapum), the WGJV will use trenchless construction methods (i.e., tunnelling beneath the highway) to undertake construction without disruption to the Highlands Highway.

18.4.1.10. Summary of Initial Impact Assessment for Study Area 2

Table 18.16 presents the impacts identified in relation to Study Area 2 and the assessment of the significance of these impacts prior to the application of any management measures.

18.4.2. Proposed Management Measures

Table 18.14 presents a list of proposed management measures consolidated for all study areas. Because many management measures are common to multiple study areas, a complete list of management measures for this study area is not provided.

Table 18.16: Initial impact assessment for Study Area 2

Note: blue shading indicates positive impact

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S201	Increase in local employment during construction	Employment, procurement, Project payments & local economy	People (mostly young men) who obtain employment with the Project	Construction	Likely	Minor	Moderate
S208	Increased or ongoing local employment during operations	Employment, procurement, Project payments & local economy	People (mostly young men) who obtain employment with the Project	Operations	Possible	Minor	Moderate
S213	Increase in village business income (trade stores, chickens, etc.) as a result of higher local income levels	Employment, procurement, Project payments & local economy	Small business operators, particularly in Zifasing	Life of Mine	Possible	Minor	Moderate
S217	Inflated cost of goods sold in trade stores and markets in local villages making it more difficult to afford store-bought foods, fuel and batteries, particularly for those not receiving income as a result of the Project	Employment, procurement, Project payments & local economy	Zifasing in particular; far less likely in other villages	Life of Mine	Unlikely	Minor	Low
S218	Reduction in income levels as Project employment falls at the end of the construction phase	Employment, procurement, Project payments & local economy	People (mostly young men) who obtain employment with the Project	Construction	Possible	Minor	Moderate
S220	Reduction in income levels as Project employment falls upon mine closure	Employment, procurement, Project payments & local economy	People (mostly young men) who obtain employment with the Project	Closure	Unlikely	Minor	Low
S271	Physical displacement	Physical and economic displacement (Resettlement)	Any household unable to be avoided through detailed design of the 50m construction right-of-way.	Construction	Possible	Major	Very High

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S257	Increased pressure on the availability of land-based natural resources as a result of in-migration: * Food derived from hunting * Food harvested from naturally occurring plant species * Food from gardens * Trees/other plant species used to make houses * Traditional medicine * Firewood	Land and water resource use	Zifasing in particular; far less likely in other villages	Construction	Unlikely	Minor	Low
S259	Increased pressure on the availability of water-based natural resources as a result of in-migration: * Drinking water * Food derived from fishing and collecting in local waterways	Land and water resource use	Zifasing in particular; far less likely in other villages	Construction	Unlikely	Minor	Low
S285	Economic displacement (loss of livelihood assets, including gardens)	Land and water resource use	Any garden or other livelihood asset unable to be avoided through detailed design of the 50m construction right-of-way	Construction	Possible	Moderate	High
S286	Temporary, restricted access to areas used for subsistence activities during construction of the Infrastructure Corridor	Land and water resource use	Zifasing in particular; far less likely in other villages	Construction	Likely	Negligible	Low
S219	Temporary, restricted access to health facilities during construction of the Infrastructure Corridor, discouraging people from seeking healthcare	Community health and safety	Isolated occurrences across study area	Construction	Unlikely	Minor	Low
S231	Increased domestic responsibilities placed on women and potentially children where villages have a high level of male Project employment	Community health and safety	Women and children in particular, as men are more likely to obtain employment; more likely in Zifasing than elsewhere in study area	Construction	Possible	Minor	Moderate

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S232	Health problems resulting from increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Possible	Minor	Moderate
S233	Increase in prevalence of lifestyle diseases in villages near the Project Area as a result of changing diet and physical activity level	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Possible	Minor	Moderate
S234	Increase in the incidence of tuberculosis as a result of higher population densities in villages near the Project Area.	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Unlikely	Moderate	Moderate
S235	Increase in HIV/AIDS and other sexually transmittable infections arising from high-risk behaviour associated with higher levels of disposable income, increased mobility and/or in-migration	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Possible	Moderate	High
S237	Increased pressure on local health facilities due to an increase in population resulting from in-migration.	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Unlikely	Minor	Low
S238	Project-induced increase in incidences of communicable diseases (e.g., gastrointestinal and respiratory diseases) and vector-related diseases (e.g., malaria, lymphatic filariasis) due to in-migration	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Possible	Minor	Moderate

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S282	Disruption of community cohesion resulting from: * Increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income * Disputes arising from increased gambling as a result of higher income levels.	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Unlikely	Minor	Low
S224	Inconvenience caused to school students detouring around construction of the Infrastructure Corridor, potentially using construction as a reason not to attend school	Education	Students attending schools located near the Infrastructure Corridor, particularly those from Gabsongkeg, and to a lesser extent Yalu and Munum.	Construction	Possible	Negligible	Low
S245	Increased pressure on local schools due to an increase in the population resulting from in-migration.	Education	Zifasing in particular; far less likely in other villages	Construction	Unlikely	Minor	Low
S246	Reduction in State's capacity to provide education services due to staff seeking employment at the mine	Education	Across study area	Construction	Remote	Minor	Low
S275	Disputes over landownership in connection to compensation	Community cohesion and law and order	All villages in study area, albeit likely to be confined to households, clans or other social units claiming land near the Infrastructure Corridor	Construction	Likely	Minor	Moderate
S278	Community tensions and disputes arising from in-migration (e.g., over subsistence resources, disorderly behaviour and disregard for local landowner authority)	Community cohesion and law and order	Zifasing in particular; far less likely in other villages	Construction	Unlikely	Minor	Low
S279	Discontent with low paid jobs and lack of promotion opportunities for locals	Community cohesion and law and order	Across study area	Construction	Possible	Minor	Moderate

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S283	Inappropriate use of force by public security personnel deployed in connection with the Project	Community cohesion and law and order	People who seek to establish houses or gardens on Infrastructure Corridor after construction (and who do not comply with requests to desist)	Construction, Operations	Possible	Moderate	High
S284	Inappropriate use of force by private security personnel deployed in connection with the Project	Community cohesion and law and order	People who seek to establish houses or gardens on Infrastructure Corridor after construction (and who do not comply with requests to desist)	Operations	Possible	Moderate	High
S236	Reduction in State's capacity to provide health services due to staff seeking employment at the mine	Community health, safety and security	Across study area	Construction	Remote	Moderate	Low

18.4.3. Residual Impact Assessment

The initial impact assessment identified 29 socioeconomic impacts for Study Area 2, of which 26 were adverse impacts and 3 were positive. Of the 26 adverse impacts, 1 was assessed initially as being of very high significance, 4 were high, 8 were moderate and 13 were low. All positive impacts were assessed initially as moderate.

The implementation of the proposed management measures outlined in Section 18.1.2.4 is intended to enhance people's ability to realise opportunities and avoid or reduce potential adverse socioeconomic impacts of the Project. Table 18.17 provides an assessment of socioeconomic impacts for Study Area 2, following the implementation of management measures. Some residual impacts retain the same overall significance rating, notwithstanding a change in the likelihood and/or consequence rating. A summary of those adverse residual impacts that retain a very high or high level of significance is described below.

18.4.3.1. Very High Residual Impacts for Study Area 2

No impact (whether positive or negative) remained of very high significance after the implementation of management measures.

18.4.3.2. High Residual Impacts for Study Area 2

One adverse impact remained of high significance after the implementation of management measures. This impact related to the potential for physical displacement due to the construction of the Infrastructure Corridor (S271). While physical displacement was initially assessed as having a likelihood of 'possible', application of proposed management measures (in particular, the Resettlement Management Plan) would result in physical displacement being avoided where possible. The residual likelihood was reduced to 'unlikely'; however, the consequence of physical displacement remained assessed as major.

Table 18.17: Residual significance assessment for Study Area 2
Note: blue shading indicates positive impact

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S201	Increase in local employment during construction	Employment, procurement, Project payments & local economy	People (mostly young men) who obtain employment with the Project	Construction	Likely / Minor Moderate	NCM1: Implementation of local hire preference policy NCM4: Employee training and development programs NCM5: Community workforce preparedness program	Likely / Moderate High
S208	Increased or ongoing local employment during operations	Employment, procurement, Project payments & local economy	People (mostly young men) who obtain employment with the Project	Operations	Possible / Minor Moderate	NCM4: Employee training and development programs NCM5: Community workforce preparedness program	Possible / Moderate High
S213	Increase in village business income (trade stores, chickens, etc.) as a result of higher local income levels	Employment, procurement, Project payments & local economy	Small business operators, particularly in Zifasing	Life of Mine	Possible / Minor Moderate	NCM6: Establish and support the operation of an Enterprise Development Centre NCM9: Small-scale service provision program NCM12: Individual capability development	Likely / Minor Moderate
S217	Inflated cost of goods sold in trade stores and markets in local villages making it more difficult to afford store-bought foods, fuel and batteries, particularly for those not receiving income as a result of the Project	Employment, procurement, Project payments & local economy	Zifasing in particular; far less likely in other villages	Life of Mine	Unlikely / Minor Low	NCM12: Individual capability development NCM13: Community capability development	Unlikely / Minor Low
S218	Reduction in income levels as Project employment falls at the end of the construction phase	Employment, procurement, Project payments & local economy	People (mostly young men) who obtain employment with the Project	Construction	Possible / Minor Moderate	NCM12: Individual capability development NCM4: Employee training and development programs NCM4: Employee training and development programs	Possible / Negligible Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S220	Reduction in income levels as Project employment falls upon mine closure	Employment, procurement, Project payments & local economy	People (mostly young men) who obtain employment with the Project	Closure	Unlikely / Minor Low	NCM12: Individual capability development NCM4: Employee training and development programs	Remote / Negligible Low
S271	Physical displacement	Physical and economic displacement (Resettlement)	Any household unable to be avoided through detailed design of the 50m construction right-of-way.	Construction	Possible / Major Very High	SMM13: Resettlement management LMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM20: Respecting existing local ties, traditions and sense of place	Unlikely / Major High
S257	Increased pressure on the availability of land-based natural resources as a result of in-migration: * Food derived from hunting * Food harvested from naturally occurring plant species * Food from gardens * Trees/other plant species used to make houses * Traditional medicine * Firewood	Land and water resource use	Zifasing in particular; far less likely in other villages	Construction	Unlikely / Minor Low	SMM14: In-migration management SMM10: Location of business activity to discourage development of informal settlements NCM1: Implementation of local hire preference policy	Remote / Minor Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S259	Increased pressure on the availability of water-based natural resources as a result of in-migration: * Drinking water * Food derived from fishing and collecting in local waterways	Land and water resource use	Zifasing in particular; far less likely in other villages	Construction	Unlikely / Minor Low	SMM14: In-migration management SMM10: Location of business activity to discourage development of informal settlements SMM11: Facilitate the development of local-level law and order institutions NCM1: Implementation of local hire preference policy	Remote / Minor Low
S285	Economic displacement (loss of livelihood assets, including gardens)	Land and water resource use	Any garden or other livelihood asset unable to be avoided through detailed design of the 50m construction right-of-way	Construction	Possible / Moderate High	SMM13: Resettlement management LAMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Possible / Minor Moderate
S286	Temporary, restricted access to areas used for subsistence activities during construction of the Infrastructure Corridor	Land and water resource use	Zifasing in particular; far less likely in other villages	Construction	Likely / Negligible Low	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure TMP2: Advance warning of changes in traffic conditions SMM6: Safety Awareness and Behaviour Program	Unlikely / Negligible Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S219	Temporary, restricted access to health facilities during construction of the Infrastructure Corridor, discouraging people from seeking healthcare	Community health and safety	Isolated occurrences across study area	Construction	Unlikely / Minor Low	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure TMP2: Advance warning of changes in traffic conditions SMM6: Safety Awareness and Behaviour Program	Remote / Minor Low
S231	Increased domestic responsibilities placed on women and potentially children where villages have a high level of male Project employment	Community health and safety	Women and children in particular, as men are more likely to obtain employment; more likely in Zifasing than elsewhere in study area	Construction	Possible / Minor Moderate	SMM17: Consultation to assist women undertaking domestic duties NCM1: Implementation of local hire preference policy	Unlikely / Minor Low
S232	Health problems resulting from increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Possible / Minor Moderate	SMM22: Health Awareness Program (workforce) SMM1: Health Awareness Program (communities)	Unlikely / Minor Low
S233	Increase in prevalence of lifestyle diseases in villages near the Project Area as a result of changing diet and physical activity level	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Possible / Minor Moderate	SMM6: Safety Awareness and Behaviour Program SMM22: Health Awareness Program (workforce)	Unlikely / Minor Low
S234	Increase in the incidence of tuberculosis as a result of higher population densities in villages near the Project Area.	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Unlikely / Moderate Moderate	SMM26: Managing the potential increase in spread of tuberculosis SMM1: Health Awareness Program (communities) SMM14: In-migration management	Remote / Moderate Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S235	Increase in HIV/AIDS and other sexually transmittable infections arising from high-risk behaviour associated with higher levels of disposable income, increased mobility and/or in-migration	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Possible / Moderate High	SMM1: Health Awareness Program (communities) SMM14: In-migration management SMM22: Health Awareness Program (workforce)	Unlikely / Moderate Moderate
S237	Increased pressure on local health facilities due to an increase in population resulting from in-migration.	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Unlikely / Minor Low	NCM11: Support for Provincial service delivery programs SMM14: In-migration management	Remote / Minor Low
S238	Project-induced increase in incidences of communicable diseases (e.g., gastrointestinal and respiratory diseases) and vector-related diseases (e.g., malaria, lymphatic filariasis) due to in-migration	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Possible / Minor Moderate	NCM11: Support for Provincial service delivery programs SMM14: In-migration management	Unlikely / Minor Low
S282	Disruption of community cohesion resulting from: * Increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income * Disputes arising from increased gambling as a result of higher income levels.	Community health and safety	Zifasing in particular; far less likely in other villages	Construction	Unlikely / Minor Low	SMM11: Facilitate the development of local-level law and order institutions SMM22: Health Awareness Program (workforce) SMM8: Workforce Code of Conduct SMM12: Facilitate local organisations to implement activities aimed at building social capital	Unlikely / Minor Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S224	Inconvenience caused to school students detouring around construction of the Infrastructure Corridor, potentially using construction as a reason not to attend school	Education	Students attending schools located near the Infrastructure Corridor, particularly those from Gabsongkeg, and to a lesser extent Yalu and Munum.	Construction	Possible / Negligible Low	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure TMP2: Advance warning of changes in traffic conditions SMM6: Safety Awareness and Behaviour Program	Remote / Negligible Low
S245	Increased pressure on local schools due to an increase in the population resulting from in-migration.	Education	Zifasing in particular; far less likely in other villages	Construction	Unlikely / Minor Low	NCM1: Implementation of local hire preference policy NCM11: Support for Provincial service delivery programs SMM14: In-migration management	Remote / Minor Low
S246	Reduction in State's capacity to provide education services due to staff seeking employment at the mine	Education	Across study area	Construction	Remote / Minor Low	NCM1: Implementation of local hire preference policy NCM11: Support for Provincial service delivery programs	Remote / Negligible Low
S275	Disputes over landownership in connection to compensation	Community cohesion and law and order	All villages in study area, albeit likely to be confined to households, clans or other social units claiming land near the Infrastructure Corridor	Construction	Likely / Minor Moderate	SMM11: Facilitate the development of local-level law and order institutions SMM12: Facilitate local organisations to implement activities aimed at building social capital NCM11: Support for Provincial service delivery programs LMM1: Management of compensation obligations	Possible / Minor Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S278	Community tensions and disputes arising from in-migration (e.g., over subsistence resources, disorderly behaviour and disregard for local landowner authority)	Community cohesion and law and order	Zifasing in particular; far less likely in other villages	Construction	Unlikely / Minor Low	NCM11: Support for Provincial service delivery programs SMM11: Facilitate the development of local-level law and order institutions SMM14: In-migration management SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Remote / Minor Low
S279	Discontent with low paid jobs and lack of promotion opportunities for locals	Community cohesion and law and order	Across study area	Construction	Possible / Minor Moderate	NCM1: Implementation of local hire preference policy NCM4: Employee training and development programs NCM5: Community workforce preparedness program SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Unlikely / Minor Low
S283	Inappropriate use of force by public security personnel deployed in connection with the Project	Community cohesion and law and order	People who seek to establish houses or gardens on Infrastructure Corridor after construction (and who do not comply with requests to desist)	Construction, Operations	Possible / Moderate High	SECMP1: Security Management Plan NCM11: Support for Provincial service delivery programs SMM27: Facilitate police training on the Voluntary Principles on Security and Human Rights	Unlikely / Moderate Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S284	Inappropriate use of force by private security personnel deployed in connection with the Project	Community cohesion and law and order	People who seek to establish houses or gardens on Infrastructure Corridor after construction (and who do not comply with requests to desist)	Operations	Possible / Moderate High	SECMP1: Security Management Plan SMM8: Workforce Code of Conduct SMM28: Provide training for security personnel in the Voluntary Principles on Security and Human Rights	Unlikely / Minor Low
S236	Reduction in State's capacity to provide health services due to staff seeking employment at the mine	Community health, safety and security	Across study area	Construction	Remote / Moderate Low	NCM1: Implementation of local hire preference policy NCM11: Support for Provincial service delivery programs SMM2: Facilitate public health service delivery	Remote / Minor Low

18.5. Impact Assessment for Study Area 3 (Lae)

Within this study area, the Infrastructure Corridor will traverse through partially cleared forest and gardens along the upper terrace of the Markham River floodplain, through the areas of 3 Mile and Bugandi within Lae Urban LLG. The concentrate and fuel pipelines will terminate at the Port Facilities Area at the Port of Lae, while the terrestrial tailings pipeline will continue along roads through the city centre of Lae, Chinatown and Malahang respectively, before continuing through Study Area 4 to the Outfall Area.

At the Port Facilities Area, the proposed facilities will include the concentrate filtration plant and materials handling, storage and ship loading facilities. The facilities will also include conveyors for ship loading, a wastewater treatment plant and concentrate storage shed. The Port Facilities will be within a fenced compound within the Port of Lae precinct. Access to the facilities will be via existing roads to the security-control point. Construction of the facilities is estimated to take 18 months.

18.5.1. Impact Identification and Initial Impact Assessment

The expected changes and socioeconomic impacts resulting from the Project for Study Area 3, prior to the application of any proposed management measures, are described below. Impacts are grouped by the categories listed in Section 18.1.2.2. The section concludes with a table presenting the significance of impacts identified for this study area.

18.5.1.1. Employment, Procurement, Project Payments and the Local Economy

18.5.1.1.1. Employment

As Lae is a major city and the industrial centre of PNG, there is a population of skilled, semi-skilled and unskilled workers residing in Lae, some of which may be recruited for the Project.

Some unskilled workers from Lae may benefit from construction work at the Port Facilities Area and sections of the Infrastructure Corridor within Lae. Semi-skilled and skilled positions (for both construction and operations) will likely be filled by workers from Lae, as there are relatively few skilled and semi-skilled individuals residing in Study Areas 1 and 2.

The impact of employment with the Project is likely to be restricted to individual employees and their families. Employment with the Project is unlikely to have large city-scale effects in the city of Lae.

As noted in Section 18.3.2.1.1, Employment, Study Area 1, an estimate of population demographics suggests that the majority of unskilled jobs at the Mine Area (during construction and operation) might be fulfilled by people of the Hengambu, Babuaf and Yanta villages (i.e., Study Area 1, Tier 1), with the remainder mostly fulfilled by people from Study Area 1, Tier 2 and Study Area 2.

18.5.1.1.2. Procurement

The Project may procure goods and services from a wide range of businesses located in Lae. As a major city in PNG, there are likely to be a number of businesses established within Lae able to supply the Project in any of the potential opportunities identified by the WGJV, in Table 18.4. More significant contracts may also be entered into with businesses based in Lae, given that Lae is the industrial centre of PNG.

Businesses from Lae will be preferentially engaged over those from other parts of PNG, assuming comparable degrees of PNG ownership and subject to compliance with WGJV business management standards.

Procurement will benefit business owners. Although Lae has an existing commercial and industrial environment, Project procurement is likely to have a considerable impact. As discussed in Section 18.2.2, Procurement at the provincial and national levels, procurement from local businesses estimated to reach USD500 million. While not all local businesses will be based in Lae (since 'local' can include businesses based elsewhere in PNG), procurement preferences for Morobe Province make it likely that contracts will be made with businesses in Lae.

18.5.1.1.3. Local Economy

The Project will contribute to the economy of Morobe Province (see Section 18.2). As the economic centre of the Province, the contribution is likely to be distributed and dispersed within Lae. For example, individuals and businesses engaged directly with the Project may in turn spend money in Lae, distributing wealth elsewhere in Lae (the multiplier effect).

Commercial tuna interests in Lae will not be affected by DSTP. This is because, as advised by the National Fisheries Authority, no commercial tuna fishing is permitted or currently takes place in the Huon Gulf. A literature review was also undertaken to identify breeding and spawning areas in the western and central Pacific Ocean with the aim of identifying commercial tuna species that may breed or spawn in the Huon Gulf or adjoining Solomon Sea (Appendix S, Fisheries and Marine Resource Use Characterisation). The findings of the assessment concluded there to be no known tuna spawning areas within the Huon Gulf. Furthermore, the bioaccumulation study (Appendix N, Assessment of Metal Bioaccumulation and Biomagnification from DSTP in the Huon Gulf) that assessed the potential for metals to bioaccumulate in the food chain as a result of DSTP deemed that this was not predicted to occur. Therefore, only an indirect impact to commercial tuna canneries with facilities in Lae could result, and only in the event that members of the general public negatively associate canneries' locations in Lae to DSTP, due to their proximity to the Outfall Area. Some reputational and public relations issues may arise, despite there being negligible risk that DSTP will contaminate tuna (or any fish caught near Lae or elsewhere in the Huon Gulf). To date, no stakeholder, including the National Fisheries Authority, has raised reputational risk to commercial tuna as a concern throughout the ongoing engagement with the WGJV.

Studies predict that DSTP will not affect the resource availability or food-safety of fish caught near Lae or elsewhere in the Huon Gulf (see Chapter 17, Offshore Marine Environment Impact Assessment), there may be concerns over the edibility of fish due to perceived contamination by DSTP. Such concerns could impact vendors' livelihoods at DCA Point, Voco Point, Lae Main Market and other points of sale. The WGJV intends to disseminate DSTP monitoring results; however, the WGJV cannot control individuals' food preferences.

18.5.1.2. In-migration

Lae's population growth is comparable to the provincial growth rate (2% and 2.4% per annum respectively), and in-migrants are often informal settlers arriving from other parts of Morobe province or the Highlands region. Informal settlers make up approximately half of Lae's population (JICA, 2017).

Although Project-induced in-migration is likely to be concentrated in Study Area 1 villages, in-migration may also occur in this study area, as people may migrate to Lae to seek employment opportunities directly with the Project, or in jobs indirectly created by the Project (e.g., in public administration, or in businesses supplying goods and services to the Project). Some in-migrants to Lae may also seek to claim compensation from the Project by moving within or near the Infrastructure Corridor, particularly at 3 Mile and Bugandi where there are existing settlements. However, compensation agreements for the

Infrastructure Corridor are scheduled to be finalised prior to the grant of a special mining lease, which may discourage such claims.

In-migration may have effects on public health, particularly in informal settlements which often currently lack basic services such as water, sanitation and electricity. In-migration may also increase demand on urban garden areas which are a food source for residents of Lae. Such gardens are likely to be more critical for informal settlers, who may not have other sources of food.

However, given that in-migration (and an increase in associated adverse health issues) is already occurring in Lae, it is unlikely that highly significant impacts to health would be attributable to the Project. In-migration that is driven specifically by the Project is also likely to extend only to the construction phase. After the construction phase, there will be reduced recruitment by the Project and decreased publicity surrounding the Project. In-migration will likely continue in Lae, but is not expected to be induced by the Project.

18.5.1.3. Physical and Economic Displacement (Resettlement)

As discussed in Section 18.3.2.3, Physical and Economic Displacement, Study Area 1, displacement refers to 'physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use' (IFC, 2012). Resettlement is defined in this EIS as a process of planning and implementing activities that manage the effects of displacement (DFAT, 2015).

Economic displacement may occur where construction of the Infrastructure Corridor results in the loss or damage of plantations or gardens along the upper terrace of the Markham River floodplain. At 3 Mile and Bugandi, construction of the Infrastructure Corridor may result in physical and economic displacement due to the loss of settlers' houses or gardens which are located within the proposed corridor. The vast majority of settlers' houses are located to the north of the Infrastructure Corridor; gardens are more likely to be affected than houses. The precise number of affected households will be determined following further landowner surveys.

Displaced households would need to re-establish homes, gardens and other facilities elsewhere, as a right-of-way to the Infrastructure Corridor would be maintained for the life of the Project. If impacted, informal settlers could be particularly vulnerable because they often lack rights to the land on which they live, and often lack basic infrastructure and services, and have limited (or absent) family or other social networks.

From the Port Facilities Area through to Malahang, the Infrastructure Corridor will be located within road reserves. No houses or gardens are expected to be lost. Some roadside stalls selling snack foods and mobile phone credit were observed in Malahang, although not immediately adjacent to the proposed Infrastructure Corridor and are unlikely to be affected.

No physical or economic displacement is anticipated for the Port Facilities Area.

18.5.1.4. Land and Water Resources

18.5.1.4.1. Urban Land Use

With Lae being an urban centre, land use within this study area is predominantly mixed commercial and residential. As discussed in Section 18.5.1.3, Physical and Economic Displacement (Resettlement), partially cleared forest and gardens are located at the western part of this study area, where the Infrastructure Corridor traverses through the upper terrace of the Markham River floodplain. Settlers' houses and gardens are located at 3 Mile and Bugandi.

From the Port of Lae to Lae city centre, impacts will be experienced across a range of urban land uses adjacent to the road reserves along which the Infrastructure Corridor would traverse. Land use adjacent to Bumbu Road (near the Port of Lae) is predominantly industrial. Further towards the city centre, businesses and services are located along the proposed Infrastructure Corridor, including banks and agricultural and manufacturing businesses. Lae Market is also located adjacent to the proposed Infrastructure Corridor, as well as the Brian Bell Plaza, the largest retail mall in Lae. Lae International Hospital is located on Mangola Street, adjacent to the proposed Infrastructure Corridor.

From the city centre of Lae to Chinatown, the Infrastructure Corridor will traverse a mixed commercial and residential area. The Amelia Earhart Memorial, a swimming pool and the Kilage Sport Stadium are located immediately adjacent to the proposed corridor. From Chinatown to Malahang, businesses and industrial facilities are located adjacent to the proposed Infrastructure Corridor, as well as settler houses and gardens, and two schools.

Construction of the Infrastructure Corridor will be slower through Lae than for Study Area 2. The construction front is estimated to advance at a rate of 50m/day through urbanised areas, using trenching methods of pipeline installation (see Table 6.9, Chapter 6, Project Description). During construction, access to premises adjacent to construction can be maintained where required by steel plates placed over the trench to allow foot and potentially vehicular traffic. Access to critical services (e.g., hospitals, police stations) would be maintained, potentially using trenchless (i.e., tunnelling) construction methods. The majority of construction would be undertaken at night in order to minimise disruption, however some daytime construction would be unavoidable (e.g., in residential or mixed commercial/residential areas such as Chinatown).

18.5.1.4.2. Water Resources

The Port of Lae is PNG's largest and busiest port, handling about 50% of PNG exports including twenty-seven purse seining vessels that operate out of Lae (EnviroGulf, 2017) and more than 60% of registered international and coastal trade (Department of Transport and Infrastructure, 2013). As explained in Chapter 16, Nearshore Marine Impact Assessment, with the existing high volumes of vessel traffic at the port (2,854 vessels per year on average) and the industrial activities at the Port of Lae, the additional 18 concentrate vessel movements per year will equate to 0.01% of annual vessel traffic at the port during Project operations. This will not be discernible from existing conditions and disruption to small-scale fishing enterprises as a result of Project activities is expected to be negligible.

As discussed in Section 18.5.1.1.3, Local Economy, DSTP is not expected to affect the resource availability or food-safety of fish caught near Lae or elsewhere in the Huon Gulf. However, public concern over the food safety of fish may affect small-scale fishing enterprises who catch fish within Huon Gulf and sell fish at DCA Point, Voco Point, Lae Main Market and other points of sale. Perceived risks of DSTP may also discourage recreational fishing and swimming in the Huon Gulf.

The Infrastructure Corridor may lead to impacts in the westernmost part of this study area, where the Infrastructure Corridor traverses the upper terrace of the Markham River floodplain. During construction, people seeking to access the Markham River for fishing may need to detour several hundred metres around the construction site, for a period of several days.

18.5.1.5. Community Health and Safety

This category identifies impacts relating to community health and safety within this study area. It adopts the environmental health areas given by the *IFC Good Practice publication, Introduction to Health Impact Assessment* (IFC, 2009b). Each environmental health area

is discussed systematically in this section, although some will be inapplicable to Study Area 3 and noted accordingly.

Vector-related Diseases

As discussed in Section 18.5.1.2, In-migration, the degree of Project-induced in-migration into Lae is expected to contribute only slightly to existing in-migration into Lae. In particular, JICA (2017) indicated that, between 2003 and 2015, the land area of informal settlements in Lae more than doubled, indicating an existing trend of rapid in-migration into informal settlements.

Where the Project does contribute to in-migration into informal settlements, there may be some increase in vector-related diseases; however, it is expected that any such contribution would be small given the existing conditions in informal settlements.

The Project is not expected to materially affect the prevalence of vector-related diseases elsewhere in Lae.

Respiratory and Housing Issues

Any Project-induced in-migration into Lae (particularly into informal settlements) may overburden already overcrowded living conditions. In-migration could also elevate the risk of respiratory diseases and other communicable diseases. However, as noted above, the Project is expected to contribute only slightly to existing in-migration into Lae.

Veterinary Medicine and Zoonotic Issues

This environmental health area relates to diseases affecting animals, and the potential for such diseases to affect humans. No impacts of this nature are expected for this study area.

Sexually Transmitted Infections

People earning income from the Project (or having increased liquidity from compensation) may engage in high-risk sexual behaviour, including seeking sexual services from the existing sex industry in Lae. By this means, it is possible that the Project will increase the prevalence of HIV/AIDS or other sexually transmitted infections.

Soil- and Water-sanitation-related Diseases

In-migration to informal settlements may overburden already overcrowded living conditions, potentially exacerbating sanitation issues (e.g., gastro-intestinal diseases). However, as noted above, the Project is expected to contribute only slightly to in-migration in this study area.

Food- and Nutrition-related Issues

Where the construction of the Infrastructure Corridor results in loss or damage to settlers' gardens (potentially at 3 Mile, Bugandi or the Markham River upper terraces), people using those gardens for food may experience a reduction or disruption in their food supply.

Some residents of this study area may receive income or compensation from the Project (see Section 18.5.1.1, Employment, Procurement, Project Payments and the Local Economy – Study Area 3). The Project may lead to or exacerbate nutritional issues, where individuals choose to spend income on unhealthy foods. While such an impact depends on individual choices, Pus et al. (2016) suggest that healthy eating practices are not widely observed in PNG, and therefore possible within this study area.

Accidents and Injuries

Construction of the Infrastructure Corridor from the Port of Lae to Malahang will temporarily disrupt vehicle and foot traffic, and add more traffic as construction vehicles access the

construction site. This will heighten the risk of road accidents. People may become frustrated at congestion and drive more aggressively. Pedestrians seeking detours may need to cross more roads, potentially at unsafe locations.

Exposure to Potentially Hazardous Materials

Dust, noise and light may affect residents and businesses in the immediate vicinity of the Infrastructure Corridor and the Port Facilities Area. The WGJV intends to avoid night works in residential areas to minimise interference with sleep. However, if this is impracticable (e.g., because of traffic impacts associated with daytime works), people living in the mixed commercial/residential areas of Chinatown and Malahang would experience the most significant impacts of this nature which would be temporary.

Spills and leaks may occur in the event of pipeline rupture (whether by accident or by sabotage). The actual volume of any leak will depend on multiple factors. Continual leak monitoring and shutdown systems will limit the volume released. Impacts arising from unplanned events of this nature are assessed in detail in Chapter 21, Unplanned Events (Natural Hazards and Accident Events). Due to the density of population in Lae, a leak may affect a large number of people compared to a leak in any of the other study areas.

Social Determinants of Health

Increased income from employment or procurement, or increased cash liquidity from compensation, may encourage individuals to misuse substances, such as alcohol, tobacco, betel nut or marijuana.

The potential for security personnel to use inappropriate force is discussed in Section 18.5.1.7, Community cohesion and law and order.

Cultural Health Practices

Nearly 40% of Lae's population are migrants (born outside of Lae), according to JICA (2017, p.4-4). Of the migrant population within Lae, approximately a third migrated from elsewhere in Morobe Province, and two thirds migrated from elsewhere in PNG (ibid). Due to the mix of cultural backgrounds already existing within Lae, no impacts to cultural health practices (such as use of traditional medicine for the treatment of illness) are expected to arise in this study area.

Health services infrastructure and capacity

Two hospitals are located in proximity to the proposed Infrastructure Corridor: the Lae International Hospital (located near the Port of Lae on Mangola Street, immediately adjacent to the Infrastructure Corridor), and the ANGAU Memorial Hospital (located on Markham Road, approximately 400m from the Infrastructure Corridor alignment). The WGJV will maintain access at all times to critical infrastructure, including hospitals. While some temporary inconvenience is likely (e.g., due to traffic congestion in the general vicinity), access to healthcare facilities will not be impaired.

Non-communicable diseases

Poor dietary choices and substance misuse (see above) may lead to non-communicable diseases among people who receive an income (or an increase in liquidity) from the Project. However, Project-induced increases in non-communicable diseases are expected to be unlikely.

18.5.1.6. Education

Few impacts on education are anticipated for this study area. There may be some impacts on access to schools during construction (if undertaken during the day), with students needed to travel further to detour construction activities.

18.5.1.7. Community Cohesion and Law and Order

As discussed in Section 18.5.1.1.3, Economy, compensation will be payable to landowners and settlers whose land is affected by the Infrastructure Corridor. Disputes may arise as to entitlement to compensation related to both the value of the compensation and the disputed land ownership claims. Landowners may also claim that settlers are not entitled to compensation. Disputes may lead to violence between members of the public.

People opposing the Project may engage in protests directed towards the State of PNG, particular agencies, or the Project. People inconvenienced by construction may contribute to unrest.

The Project plans to engage private security personnel, and work with public security personnel (including police) to ensure the safety of the workforce and Project assets.

Members of the Project workforce engaged in construction work, and/or residing in WGJV facilities at 9 Mile and 11 Mile (just outside Lae to the west) may engage in disorderly behaviour, creating law and order and/or or community cohesion issues within this study area. However, to do so would immediately place their employment on the Project at risk.

18.5.1.8. Tradition and Culture

No impacts relating to tradition and culture are expected for this study area.

18.5.1.9. Traffic

Traffic impacts in this study area would be restricted to the construction phase. Impact to urban land use is likely to extend beyond the immediate construction work zones, as traffic congestion will be experienced elsewhere along the road network of Lae. To the fullest extent practicable, the WGJV will keep a single lane open at all times with traffic management measures, and night works would take place provided that night time noise criteria are met. Some degree of congestion would be unavoidable.

Congestion may be worst along roads that are proximate to the proposed Infrastructure Corridor, and are currently at or over capacity. In particular, Independence Drive (which leads from the city centre to Malahang) is predicted to be over capacity by 2025 (JICA, 2017), and currently experiences heavy traffic at peak morning and evening times. Residences are located adjacent to Independence Drive, which may constrain night works. Construction work at a section of Independence Drive may create congestion extending along Independence Drive for kilometres.

Roads feeding into Independence Drive may also be affected, and in turn, other roads feeding into those roads. For example, Sandpiper Road (located at the northern part of the city centre) is predicted to be over-capacity by 2025. It feeds into Independence Drive at Chinatown. Congestion along Independence Drive may create additional congestion on Sandpiper Road, which may in turn create congestion at the city centre – particularly along Huon Road, which is also projected to be over-capacity by 2025. In general, congestion may cause public inconvenience. It may disrupt public transport, commuters and businesses, services and community destinations.

The Infrastructure Corridor may lead to impacts in 3 Mile and Bugandi, and where the Infrastructure Corridor traverses the upper terrace of the Markham River floodplain. While

it is not anticipated that land which is currently used for gardening will be directly affected, access may be temporarily constrained for people seeking who need to cross the Infrastructure Corridor to reach their gardens during construction.

18.5.1.10. Summary of Initial Impact Assessment for Study Area 3

Table 18.18 presents the impacts identified in relation to Study Area 3 and the assessment of the significance of these impacts prior to the application of any management measures.

18.5.2. Proposed Management Measures

Table 18.14 presents a list of management measures consolidated for all study areas. Because many proposed management measures are common to multiple study areas, a complete list of management measures for this study area is not provided.

The management measures specifically devised for this study area are:

- SMM16: Public engagement on DSTP, which will provide frequent and regular engagement (e.g., through traditional and social media) to disseminate information on DSTP. This management measure will include regular presentation of monitoring results regarding marine ecosystem health.
- SMM25: Lae pre-construction consultation, for which the WGJV will work with local and provincial government to consult with stakeholders in Lae in advance of and during construction of the Infrastructure Corridor. This measure is intended to manage traffic and access impacts within Lae.

Table 18.18: Initial impact assessment for Study Area 3

Note: blue shading indicates positive impact

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S301	Increase in local employment during Project construction	Employment, procurement, Project payments & local economy	Suitably qualified residents of Lae	Construction	Almost certain	Minor	High
S308	Increased or ongoing local employment during Project operations	Employment, procurement, Project payments & local economy	Suitably qualified residents of Lae	Operations	Almost certain	Negligible	Moderate
S312	Increase in local procurement during Project construction	Employment, procurement, Project payments & local economy	Businesses and employees of businesses within Lae	Construction	Almost certain	Minor	High
S313	Improved business and employment opportunities as an indirect result of the Project	Employment, procurement, Project payments & local economy	Dispersed across study area	Life of Mine	Likely	Negligible	Low
S314	Increase in local procurement during Project operations	Employment, procurement, Project payments & local economy	Businesses and employees of businesses within Lae	Operations	Almost certain	Minor	High
S303	Reputational damage to industrial tuna industry, due to perceived (rather than actual) adverse impacts of DSTP	Employment, procurement, Project payments & local economy	Industrial tuna industry within Lae	Operations	Unlikely	Moderate	Moderate
S371	Physical displacement of settlers' homes along portion of Infrastructure Corridor at 3 Mile and Bugandi	Physical and economic displacement (Resettlement)	Settlers living within the Infrastructure Corridor at 3 Mile and Bugandi	Life of Mine	Unlikely	Major	High

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S387	Economic displacement of plantations or gardens along portion of Infrastructure Corridor west of Lae (upper terrace of Markham River floodplain)	Physical and economic displacement (Resettlement)	Landowners and/or settlers within the section of the Infrastructure Corridor along the upper terrace of the Markham River floodplain	Life of Mine	Possible	Moderate	High
S388	Economic displacement of settlers' gardens along portion of Infrastructure Corridor at 3 Mile and Bugandi	Physical and economic displacement (Resettlement)	Settlers maintaining gardens within the Infrastructure Corridor at 3 Mile and Bugandi	Life of Mine	Possible	Moderate	High
S389	Economic displacement of roadside stalls along portion of Infrastructure Corridor between the Port of Lae and Malahang	Physical and economic displacement (Resettlement)	People operating roadside stalls adjacent to the Infrastructure Corridor (principally on Independence Drive) between the Port of Lae and Malahang	Life of Mine	Possible	Minor	Moderate
S302	Lost or diminished livelihoods for small-scale fish vendors, as a result of public concerns over DSTP	Land and water resource use	Small-scale fish vendors operating in Lae (including people from Labu)	Life of Mine	Unlikely	Moderate	Moderate
S357	Project-induced increased pressure on the availability of subsistence resources as a result of in-migration	Land and water resource use	Residents of informal settlements within Lae	Construction	Unlikely	Moderate	Moderate
S386	Temporary, restricted access to areas used for subsistence activities during construction of the Infrastructure Corridor (including access to the Markham River)	Land and water resource use	Small-scale fish vendors operating in Lae (including people from Labu)	Construction	Likely	Negligible	Low

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S322	Impaired amenity (e.g., dust, noise, light, visual, plant emissions) during construction of the Infrastructure Corridor and Outfall System	Community health and safety	Residents in proximity to Infrastructure Corridor	Construction	Likely	Minor	Moderate
S327	Increased incidences of traffic and pedestrian accidents within Lae due to construction of the Infrastructure Corridor	Community health and safety	Lae, particularly in the southern and eastern parts of the city	Construction	Possible	Major	Very High
S332	Health problems resulting from increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income from the Project	Community health and safety	People receiving income or compensation from the Project	Life of Mine	Possible	Minor	Moderate
S333	Project-induced increase in prevalence of lifestyle diseases as a result of changing diet and physical activity level	Community health and safety	People receiving income or compensation from the Project	Life of Mine	Possible	Minor	Moderate
S335	Project-induced increase in HIV/AIDS and other sexually transmittable infections arising from high-risk behaviour associated with higher levels of disposable income and/or in-migration	Community health and safety	People receiving income or compensation from the Project, and their sexual partners	Life of Mine	Possible	Moderate	High

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S338	Project-induced increase in incidences of communicable diseases (e.g., gastrointestinal and respiratory diseases) within informal settlements in Lae, due to in-migration	Community health and safety	Residents of informal settlements within Lae	Construction	Unlikely	Moderate	Moderate
S383	Inappropriate use of force by public security personnel deployed in connection with the Project	Community health and safety	Landowners and settlers living in proximity to the Infrastructure Corridor; protestors against the Project, mining or DSTP	Life of Mine	Possible	Major	Very High
S384	Inappropriate use of force by private security personnel deployed in connection with the Project	Community health and safety	Landowners and settlers living in proximity to the Infrastructure Corridor; protestors against the Project, mining or DSTP	Life of Mine	Possible	Major	Very High
S391	Reduction in recreational fishing and swimming as a result of concerns over DSTP	Community health and safety	3 Mile, Bugandi and upper terrace of Markham River	Operations	Possible	Negligible	Low
S375	Disputes and potentially conflict over landownership and/or entitlement to compensation	Community cohesion and law and order	Infrastructure Corridor, particularly sections running through upper terrace of Markham River floodplain, 3 Mile and Bugandi	Construction	Possible	Moderate	High
S392	Community tensions and disputes arising from interaction with Project workforce	Community cohesion and law and order	Across study area, but likely near accommodation at 9 Mile or 11 Mile on the outskirts of Lae	Life of Mine	Possible	Minor	Moderate

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S394	Unrest originating from activists, non-governmental organisations or sectors of the general public in opposition to the Project	Community cohesion and law and order	Within Lae	Life of Mine	Possible	Minor	Moderate
S304	Where construction activities occur during business hours: disruption to businesses as a direct result of disrupted access during construction of Infrastructure Corridor	Traffic	Businesses adjacent to the proposed Infrastructure Corridor, between Port of Lae and Malahang	Construction	Possible	Moderate	High
S305	Where construction activities occur during business hours: disruption to businesses as a result of traffic congestion generated by construction of Infrastructure Corridor	Traffic	Businesses within Lae, particularly in the southern and eastern parts of the city	Construction	Possible	Moderate	High
S306	Where construction activities occur during business hours: disrupted access to shops, public services, financial services, health and education facilities, public transport, and other services	Traffic	General public and institutions within Lae, including: businesses, non-government organisations, government agencies, financial institutions, schools, health facilities	Construction	Possible	Moderate	High
S390	Additional disruption to boating routes used by small-scale fishing enterprises, as a result of increased shipping traffic at the Port of Lae	Traffic	People in Lae who fish or swim in the Huon Gulf recreationally	Operations	Likely	Negligible	Low

18.5.3. Residual Impact Assessment

The initial impact assessment identified 29 socioeconomic impacts for Study Area 3, of which 24 were adverse impacts and five were positive. Of the 24 adverse impacts, 3 were initially assessed as being of very high significance, 8 were high, 10 were moderate and 3 were low. Of the 5 positive impacts, 3 were assessed as high, 1 was moderate, and 1 was low.

The implementation of the proposed management measures outlined in Section 18.3.3 is intended to enhance people's ability to realise opportunities and avoid or reduce potential adverse socioeconomic impacts of the Project. Table 18.19 provides an assessment of socioeconomic impacts for Study Area 3, following the implementation of management measures. Some residual impacts retain the same overall significance rating, notwithstanding a change in the likelihood and/or consequence rating. A summary of residual impacts that have a very high or high level of significance is provided below.

18.5.3.1. Very High Residual Impacts for Study Area 3

One positive impact had a very high residual impact – increase in local procurement during construction (S312). This impact is enhanced by measures which encourage and reserve procurement preferences for local businesses (NCP10).

18.5.3.2. High Residual Impacts for Study Area 3

Two adverse impacts had a high residual significance in this study area. One related to the inappropriate use of force by public security personnel (e.g., police) deployed in connection with the Project (S383). As public security forces, the Project has limited control over their conduct. The management measure proposed included engagement with public security forces in the Security Management Plan, support for Provincial service delivery programs (including law enforcement programs, where appropriate), and facilitating police training on the Voluntary Principles on Security and Human Rights. With the application of these management measures, the likelihood of this impact was reduced from 'possible' to 'unlikely'.

Inappropriate use of force by privately contracted personnel (S384) did not have a high residual significance. Because these personnel would be contracted by the WGJV, the ability to control their operational procedures would limit the amount of force that could be applied (e.g., by restricting or prohibiting circumstances where firearms would be carried). Consequently, this impact had a moderate residual impact.

The second adverse impact of high residual significance related to the risk of increased traffic and pedestrian accidents within Lae due to the construction of the Infrastructure Corridor. It is acknowledged that the WGJV will consult with stakeholders to ensure coordination of management efforts and implement the Traffic Management Plan to ensure worksite safety. These management measures influenced the residual likelihood of this impact to be 'unlikely'. However, due to the potential seriousness of vehicular accidents, the residual consequence was considered high, leading to a high residual significance.

Two positive impacts had a residual significance of 'high'. Both related to increased local procurement (S312 and S314). As the industrial centre of Lae, significant procurement contracts are likely to be made with businesses based in Lae.

Table 18.19: Residual significance assessment for Study Area 3
Note: blue shading indicates positive impact

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S301	Increase in local employment during Project construction	Employment, procurement, Project payments & local economy	Suitably qualified residents of Lae	Construction	Almost certain / Minor High	NCM1: Implementation of local hire preference policy NCM4: Employee training and development programs NCM5: Community workforce preparedness program	Almost certain / Minor High
S308	Increased or ongoing local employment during Project operations	Employment, procurement, Project payments & local economy	Suitably qualified residents of Lae	Operations	Almost certain / Negligible Moderate	NCM1: Implementation of local hire preference policy NCM4: Employee training and development programs NCM5: Community workforce preparedness program	Almost certain / Negligible Moderate
S312	Increase in local procurement during Project construction	Employment, procurement, Project payments & local economy	Businesses and employees of businesses within Lae	Construction	Almost certain / Minor High	NCM10: Local participation in the Project supply chain	Almost certain / Moderate Very High
S313	Improved business and employment opportunities as an indirect result of the Project	Employment, procurement, Project payments & local economy	Dispersed across study area	Life of Mine	Likely / Negligible Low	NCM10: Local participation in the Project supply chain	Almost certain / Minor High
S314	Increase in local procurement during Project operations	Employment, procurement, Project payments & local economy	Businesses and employees of businesses within Lae	Operations	Almost certain / Minor High	NCM10: Local participation in the Project supply chain	Almost certain / Minor High

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S303	Reputational damage to industrial tuna industry, due to perceived (rather than actual) adverse impacts of DSTP	Employment, procurement, Project payments & local economy	Industrial tuna industry within Lae	Operations	Unlikely / Moderate Moderate	SMM16: Public engagement on DSTP	Remote / Moderate Low
S371	Physical displacement of settlers' homes along portion of Infrastructure Corridor at 3 Mile and Bugandi	Physical and economic displacement (Resettlement)	Settlers living within the Infrastructure Corridor at 3 Mile and Bugandi	Life of Mine	Unlikely / Major High	SMM13: Resettlement management LAMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM20: Respecting existing local ties, traditions and sense of place	Unlikely / Moderate Moderate
S387	Economic displacement of plantations or gardens along portion of Infrastructure Corridor west of Lae (upper terrace of Markham River floodplain)	Physical and economic displacement (Resettlement)	Landowners and/or settlers within the section of the Infrastructure Corridor along the upper terrace of the Markham River floodplain	Life of Mine	Possible / Moderate High	SMM13: Resettlement management LAMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Unlikely / Moderate Moderate
S388	Economic displacement of settlers' gardens along portion of Infrastructure Corridor at 3 Mile and Bugandi	Physical and economic displacement (Resettlement)	Settlers maintaining gardens within the Infrastructure Corridor at 3 Mile and Bugandi	Life of Mine	Possible / Moderate High	SMM13: Resettlement management LAMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Unlikely / Moderate Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S389	Economic displacement of roadside stalls along portion of Infrastructure Corridor between the Port of Lae and Malahang	Physical and economic displacement (Resettlement)	People operating roadside stalls adjacent to the Infrastructure Corridor (principally on Independence Drive) between the Port of Lae and Malahang	Life of Mine	Possible / Minor Moderate	SMM13: Resettlement management LAMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Possible / Negligible Low
S302	Lost or diminished livelihoods for small-scale fish vendors, as a result of public concerns over DSTP	Land and water resource use	Small-scale fish vendors operating in Lae (including people from Labu)	Life of Mine	Unlikely / Moderate Moderate	SMM16: Public engagement on DSTP	Remote / Minor Low
S357	Project-induced increased pressure on the availability of subsistence resources as a result of in-migration	Land and water resource use	Residents of informal settlements within Lae	Construction	Unlikely / Moderate Moderate	SMM14: In-migration management	Unlikely / Moderate Moderate
S386	Temporary, restricted access to areas used for subsistence activities during construction of the Infrastructure Corridor (including access to the Markham River)	Land and water resource use	Small-scale fish vendors operating in Lae (including people from Labu)	Construction	Likely / Negligible Low	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM6: Safety Awareness and Behaviour Program	Likely / Negligible Low
S322	Impaired amenity (e.g., dust, noise, light, visual, plant emissions) during construction of the Infrastructure Corridor and Outfall System	Community health and safety	Residents in proximity to Infrastructure Corridor	Construction	Likely / Minor Moderate	SMM4: Environmental Management Plan	Possible / Minor Moderate
S327	Increased incidences of traffic and pedestrian accidents within Lae due to construction of the Infrastructure Corridor	Community health and safety	Lae, particularly in the southern and eastern parts of the city	Construction	Possible / Major Very High	TMP1: Traffic Management Plan SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM25: Lae pre-construction consultation	Unlikely / Major High

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S332	Health problems resulting from increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income from the Project	Community health and safety	People receiving income or compensation from the Project	Life of Mine	Possible / Minor Moderate	SMM1: Health Awareness Program (communities) SMM22: Health Awareness Program (workforce)	Unlikely / Minor Low
S333	Project-induced increase in prevalence of lifestyle diseases as a result of changing diet and physical activity level	Community health and safety	People receiving income or compensation from the Project	Life of Mine	Possible / Minor Moderate	SMM1: Health Awareness Program (communities) SMM22: Health Awareness Program (workforce)	Unlikely / Minor Low
S335	Project-induced increase in HIV/AIDS and other sexually transmittable infections arising from high-risk behaviour associated with higher levels of disposable income and/or in-migration	Community health and safety	People receiving income or compensation from the Project, and their sexual partners	Life of Mine	Possible / Moderate High	SMM1: Health Awareness Program (communities) SMM14: In-migration management SMM22: Health Awareness Program (workforce)	Unlikely / Moderate Moderate
S338	Project-induced increase in incidences of communicable diseases (e.g., gastrointestinal and respiratory diseases) within informal settlements in Lae, due to in-migration	Community health and safety	Residents of informal settlements within Lae	Construction	Unlikely / Moderate Moderate	NCM11: Support for Provincial service delivery programs SMM14: In-migration management	Unlikely / Minor Low
S383	Inappropriate use of force by public security personnel deployed in connection with the Project	Community health and safety	Landowners and settlers living in proximity to the Infrastructure Corridor; protestors against the Project, mining or DSTP	Life of Mine	Possible / Major Very High	SECMP1: Security Management Plan NCM11: Support for Provincial service delivery programs SMM27: Facilitate police training on the Voluntary Principles on Security and Human Rights	Unlikely / Major High

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S384	Inappropriate use of force by private security personnel deployed in connection with the Project	Community health and safety	Landowners and settlers living in proximity to the Infrastructure Corridor; protestors against the Project, mining or DSTP	Life of Mine	Possible / Major Very High	SECMP1: Security Management Plan SMM8: Workforce Code of Conduct SMM28: Provide training for security personnel in the Voluntary Principles on Security and Human Rights	Unlikely / Moderate Moderate
S391	Reduction in recreational fishing and swimming as a result of concerns over DSTP	Community health and safety	3 Mile, Bugandi and upper terrace of Markham River	Operations	Possible / Negligible Low	SMM16: Public engagement on DSTP	Unlikely / Negligible Low
S375	Disputes and potentially conflict over landownership and/or entitlement to compensation	Community cohesion and law and order	Infrastructure Corridor, particularly sections running through upper terrace of Markham River floodplain, 3 Mile and Bugandi	Construction	Possible / Moderate High	LAMM1: Management of compensation obligations LAMM2: Tenement land inspection and management SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Unlikely / Moderate Moderate
S392	Community tensions and disputes arising from interaction with Project workforce	Community cohesion and law and order	Across study area, but likely near accommodation at 9 Mile or 11 Mile on the outskirts of Lae	Life of Mine	Possible / Minor Moderate	SMM8: Workforce Code of Conduct SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Unlikely / Minor Low
S394	Unrest originating from activists, non-governmental organisations or sectors of the general public in opposition to the Project	Community cohesion and law and order	Within Lae	Life of Mine	Possible / Minor Moderate	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM16: Public engagement on DSTP	Possible / Minor Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S304	Where construction activities occur during business hours: disruption to businesses as a direct result of disrupted access during construction of Infrastructure Corridor	Traffic	Businesses adjacent to the proposed Infrastructure Corridor, between Port of Lae and Malahang	Construction	Possible / Moderate High	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure TMP2: Advance warning of changes in traffic conditions	Possible / Minor Moderate
S305	Where construction activities occur during business hours: disruption to businesses as a result of traffic congestion generated by construction of Infrastructure Corridor	Traffic	Businesses within Lae, particularly in the southern and eastern parts of the city	Construction	Possible / Moderate High	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure TMP2: Advance warning of changes in traffic conditions	Possible / Minor Moderate
S306	Where construction activities occur during business hours: disrupted access to shops, public services, financial services, health and education facilities, public transport, and other services	Traffic	General public and institutions within Lae, including: businesses, non-government organisations, government agencies, financial institutions, schools, health facilities	Construction	Possible / Moderate High	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure TMP2: Advance warning of changes in traffic conditions	Possible / Minor Moderate
S390	Additional disruption to boating routes used by small-scale fishing enterprises, as a result of increased shipping traffic at the Port of Lae	Traffic	People in Lae who fish or swim in the Huon Gulf recreationally	Operations	Likely / Negligible Low	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM6: Safety Awareness and Behaviour Program	Possible / Negligible Low

18.6. Impact Assessment for Study Area 4 (Wagang and Yanga villages)

In this study area, the Infrastructure Corridor will traverse land to the south of Yanga and east of Wagang village, until it reaches the Outfall Area. The Outfall Area will include the mix/de-aeration tank, seawater intake pipelines and DSTP outfall pipelines (collectively, the Outfall System), as well as associated, co-located facilities (namely, the pipeline laydown area, choke station, access track and parking and turnaround area).

Within the Infrastructure Corridor, the terrestrial tailings pipeline will be buried below ground. The mix/de-aeration tank will have a diameter of approximately 12m and a height of 10m. It will be located within a dry moat, approximately 26.5m by 16m and 14m deep, relative to local ground level (approximately 7m above the low-water mark). The bottom of the mix/de-aeration tank will be 7m below sea level (low-water mark). The total footprint of the onshore components of the Outfall System will be approximately 100m by 100m, potentially with additional laydown areas during construction.

18.6.1. Impact Identification and Initial Impact Assessment

The expected changes and socioeconomic impacts resulting from the Project for Study Area 4, prior to the application of any management measures, are described below. Impacts are grouped by the categories listed in Section 18.1.2.2 and the section concludes with a table presenting the initial significance assessment for the identified impacts.

18.6.1.1. Employment, Procurement, Project Payments and the Local Economy

18.6.1.1.1. Employment

Wagang and Yanga villages are landowners of land on which the Infrastructure Corridor and the terrestrial components of the Outfall System are located. As such, individuals for Wagang and Yanga villages would be recruited as first preference for construction of these components.

The number of persons who might be eligible for employment in these villages can be estimated based on population demographics, however it should be noted that this does not take into account existing employment or other obligations which may prohibit an individual from seeking work. Approximately two-thirds of the population of Wagang village is between 15 and 65 years of age (i.e., working age). With an estimated population of approximately 600 in 2017, 400 persons of working age would be residing in Wagang. Similar figures for Yanga would suggest 800 persons of working age within this study area.

As noted above, during construction, approximately 400 FTE workers will be required for the length of the Infrastructure Corridor and 200 FTE for the Outfall Area. However, this work is largely technical in nature, and a specialist contractor will be engaged for the majority of the work. While some job-seekers from this study area may be suitably qualified for these specialised roles, the majority of roles available to residents of Wagang and Yanga are expected to be unskilled.

Not every person of working-age would or could seek work with the Project. However, with an estimated working-age population of 800, employment with the Project presents an opportunity for Wagang and Yanga villages.

During construction, other residents of this study area may find work at the Mine Area, although landowners and residents of communities near the Mine Area (i.e., Study Area 1 communities) would have higher recruitment preference. Similarly, during operation, some residents of this study area may find work at the Mine Area and/or the Port Facilities Area,

but Wagang and Yanga would not be top recruitment priority and job availability would be less compared to the construction phase.

For individuals who gain employment with the Project, employment may lead directly to increased incomes for employees and their families, although some employees may merely be changing from one job to another. In the longer-term, job experience and training gained with the Project may lead to improved employability elsewhere.

There may be perceived unfairness as to who is recruited, leading to community tensions. Similar tensions may arise when the workforce downsizes after the construction phase, upon which most employees will no longer hold jobs with the Project. There may be perceived unfairness as to who retained jobs. Those who lost jobs may not be content with returning to their pre-employment life.

18.6.1.1.2. Procurement

Within this study area, business activities currently account for approximately a fifth of village income, indicating that some people are accustomed to carrying out business activities. The extent to which existing or future businesses will adapt to harness opportunities provided by the Project is unclear, but it is possible that some people will be willing and able to do so, which could lead to increased income and/or indirect employment opportunities as businesses grow.

18.6.1.1.3. Project Payments

As discussed in Section 18.3.2.1, Wagang and Yanga villages may receive a portion of royalties, or some form of Project benefit. Affected landowners will also receive compensation for loss or damage to land, arising from the construction of the Infrastructure Corridor and the Outfall System.

While boosts in income sometimes lead to inflation in the prices of goods and services, it is unlikely in Study Area 4, because households tend to shop in Lae, with the majority taking PMV for a return fare of PGK1 – 2. Competition with vendors in Lae would tend to keep costs steady. Were inflation to occur, the increase in cost will likely be minor.

18.6.1.2. In-migration

Although in-migration is likely to be concentrated in Study Area 1 villages, some in-migration may occur in this study area. In-migration may be driven by a desire for employment or to benefit from compensation either directly or through friends and family. In this study area, some in-migrants might also seek to move into this study area for cost, comfort or family reasons if they were recruited into the Project and would otherwise need to live in Lae.

Household surveys in Wagang in 2017 indicate that in-migration to date has predominantly been for family or marriage reasons. Over half the respondents indicated having been born in Wagang. Of those that had moved to Wagang, three-quarters moved for family or marriage. Six percent moved for better access to services. No comparable data was collected for Yanga village, but in both cases large-scale in-migration (and associated rapid population growth) is considered unlikely.

In-migration can trigger a number of related impacts, such as changes to the health status of the host community due to the introduction of new diseases, increased demand for health facilities, or increased pressure on locally grown food sources. Similarly, in-migration can generate social cohesion challenges where there is friction between host communities and new arrivals, potentially spilling over into violence in extreme cases.

Wagang and Yanga villages are likely to be accustomed to new arrivals (as indicated by the fact that nearly half of the respondents to household surveys in 2017 were born outside of Wagang). Their proximity to Lae (and, in the case of Wagang, the fact that they receive visitors from Lae regularly on weekends) suggests that residents of these villages are well accustomed to mixing with people from outside the village. However, village leaders in Wagang did report concerns about land availability, which in-migration would exacerbate.

18.6.1.3. Physical and Economic Displacement (Resettlement)

Involuntary resettlement, as defined by the IFC (2012), 'refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use.'

Displacement of villages as a whole is not anticipated for this study area. The WGJV seeks to avoid physical displacement of households through route and infrastructure siting choice. Loss or destruction of houses is unlikely at Wagang village. The Infrastructure Corridor bypasses the residential areas of Wagang village. No households are located in the footprint or immediate vicinity of the Outfall System. There is a slight possibility of physical displacement of houses in Yanga village, where the Infrastructure Corridor follows the road through Yanga village, and where houses are built close to the edge of the road.

Economic displacement may occur within both Yanga and Wagang villages, primarily due to loss of or damage to gardens, cash crops, water courses and springs where the Infrastructure Corridor turns southwards towards the coast from the road at Yanga. Such damage or destruction would amount to economic displacement, and will be discussed in Section 18.6.1.4, Land and water resources. However, economic displacement would be compensable, which would offset most if not all impact.

Roadside stalls may also be impacted where the Infrastructure Corridor follows the road through Yanga village. However, it is likely that stalls would be preserved/relocated, with restricted access during construction only.

18.6.1.4. Land and Water Resources

18.6.1.4.1. Land-based Resources

The land through which the Infrastructure Corridor will traverse includes areas used by both villages for gardening, hunting, gathering of forest supplies, and collection of shellfish, fish and other aquatic resources. Springs and creeks used for collecting drinking water, washing and bathing in the immediate area of the Infrastructure Corridor may be disrupted temporarily during construction, including Bugalung Creek and Gaisong Creek, which meander in the vicinity of the Infrastructure Corridor (see Figure 12.46). No gardens or houses would be permitted over the Infrastructure Corridor following construction for the life of the mine, due to the need to maintain operational access and the safety and integrity of the buried pipeline. Foot access will be permitted and, after construction, will not be impeded by the buried pipeline.

The land on which the mix/de-aeration tank will be situated (as well as associated, co-located facilities) will also be unavailable for subsistence activities for the life of the mine. While no specific land use was identified for the site, Wagang villagers reported that the site was within a general area used for gardens, hunting and gathering, as well as washing, bathing and collecting drinking water.

Resources gathered in this area were for both subsistence and commercial purposes. For example, garden produce was mostly consumed, with surplus sold. Some types of shellfish

were consumed, while others were used to make powder sold to people who consume it with betel nut. Loss or damage to such resources is compensable.

A temporary impact on land use and land-based livelihoods would be experienced during the construction phase. Foot access across the Infrastructure Corridor and the Outfall System site would be prohibited during construction. Detours would be necessary, potentially disrupting access to areas used for gardening, hunting, fishing and gathering. For the Infrastructure Corridor construction, detours could add up to several hundred metres to a foot journey, and be in place for several days. Access along Wagang beach would be disrupted for several months during construction of the DSTP outfall pipelines.

Finally, the Project may exacerbate a concern that existing land and water resources would not be able to support future generations. Wagang village leaders stated that land availability for future generations was the principal concern of the village, as the land is currently constrained by Busu River to the east, the coastline to the south, and existing land uses to the north and west. The potential Wagang Fisheries Wharf project less than 500m to the west adds to this concern (discussed in Chapter 22, Cumulative Impact Assessment).

18.6.1.4.2. Water-based Resources

Deep sea tailings placement is not expected to affect the resource availability or food-safety of fish caught within the Huon Gulf. However, concerns over DSTP may discourage some community members from fishing and swimming in the coastal areas near Wagang.

Fishing is a prominent part of life at both Wagang and Yanga villages, with approximately two thirds of households regularly engaging in fishing. Fish caught are usually eaten or given to family members. Few people reported selling fish commercially. The beach is the most popular location for fishing (used by 80% of people who fish).

Approximately a third of people who fish do so offshore, within 500m of the shore. At about 500m offshore from Wagang, water depths are at approximately 100m, well above the depth of the DSTP outfall at approximately 200m. Additionally, villagers did not report regularly attempting to catch deep slope fish and the results of the deep slope fish survey (Appendix P, Deep-slope and Pelagic Fish Characterisation) show that there is not an exploitable resource of deep slope fish there even if they chose to do so. The fishing gear observed did not appear to enable fishing at depths much greater than 100m.

The beach at Wagang is also a popular swimming location. Residents from both villages reported swimming at Wagang beach. On weekends, visitors from Lae also visit the beach for recreation. Wagang villagers operate a market and a beer store to sell goods to visitors.

Concern about DSTP affecting fish and water quality may reduce the amount of fresh fish caught and eaten (or gifted to family members), the amount of time spent fishing and swimming recreationally, and the amount of revenue earned from selling market goods and beer to recreational visitors to Wagang beach.

A temporary impact on water use and water-based livelihoods would be experienced during the construction phase. Foot access across the Infrastructure Corridor and the Outfall System site would be prohibited during construction. Detours could add several hundred metres to a foot journey, and be in place for several days for the Infrastructure Corridor construction, and several months for the Outfall System. Some activities (e.g., bathing) would not be able to take place when construction work is occurring nearby i.e., within a safety exclusion zone.

18.6.1.5. Community Health and Safety

This section identifies impacts relating to community health and safety within this study area. It adopts the environmental health areas given by the IFC Good Practice publication, *Introduction to Health Impact Assessment* (IFC, 2009b). While not all areas will be applicable to this study area, each area is discussed systematically.

As discussed in Section 18.6.1.1, Employment, procurement, Project payments and local economy, the Project is likely to increase income for people who obtain employment or procurement opportunities. Compensation for loss of or damage to interests in land would increase recipients' liquidity. These impacts may drive other impacts under this category.

Some in-migration into Wagang and Yanga may occur (see Section 18.6.1.2, In-migration), leading to community health and safety impacts. However, the degree of in-migration is not expected to be considerable.

Vector-related Diseases

A Project-induced increase in vector-related diseases is not expected in this study area.

Respiratory and Housing Issues

The Project is not expected to result in respiratory or housing issues.

Veterinary Medicine and Zoonotic Issues

No impacts relating to veterinary medicine and zoonotic issues are expected.

Sexually Transmitted Infections

The likelihood of increased STIs is considered possible, as some people will receive income or compensation from the Project, which may be spent in any number of ways, including prostitution.

Soil- and Water-sanitation-related Diseases

Impacts relating to soil- and water-sanitation diseases are considered unlikely, given that Wagang and Yanga have running water and composting toilets, and that overcrowding from in-migration is unlikely.

Food- and Nutrition-related Issues

Concerns over DSTP may discourage people from fishing, particularly at Wagang, the closest village to the outfall location. As fishing is undertaken by the majority of households, the consumption of fresh fish might decline based on the perception that fish may be poisoned by DSTP, even though this is not predicted to occur. This would likely lead to greater reliance on tinned fish and other protein sources (see Section 18.6.1.4.2, Water-based resource use).

Accidents and Injuries

Impacts relating to accidents and injuries are expected to be of low significance in this study area. While construction would result in temporary disruption to the road between Malahang and Yanga (either due to construction of the Infrastructure Corridor, or the need to convey materials to the Outfall Area), traffic along that road was observed to be slow and ordinary construction management is expected to mitigate most risks of accident and injury.

Exposure to Potentially Hazardous Materials

Health issues may also arise in connection with construction. Dust, noise and light may affect residents in the vicinity of the Infrastructure Corridor, particularly residents of Yanga village living close to the road along which the Infrastructure Corridor will traverse. This

impact may be several days in duration. While the dust is not likely to be hazardous, the emission of dust, noise and light might disturb daily life in ways that affect mental wellbeing.

Social Determinants of Health

This category considers health issues connected to resettlement, violence, gender issues, education, income, occupation, social class, security concerns, substance misuse, depression and changes to social cohesion.

Of these, issues relating to resettlement, violence, education, income, occupation, security and social cohesion are discussed under other categories of impact. Of the remaining issues, only substance misuse was identified as a potential impact within this study area – namely, the increased consumption of betel nut, alcohol, tobacco and/or marijuana, as a result of increased disposable income from the Project. This impact was considered possible; individuals may spend money in any number of ways.

Cultural Health Practices

Traditional medicines were reported as being collected in the present day, in the general area east of Wagang and south of Yanga through which the Infrastructure Corridor will traverse. Due to the narrow confines of the Infrastructure Corridor, however, impacts on the supply of traditional medicines were not expected to arise.

Health Services Infrastructure and Capacity

Construction would result in a temporary narrowing (likely for no more than a week) of part of the road between Yanga and Lae. This road leads to Malahang Health Centre, the primary health facility used by both Wagang and Yanga villagers. While the WGJV will maintain access to the health centre, residents of both villages reach the health centre via this road, primarily on foot. Construction may cause minor inconvenience.

Non-communicable Diseases

Poor dietary choices and substance misuse (see above) may lead to non-communicable diseases among people who receive an income (or an increase in liquidity) from the Project.

18.6.1.6. Education

Few impacts on education are anticipated for this study area. There may be some minor impacts on access to schools during construction, with students needing to travel a little further to detour around construction activities. In particular, elementary and primary school students from Wagang village would have to cross the Infrastructure Corridor to reach schools at Yanga and Bowali (near Yanga). Elementary and primary school students from Yanga would not be impacted.

Secondary school students from both villages would reach Malahang Secondary School by travelling a road along which the Infrastructure Corridor will be constructed. Construction activities will necessitate a short detour by students to reach the school.

18.6.1.7. Community Cohesion and Law and Order

The Project may threaten community cohesion and could likely lead to law and order issues. Alcohol was the most frequently mentioned law and order issue in Wagang, nominated by 9 out of 10 survey respondents. Public disturbances, drug use, domestic violence and land conflicts were the next most nominated law and order issues. Similar issues were raised by focus groups in Yanga.

The Project may exacerbate some of these issues. As noted in Section 18.6.1.5, Community health and safety, increased substance abuse may be driven by in-migration,

increased income, and increased availability of cash (e.g., through compensation). However, while possible, these drivers are not considered likely to occur.

Additionally, disputes may arise as to landownership, where landownership influences the amount of compensation payable to individuals.

A portion of the construction workforce will likely interact with residents of Wagang and Yanga village during construction. The presence of workers from a range of different cultural backgrounds can be a source of animosity within the workforce and between the workforce and local communities. There may be a perception that ‘outsiders’ are taking jobs away from local people, particularly as the construction of the Outfall System will require a team of highly skilled individuals, some of whom may need to be sourced outside PNG. If not managed appropriately, such animosity can result in tension, conflict and violence.

It is possible that some individuals may seek to establish gardens or houses over the Infrastructure Corridor subsequent to construction. This would be prohibited, as maintenance access will be retained by the WGJV to fulfil its duties to protect the integrity and safety of the pipeline. Given the support expressed for the Project (see Chapter 5, Stakeholder Engagement), and the narrowness of the maintenance access (less than 25m), it is unlikely that such individuals would be uncooperative to requests to desist from gardening or constructing houses over the pipeline. However, in the unlikely event that an individual refuses to do so, security personnel (public or private) may use inappropriate levels of force.

18.6.1.8. Tradition and Culture

As peri-urban communities near Lae, Wagang and Yanga villages are accustomed to the cash economy. Consequently, the Project is unlikely to lead to extreme changes in current traditions and culture. However, as discussed in Section 18.6.1.4.2, concerns over DSTP may discourage people from fishing or swimming recreationally. These are key parts of the way of life within this study area, and may be diminished as a result of the Project.

18.6.1.9. Traffic

Impacts to traffic are expected to be negligible. Construction would result in a temporary narrowing (likely no more than a week) of part of the road between Yanga and Lae, and may cause minor inconvenience.

18.6.1.10. Summary of Initial Impact Assessment for Study Area 4

Table 18.20 presents the impacts identified in relation to Study Area 4 and the assessment of the significance of these impacts prior to the application of any management measures.

Table 18.20: Initial impact assessment for Study Area 4

Note: blue shading indicates positive impact

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S401	Increase in local employment during construction	Employment, procurement, Project payments & local economy	People of working age	Construction	Likely	Moderate	High
S402	Increase in local employment during operation	Employment, procurement, Project payments & local economy	People of working age	Operations	Possible	Minor	Moderate
S403	Increased income and liquidity from Project payments	Employment, procurement, Project payments & local economy	Landowners along the Infrastructure Corridor and at the Outfall System	Life of Mine	Almost certain	Moderate	Very High
S412	Increase in local procurement during Project construction	Employment, procurement, Project payments & local economy	Business owners	Construction	Possible	Minor	Moderate
S414	Increased or ongoing local procurement during Project operations	Employment, procurement, Project payments & local economy	Business owners	Operations	Possible	Minor	Moderate
S417	Inflated cost of goods sold in trade stores and markets in local villages making it more difficult to afford store-bought foods, fuel and batteries, particularly for those not receiving income as a result of the Project	Employment, procurement, Project payments & local economy	Across study area	Life of Mine	Remote	Minor	Low

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S471	Physical displacement of households	Physical and economic displacement (Resettlement)	Residents of Yanga who live adjacent to the road along which the Infrastructure Corridor will traverse	Construction	Unlikely	Major	High
S457	Project-induced Increased pressure on the availability of subsistence resources as a result of in-migration	Land and water resource use	Individuals within study area	Construction	Possible	Minor	Moderate
S485	Economic displacement - loss of gardens and land used for hunting, gathering and fishing, due to construction of the Infrastructure Corridor and/or Outfall System	Land and water resource use	Wagang and Yanga villagers who use land within the Infrastructure Corridor/ footprint of the Outfall System	Life of Mine	Likely	Moderate	High
S486	Temporary, restricted access to areas used for subsistence activities during construction of the Infrastructure Corridor	Land and water resource use	Wagang and Yanga villagers who use land in proximity to the Infrastructure Corridor/ footprint of the Outfall System	Construction	Possible	Minor	Moderate
S491	Fishing diminished as a recreational and subsistence activity as a result of concerns over DSTP	Land and water resource use	Wagang and to a lesser extent Yanga	Operations	Possible	Moderate	High
S493	Concern over dwindling land availability for future generations	Land and water resource use	Across study area	Life of Mine	Possible	Moderate	High
S494	Swimming diminished as a recreational activity as a result of concerns over DSTP	Land and water resource use	Wagang and to a lesser extent Yanga	Operations	Possible	Minor	Moderate

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S495	Lost / reduced income from weekend markets, because concerns over DSTP results in fewer visitors to Wagang beach	Land and water resource use	Market and store vendors at Wagang	Operations	Possible	Moderate	High
S496	Economic displacement – restricted access to fishing/aquatic resource areas (streams and creeks) as a result of construction of Infrastructure Corridor and Outfall System	Land and water resource use	Wagang and to a lesser extent Yanga	Construction	Possible	Minor	Moderate
S422	Impaired amenity (e.g., dust, noise, light, visual, plant emissions) during construction of the Infrastructure Corridor and Outfall System	Community health and safety	Residents in proximity to Infrastructure Corridor - particularly at Yanga village	Construction	Likely	Moderate	High
S432	Health problems resulting from increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income from the Project	Community health and safety	People receiving income or compensation from the Project	Life of Mine	Possible	Moderate	High
S433	Project-induced increase in prevalence of lifestyle diseases as a result of changing diet and physical activity level	Community health and safety	People receiving income or compensation from the Project	Life of Mine	Possible	Moderate	High
S435	Project-induced increase in HIV/AIDS and other sexually transmittable infections arising from high-risk behaviour associated with higher levels of disposable income and/or in-migration	Community health and safety	People receiving income or compensation from the Project, and their sexual partners	Life of Mine	Possible	Moderate	High

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S438	Project-induced increase in incidences of communicable diseases (e.g., gastrointestinal and respiratory diseases) due to in-migration	Community health and safety	Individuals within study area	Construction	Unlikely	Moderate	Moderate
S483	Inappropriate use of force by public security personnel deployed in connection with the Project	Community health and safety	People who seek to establish houses or gardens on Infrastructure Corridor after construction (and who do not comply with requests to desist)	Operations	Unlikely	Moderate	Moderate
S484	Inappropriate use of force by private security personnel deployed in connection with the Project	Community health and safety	People who seek to establish houses or gardens on Infrastructure Corridor after construction (and who do not comply with requests to desist)	Operations	Unlikely	Moderate	Moderate
S497	Concerns about spills and leaks from pipelines within the Infrastructure Corridor/Outfall System, leading to avoidance of nearby land and water resources	Community health and safety	People who maintain gardens, or hunt, fish and/or gather resources near the Infrastructure Corridor/Outfall System	Operations	Possible	Negligible	Low

Ref	Impact	Primary category	Population affected	Phases	Likelihood	Consequence	Significance (initial)
S424	Inconvenience caused to school students detouring around construction of the Infrastructure Corridor, potentially using construction as a reason not to attend school	Education	School students from Wagang and Yanga	Construction	Possible	Negligible	Low
S475	Disputes over landownership and/or entitlement to compensation	Community cohesion and law and order	Wagang and to a lesser extent Yanga	Construction	Possible	Moderate	High
S478	Community tensions and disputes arising from in-migration (e.g., over subsistence resources, disorderly behaviour and disregard for local landowner authority)	Community cohesion and law and order	Wagang and to a lesser extent Yanga	Construction	Possible	Minor	Moderate
S482	Disruption of community cohesion resulting from: * Increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income * Disputes arising from increased gambling as a result of higher income levels.	Community cohesion and law and order	Wagang and Yanga	Construction	Possible	Moderate	High
S492	Community tensions and disputes arising from interaction with Project workforce	Community cohesion and law and order	Wagang and to a lesser extent Yanga	Construction	Possible	Minor	Moderate

18.6.2. Proposed Management Measures

Table 18.14 presents a list of management measures consolidated for all study areas. Because many management measures are common to multiple study areas, a complete list of management measures for this study area is not provided. As biophysical impacts from DSTP are not expected, SMM16 (Public engagement on DSTP) has been devised specifically to address impacts relating to perceived effects of DSTP.

18.6.3. Residual Impact Assessment

The initial impact assessment identified 28 socioeconomic impacts for Study Area 4, of which 23 were adverse impacts and 5 were positive. Of the 23 adverse impacts, none was initially assessed as being of very high significance, 11 were high, 9 were moderate and 3 were low. Of the 5 positive impacts, 1 was assessed initially as very high, 1 was high and 3 were moderate.

The implementation of the proposed management measures outlined in Section 18.1.2.4 is intended to enhance people's ability to realise opportunities and avoid or reduce potential adverse socioeconomic impacts of the Project. Table 18.21 provides an assessment of socioeconomic impacts for Study Area 4, following the implementation of management measures. Some residual impacts retain the same overall significance rating, notwithstanding a change in the likelihood and/or consequence rating. A summary of those residual impacts that have a very high or high level of significance is provided below.

18.6.3.1. Very High Residual Impacts for Study Area 4

No adverse impact had a very high residual significance in this study area. One positive impact, relating to increased income and liquidity from Project payments (S403) had a very high residual impact.

18.6.3.2. High Residual Impacts for Study Area 4

One adverse impact had a high residual significance. This impact relates to concern over dwindling land availability for future generations (S493), which was an express concern of village leaders in Wagang (not solely due to the Project, but also due to potential urban encroachment and other potential developments). One positive impact had a high residual significance, relating to a potential increase in local employment during construction (S401).

Table 18.21: Residual significance assessment for Study Area 4

Note: blue shading indicates positive impact

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S401	Increase in local employment during construction	Employment, procurement, Project payments & local economy	People of working age	Construction	Likely / Moderate High	NCM1: Implementation of local hire preference policy NCM4: Employee training and development programs NCM5: Community workforce preparedness program	Likely / Moderate High
S402	Increase in local employment during operation	Employment, procurement, Project payments & local economy	People of working age	Operations	Possible / Minor Moderate	NCM1: Implementation of local hire preference policy NCM4: Employee training and development programs NCM5: Community workforce preparedness program	Possible / Minor Moderate
S403	Increased income and liquidity from Project payments	Employment, procurement, Project payments & local economy	Landowners along the Infrastructure Corridor and at the Outfall System	Life of Mine	Almost certain / Moderate Very High	LAMM1: Management of compensation obligations NCM12: Individual capability development NCM13: Community capability development	Almost certain / Moderate Very High
S412	Increase in local procurement during Project construction	Employment, procurement, Project payments & local economy	Business owners	Construction	Possible / Minor Moderate	NCM10: Local participation in the Project supply chain	Possible / Minor Moderate
S414	Increased or ongoing local procurement during Project operations	Employment, procurement, Project payments & local economy	Business owners	Operations	Possible / Minor Moderate	NCM10: Local participation in the Project supply chain	Unlikely / Minor Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S417	Inflated cost of goods sold in trade stores and markets in local villages making it more difficult to afford store-bought foods, fuel and batteries, particularly for those not receiving income as a result of the Project	Employment, procurement, Project payments & local economy	Across study area	Life of Mine	Remote / Minor Low	NCM12: Individual capability development NCM13: Community capability development	Remote / Minor Low
S471	Physical displacement of households	Physical and economic displacement (Resettlement)	Residents of Yanga who live adjacent to the road along which the Infrastructure Corridor will traverse	Construction	Unlikely / Major High	SMM13: Resettlement management LAMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM20: Respecting existing local ties, traditions and sense of place	Unlikely / Moderate Moderate
S457	Project-induced Increased pressure on the availability of subsistence resources as a result of in-migration	Land and water resource use	Individuals within study area	Construction	Possible / Minor Moderate	SMM14: In-migration management	Remote / Minor Low
S485	Economic displacement - loss of gardens and land used for hunting, gathering and fishing, due to construction of the Infrastructure Corridor and/or Outfall System	Land and water resource use	Wagang and Yanga villagers who use land within the Infrastructure Corridor/ footprint of the Outfall System	Life of Mine	Likely / Moderate High	SMM13: Resettlement management LAMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Likely / Minor Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S486	Temporary, restricted access to areas used for subsistence activities during construction of the Infrastructure Corridor	Land and water resource use	Wagang and Yanga villagers who use land in proximity to the Infrastructure Corridor/ footprint of the Outfall System	Construction	Possible / Minor Moderate	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM6: Safety Awareness and Behaviour Program	Possible / Negligible Low
S491	Fishing diminished as a recreational and subsistence activity as a result of concerns over DSTP	Land and water resource use	Wagang and to a lesser extent Yanga	Operations	Possible / Moderate High	SMM16: Public engagement on DSTP	Unlikely / Moderate Moderate
S493	Concern over dwindling land availability for future generations	Land and water resource use	Across study area	Life of Mine	Possible / Moderate High	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Possible / Moderate High
S494	Swimming diminished as a recreational activity as a result of concerns over DSTP	Land and water resource use	Wagang and to a lesser extent Yanga	Operations	Possible / Minor Moderate	SMM16: Public engagement on DSTP	Unlikely / Minor Low
S495	Lost / reduced income from weekend markets, because concerns over DSTP results in fewer visitors to Wagang beach	Land and water resource use	Market and store vendors at Wagang	Operations	Possible / Moderate High	SMM16: Public engagement on DSTP	Unlikely / Moderate Moderate
S496	Economic displacement – restricted access to fishing/aquatic resource areas (streams and creeks) as a result of construction of Infrastructure Corridor and Outfall System	Land and water resource use	Wagang and to a lesser extent Yanga	Construction	Possible / Minor Moderate	SMM13: Resettlement management LMM1: Management of compensation obligations SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Unlikely / Minor Low
S422	Impaired amenity (e.g., dust, noise, light, visual, plant emissions) during construction of the Infrastructure Corridor and Outfall System	Community health and safety	Residents in proximity to Infrastructure Corridor - particularly at Yanga village	Construction	Likely / Moderate High	SMM4: Environmental Management Plan	Likely / Minor Moderate

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S432	Health problems resulting from increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income from the Project	Community health and safety	People receiving income or compensation from the Project	Life of Mine	Possible / Moderate High	SMM1: Health Awareness Program (communities) SMM22: Health Awareness Program (workforce)	Unlikely / Moderate Moderate
S433	Project-induced increase in prevalence of lifestyle diseases as a result of changing diet and physical activity level	Community health and safety	People receiving income or compensation from the Project	Life of Mine	Possible / Moderate High	SMM1: Health Awareness Program (communities) SMM22: Health Awareness Program (workforce)	Unlikely / Moderate Moderate
S435	Project-induced increase in HIV/AIDS and other sexually transmittable infections arising from high-risk behaviour associated with higher levels of disposable income and/or in-migration	Community health and safety	People receiving income or compensation from the Project, and their sexual partners	Life of Mine	Possible / Moderate High	SMM22: Health Awareness Program (workforce) SMM14: In-migration management	Unlikely / Moderate Moderate
S438	Project-induced increase in incidences of communicable diseases (e.g., gastrointestinal and respiratory diseases) due to in-migration	Community health and safety	Individuals within study area	Construction	Unlikely / Moderate Moderate	NCM11: Support for Provincial service delivery programs SMM14: In-migration management	Remote / Moderate Low
S483	Inappropriate use of force by public security personnel deployed in connection with the Project	Community health and safety	People who seek to establish houses or gardens on Infrastructure Corridor after construction (and who do not comply with requests to desist)	Operations	Unlikely / Moderate Moderate	SECMP1: Security Management Plan NCM11: Support for Provincial service delivery programs SMM27: Facilitate police training on the Voluntary Principles on Security and Human Rights	Remote / Moderate Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S484	Inappropriate use of force by private security personnel deployed in connection with the Project	Community health and safety	People who seek to establish houses or gardens on Infrastructure Corridor after construction (and who do not comply with requests to desist)	Operations	Unlikely / Moderate Moderate	SECMP1: Security Management Plan SMM8: Workforce Code of Conduct SMM28: Provide training for security personnel in the Voluntary Principles on Security and Human Rights	Remote / Minor Low
S497	Concerns about spills and leaks from pipelines within the Infrastructure Corridor/Outfall System, leading to avoidance of nearby land and water resources	Community health and safety	People who maintain gardens, or hunt, fish and/or gather resources near the Infrastructure Corridor/Outfall System	Operations	Possible / Negligible Low	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure SMM16: Public engagement on DSTP	Unlikely / Negligible Low
S424	Inconvenience caused to school students detouring around construction of the Infrastructure Corridor, potentially using construction as a reason not to attend school	Education	School students from Wagang and Yanga	Construction	Possible / Negligible Low	SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure TMP2: Advance warning of changes in traffic conditions SMM6: Safety Awareness and Behaviour Program	Unlikely / Negligible Low

Ref	Impact	Primary category	Population affected	Phases	Initial significance	Proposed management measures	Residual significance
S475	Disputes over landownership and/or entitlement to compensation	Community cohesion and law and order	Wagang and to a lesser extent Yanga	Construction	Possible / Moderate High	LAMM1: Management of compensation obligations SMM11: Facilitate the development of local-level law and order institutions SMM12: Facilitate local organisations to implement activities aimed at building social capital SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Unlikely / Moderate Moderate
S478	Community tensions and disputes arising from in-migration (e.g., over subsistence resources, disorderly behaviour and disregard for local landowner authority)	Community cohesion and law and order	Wagang and to a lesser extent Yanga	Construction	Possible / Minor Moderate	SMM14: In-migration management SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Unlikely / Minor Low
S482	Disruption of community cohesion resulting from: * Increased consumption of betel nut, alcohol, tobacco or potentially marijuana as a result of an increase in disposable income * Disputes arising from increased gambling as a result of higher income levels.	Community cohesion and law and order	Wagang and Yanga	Construction	Possible / Moderate High	SMM8: Workforce Code of Conduct SMM11: Facilitate the development of local-level law and order institutions SMM12: Facilitate local organisations to implement activities aimed at building social capital SMM22: Health Awareness Program (workforce)	Unlikely / Moderate Moderate
S492	Community tensions and disputes arising from interaction with Project workforce	Community cohesion and law and order	Wagang and to a lesser extent Yanga	Construction	Possible / Minor Moderate	SMM8: Workforce Code of Conduct SEMP1: Stakeholder Engagement and Management Plan including Concerns, Complaints and Grievance Procedure	Unlikely / Minor Low

18.7. Overview of Socioeconomic Impacts

This section provides an overview of socioeconomic impacts across all four study areas, to describe the anticipated impact of the Project as a whole. Figure 18.3 comprises three charts (a, b and c) that compare the number of positive and adverse impacts across the study areas.

Figure 18.3 a presents the number of positive impacts per study area, divided into ratings of residual significance (i.e., following the implementation of management measures). Study Area 1 is expected to experience the greatest benefit from the Project, largely driven by recruitment and procurement preferences, and receipt royalties and Project benefits. Study Area 3 shows higher levels of benefit compared to Study Areas 2 and 4, because Lae's status as the industrial centre of PNG makes it likely that considerable procurement contracts would be made with businesses based in Lae.

Figure 18.3b presents the number of adverse impacts for each study area, divided into ratings of initial significance (i.e., prior to the implementation of management measures). Study Area 1 has the highest number of impacts with initial significance of high and very high, which is expected because mining activities will take place within this study area. Study Area 3 has the second highest count of very high and high initial impacts, attributable primarily to traffic impacts (and the heightened risk of accidents and injuries) within Lae during construction of the Infrastructure Corridor.

Figure 18.3c presents a count of adverse impacts, divided by residual ratings. Comparing this figure to Figure 18.3b highlights the effect of management measures on the impacts identified. In particular, the number of impacts initially considered highly significant in Study Area 4 was reduced to only two after the application of management measures (namely, economic displacement of gardens for the Infrastructure Corridor and Outfall System, and concerns about dwindling land availability). Residual impacts for Study Area 2 are mostly of low significance.

18.8. Framework for Managing Socioeconomic Impacts

The WGJV Environmental and Social Management Framework comprises a number of management plans which relate to the management of predicted environmental and social impacts. Figure 18.4 illustrates the management plans which constitute the framework, and Table 18.22 describes the function of each plan.

Figure 18.3a: Residual significance (positive impacts)

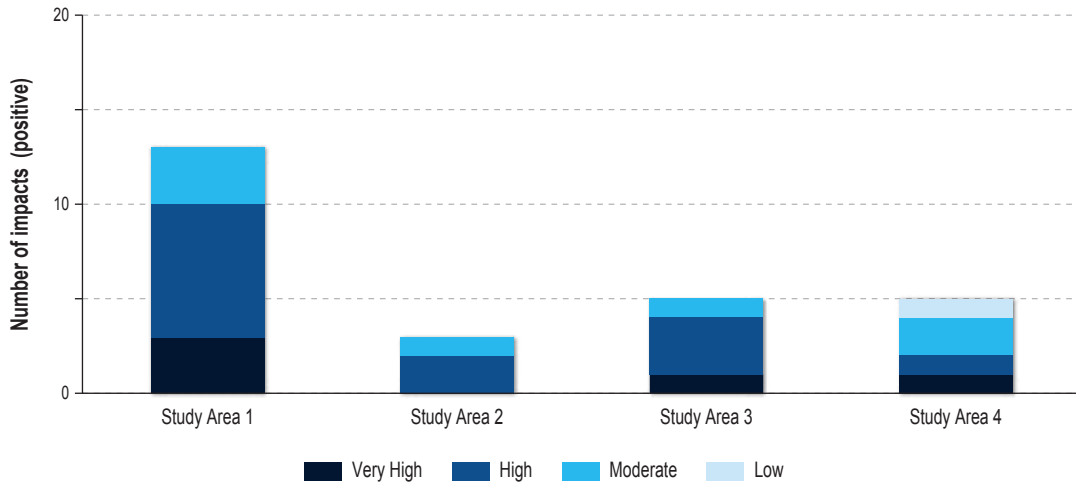


Figure 18.3b: Initial significance (adverse impacts)

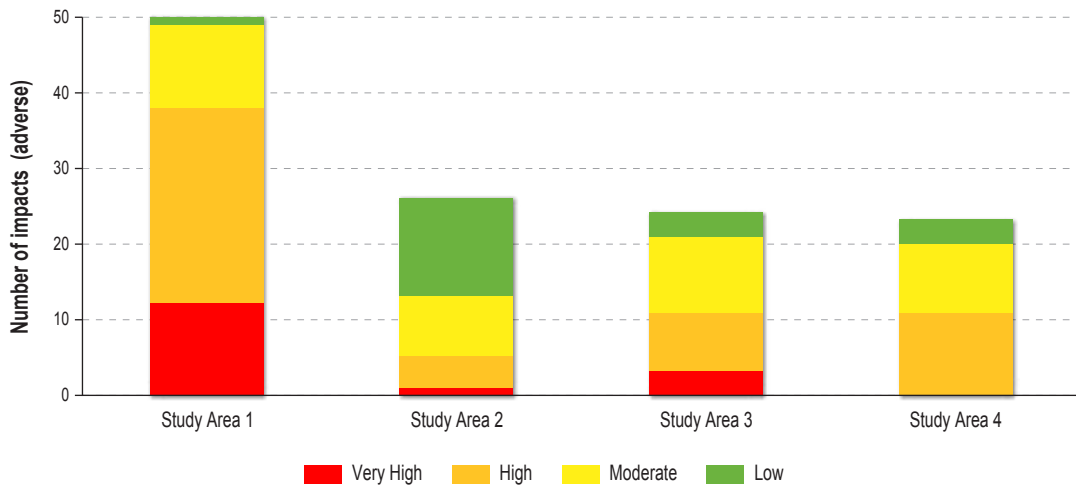
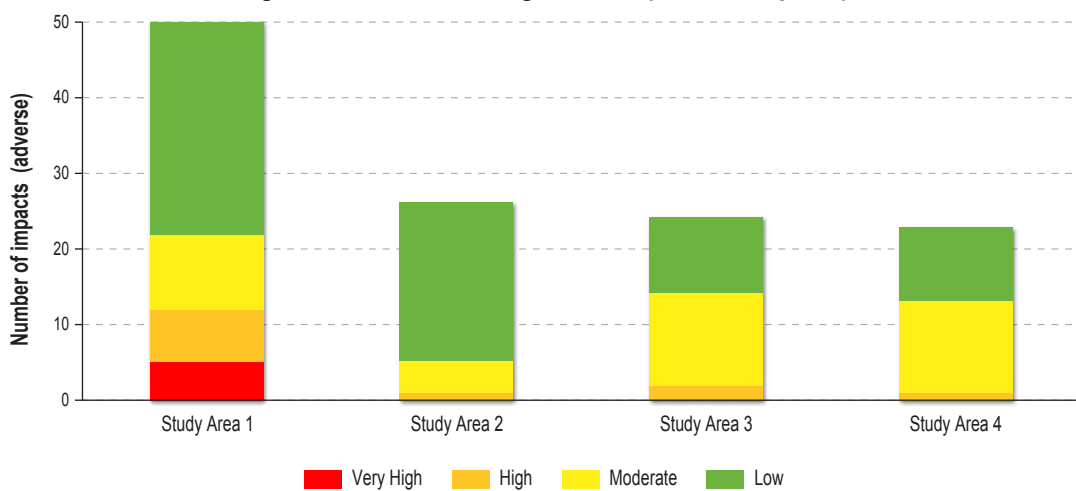


Figure 18.3c: Residual significance (adverse impacts)



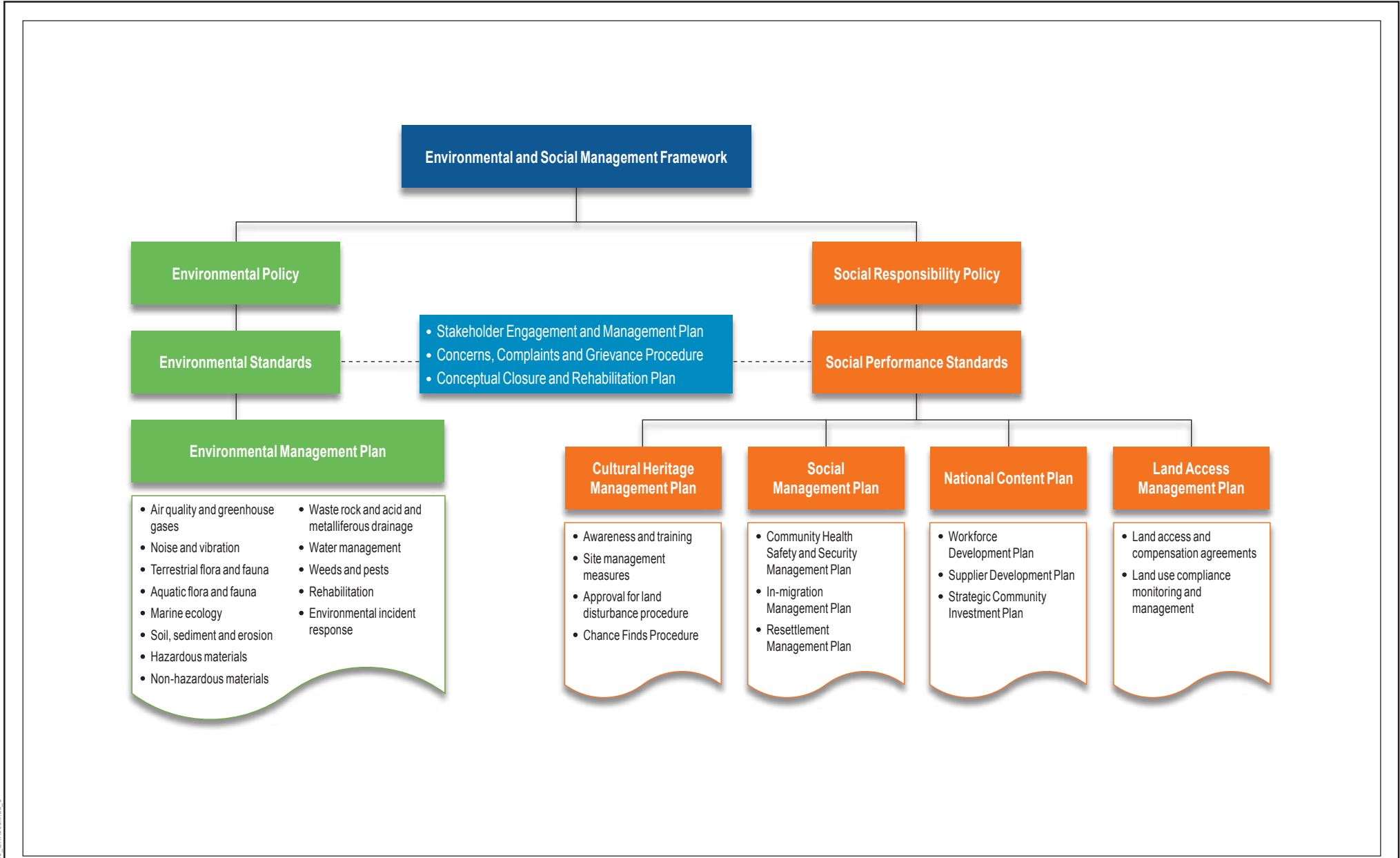


Table 18.22: Plans under the WGJV Environmental and Social Management Framework

Plan	Function
Project Environmental Management Plan (EMP) (Attachment 3)	Manages construction and operation activities that directly affects an environmental aspect
Project Social Management Plan (SMP) (Attachment 4)	Manages potential socioeconomic impacts of the Project. The SMP encompasses three topic-specific management plans: <ul style="list-style-type: none"> • Appendix A: Community Health and Safety Management Plan • Appendix B: Resettlement Management Plan • Appendix C: In-migration Management Plan
Project Cultural Heritage Management Plan (CHMP) (Attachment 5)	Manages matters that relate to an archaeological or historic site, or an oral tradition site that holds importance to a community.
National Content Plan (NCP)	Provides measures to maximise socioeconomic opportunities through workforce development, supplier development and strategic community investment sub-plans.
Land Access Management Plan (LAMP)	Manages land access and land use compliance and monitoring.
Conceptual Closure and Rehabilitation Plan (CCRP) (Attachment 2)	Sets closure objectives and manages the environmental and social aspects of closure and rehabilitation.
Stakeholder Engagement and Management Plan (SEMP) Concern, Complaints and Grievance Mechanism (CCGM)	Sets out the overall stakeholder engagement process that will be followed and how stakeholder engagement performance will be monitored, reported and evaluated. The Concern, Complaints and Grievance Mechanism (CCGM) is included in the SEMP.

The plans which constitute the Environmental and Social Management Framework will set out, in a coordinated manner, the specific measures proposed to be implemented to enhance environmental and socioeconomic opportunities and reduce, minimise or avoid potential impacts and risks.

Further detail with respect to the integrated management of potential environmental and social impacts is provided in Chapter 23, Integrated Management System.

18.8.1. Monitoring

A social monitoring program will be implemented to monitor social outcomes of the Project on a regular basis. This will encompass:

- Monitoring of key social indicators including but not limited to those which inform maternal and child health, general population statistics and health and nutrition, and school attendance
- Monitoring of key economic indicators such as employment, agricultural business turnover and household income
- The monitoring will be undertaken on a participatory basis with communities and in collaboration with government agencies

Performance indicators will be used to measure and track performance.

18.8.2. Reporting

The WGJV will prepare an annual report on social performance for internal and external communication purposes that:

- Provides a summary of compliance with any permit conditions for the reporting period
- Reviews the performance of Project activities against the Environmental and Social Management Framework (and principally the SMP)
- Provides a summary of key socioeconomic issues experienced in Project Area villages over the previous 12 month (calendar) reporting period, including statistics of the number of times the concerns, complaints and grievance mechanism has been used
- Provides a summary of social programs implemented over the previous 12-month (calendar) reporting period

The management team will review the Environmental and Social Management Framework (and the management plans constituting the framework) annually to determine its continuing suitability, adequacy and effectiveness. Reviews will include assessing opportunities for improvement and the need for changes, including review of objectives, outcomes, targets and resources.

18.9. References

Abt JTA. 2013. Morobe Mining Joint Ventures Public Health and Biomedical Survey Report. Report prepared for Morobe Mining Joint Venture, Lae, Morobe Province.

Abt JTA. 2015. Golpu Project: Human Health and Ecological Risk Assessment. Report prepared for Morobe Mining Joint Venture, Lae, Morobe Province.

Aggleton, P., Parker, R. and Thomas, F. (eds). 2015. *Culture, Health and Sexuality: An Introduction*. London: Routledge.

Aucamp, I., Woodborne, S., Perold, J., Bron, A. and Aucamp, S. M. 2011. 'Looking beyond Impact Assessment to Social Sustainability'. In *New Directions in Social Impact Assessment: Conceptual and Methodological Advances*, edited by Vanclay, F. and Esteves, A. M. Cheltenham, Gloucestershire: Edward Elgar Publishing.

Bainton N., Vivoda, V., Kemp, D., Owen, J., and Keenan, J. 2017. Project-Induced In-Migration and Large-Scale Mining: A Scoping Study. Centre for Social Responsibility in Mining (CSRMI), The University of Queensland: Brisbane.

Beggs, C. B., Noakes, C. J., Sleigh, P. A., Fletcher, L. A. and Siddiqi, K. 2003. 'The Transmission of Tuberculosis in Confined Spaces: An Analytical Review of Alternative Epidemiological Models'. *International Journal of Tuberculosis and Lung Disease* 7 (11): 1015–26.

Bonnell, S. 1999. 'Social Change in the Porgera Valley'. In *Dilemmas of Development: The Social and Economic Impact of the Porgera Gold Mine 1989-1994*, edited by Colin Filer. Canberra: ANU Press.

Clark, M., Riben, P. and Nowgesic, E. 2002. 'The Association of Housing Density, Isolation and Tuberculosis in Canadian First Nations Communities'. *International Journal of Epidemiology* 31 (5): 940–45.

Connell, J. and Negin, J. 2010. Migration, Mobility and HIV: A Rapid Assessment of Risks and Vulnerabilities in the Pacific. United Nations Development Programme and Secretariat of the Pacific Community, Suva.

- Coulthard, S. 2012. 'What Does the Debate around Social Wellbeing Have to Offer Sustainable Fisheries?' *Current Opinion in Environmental Sustainability*, Aquatic and marine systems, 4 (3): 358–63.
- Department of Transport and Infrastructure. 2013. PNG National Transport Strategy, Volume 3 Detailed Strategy. Report prepared by the Department of Transport. Port Moresby, National Capital District.
- DFAT. 2015. Aid Investment Plan Papua New Guinea: 2015–16 to 2017–18. September. Department of Foreign Affairs and Trade. Canberra.
- Di Cesare, Mariachiara, Khang, Y.-H. Asaria, P., Blakely, T., Cowan, M.J., Farzadfar, F., Guerrero, R., et al. 2013. 'Inequalities in Non-Communicable Diseases and Effective Responses'. *Lancet* 381 (9866): 585–97.
- Dinnen, S. 2001. *Law and Order in a Weak State*. Honolulu: University of Hawai'i Press.
- DMPGM. 2014. Papua New Guinea Mining Fiscal Regime: submission to Tax Review Committee. June. PNG Department of Mineral Policy and Geohazards Management. Port Moresby.
- Filer, C. and Le Meur, P. Y. 2017. *Large-Scale Mines and Local-Level Politics: Between New Caledonia and Papua New Guinea*. Canberra: ANU Press.
- Guyant, P., Canavati, S. E., Chea, N., Ly P., Whittaker, M. A., Roca-Feltrer, A. and Yeung, S. 2015. 'Malaria and the Mobile and Migrant Population in Cambodia: A Population Movement Framework to Inform Strategies for Malaria Control and Elimination'. *Malaria Journal* 14 (1).
- Gylfason, T. 2001. 'Natural Resources, Education, and Economic Development'. *European Economic Review* 45 (4–6).
- Habib, S.H. and Saha, S. 2010. 'Burden of Non-Communicable Disease: Global Overview'. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews* 4 (1): 41–47.
- Hinton, R. and Earnest, J. 2010. 'Stressors, Coping, and Social Support Among Women in Papua New Guinea'. *Qualitative Health Research* 20 (2): 224–38.
- IFC. 2009a. A Handbook for Addressing Project-Induced In-Migration. September. International Finance Corporation. Washington, DC.
- IFC. 2009b. Introduction to Health Impact Assessment. International Finance Corporation. Washington, DC.
- IFC. 2012. IFC Performance Standards on Environmental and Social Sustainability. Report prepared by the International Finance Corporation, Washington DC.
- JICA. 2017. The project for the study on Lae-Nadzab urban development plan in Papua New Guinea: final report. Report prepared by Japan International Cooperation Agency, with Yachiyo Engineering Co. Ltd. and Kokusai Kogyo Co. Ltd.
- Jorgensen, D. 2006. 'Hinterland History: The Ok Tedi Mine and Its Cultural Consequences in Telefolmin'. *The Contemporary Pacific* 18 (2): 233–63.
- Kanaparo, P. B. 2010. 'Employment and Retrenchment Issues in the Porgera Gold Mine, Papua New Guinea: A Strategic Approach to Leave Behind a Better Porgera'. *Research & Practice in Human Resource Management* 18 (1): 96–106.
- Lepani, K. 2008. 'Mobility, Violence and the Gendering of HIV in Papua New Guinea'. *The Australian Journal of Anthropology* 19 (2): 150–64.

- Macfarlane, J. 2009. 'Common Themes in the Literature on Traditional Medicine in Papua New Guinea'. *Papua New Guinea Medical Journal* 51 (1–2): 44–53.
- Martens, P and Hall, L. 2000. 'Malaria on the Move: Human Population Movement and Malaria Transmission'. *Emerging Infectious Diseases* 6 (2): 103–9.
- Oil Search Health Foundation. 2013. The Malaria Management Project: Final Report, Report prepared by the Oil Search Health Foundation, Port Moresby, National Capital District.
- Pi, J., Sun, Y., Xu, M., Su, S., and Weng, M. 2018. 'Neighborhood Social Determinants of Public Health: Analysis of Three Prevalent Non-Communicable Chronic Diseases in Shenzhen, China'. *Social Indicators Research* 135 (2): 683–98.
- Pus, A., Moriyama, M., Uno, M., and Rahman, M. M. 2016. 'Identifying Factors of Obesity in Papua New Guinea: A Descriptive Study'. *Health* 8 (14): 1616–29.
- Sutherst, R. W. 2004. 'Global Change and Human Vulnerability to Vector-Borne Diseases'. *Clinical Microbiology Reviews* 17 (1): 136–73.
- Vanclay, F. 2017. 'Project-Induced Displacement and Resettlement: From Impoverishment Risks to an Opportunity for Development?' *Impact Assessment and Project Appraisal* 35 (1): 3–21.
- Vanclay, F., Esteves, A. M., Aucamp, I. and Franks, D. M. 2015. 'Social Impact Assessment: Guidance for Assessing and Managing the Social Impacts of Projects'. April. Fargo ND: International Association for Impact Assessment.
- Westwood, E., and M. Orenstein. 2016. 'Does Resource Development Increase Community Sexually Transmitted Infections? An Environmental Scan'. *The Extractive Industries and Society* 3 (1): 240–48.
- World Bank. 2017. Papua New Guinea, Overview. A WWW publication accessed on 15 June 2017 at <http://www.worldbank.org/en/country/png/overview#2>.
- World Health Organization. 2018. Household air pollution and health. 15 February. A WWW publication accessed on 27 April 2018 at <http://www.who.int/en/news-room/fact-sheets/detail/household-air-pollution-and-health>.